SAFE from CDI

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Road Map to a Comprehensive *Clostridium difficile* Infection (CDI) Prevention Program

MINNESOTA MDH DEPARTMENT OF HEALTH

Minnesota Hospital Association

The ***Safe from CDI Road Map*** provides consistent recommendations/standards for Minnesota acute care hospitals in the development of comprehensive *Clostridium difficile* infection (CDI) prevention programs. The road map and companion tool kit were developed as part of the Minnesota CDI Prevention Collaborative, made possible with American Reinvestment and Recovery Act funds through the Centers for Disease Control and Prevention Epidemiology and Laboratory Capacity Program.

The CDI prevention strategies are presented as a two-tiered approach (core and enhanced). Enhanced strategies are to be considered in addition to core strategies when there is evidence that the core strategies are being implemented and adhered to consistently and there is evidence of ongoing transmission of *C. difficile* and/or evidence that CDI rates are not decreasing and/or evidence of a change in CDI pathogenesis. The prevention strategies address four topic areas: early recognition of patients with CDI, isolation precautions, environmental cleaning and disinfection, and antimicrobial stewardship. The road map is based on current (October 2011) guidelines, recommendations, and published literature for CDI prevention and control in acute care hospitals. The road map content will be reviewed regularly and updated, as indicated, through available published literature.

We would like to thank the following individuals and organizations for sharing their time, expertise, and experiences which made the road map and tool kit possible:

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Definitions

Health care personnel (HCP): All persons, paid and unpaid, working in an acute care facility who have the potential for exposure to patients and/or infectious materials, including body substances, contaminated medical supplies and equipment, contaminated environmental surfaces, or contaminated air. This includes persons not directly involved in patient care (e.g., clerical, housekeeping, and volunteers) but potentially exposed to infectious agents that can be transmitted to and from HCP and patients. This term includes, but is not limited to, physicians, physician assistants, nurse practitioners, nurses, nursing assistants, therapists, technicians, emergency medical service personnel, dental personnel, pharmacists, laboratory personnel, autopsy personnel, students and trainees, and contractual personnel.

Prescriber: Health care personnel who are licensed to prescribe medications, including antimicrobial agents.

Road Map to a Comprehensive *Clostridium difficile* Infection (CDI) Prevention Program

	Safe from CDI Component	Specific Action(s)	Audit Questions
S	"Safe from CDI" Teams	1) Identify senior leadership champion for CDI prevention.	1a) The facility has identified a senior leadership champion(s) to provide support and ensure resources for the CDI prevention program. 1b) Senior leadership is engaged in infection prevention, including CDI prevention, as evidenced by documented communication to key health care personnel (HCP).
		2) Provide support and expectations for CDI prevention champions.	2a) The facility has identified a physician champion(s) for CDI prevention. 2b) The physician champion(s) has a decision-making role on the facility antimicrobial stewardship team. 2c) The facility has identified an operational champion(s) for CDI prevention (e.g. environmental services director, infection preventionist, laboratorian, pharmacist, patient care director). 2d) A process is in place for communication between the physician and operational champion(s). 2e) A process is in place to partner the environmental services director and infection preventionist. 2f) The facility has defined roles, set expectations, and provides support for the champion(s).
		3) Adopt an interdisciplinary team approach to CDI prevention with a designated coordinator to oversee implementation.	3a) A team, with participation by front-line staff, is in place to oversee and support CDI prevention work. Team members include, at a minimum: i) Environmental services director or designee ii) Infection preventionist iii) Laboratorian iv) Pharmacist v) Patient care director or designee 3b) A coordinator is assigned to oversee CDI prevention implementation (e.g. schedule team meetings, plan HCP education). 3c) The coordinator has dedicated time to serve in this role. 3d) Individual roles in the CDI Prevention Strategies (patient care steps) are clearly defined and documented.
A	Access to Information	1) Verify implementation of the CDI Prevention Strategies.	The facility has a process in place to: 1a) Document implementation of the CDI Prevention Strategies.
		2) Audit the CDI Prevention Strategies.	Monitor compliance with Core and Enhanced (if indicated) CDI Prevention Strategies: 2a) Early recognition of CDI 2b) Prompt implementation of Isolation Precautions 2c) Hand hygiene 2d) Environmental cleaning and disinfection of patient care equipment and the environment of CDI patients 2e) Antimicrobial stewardship
		3) Review and analyze the CDI Prevention Strategies audit data.	Review and analyze audit data for Core and Enhanced (if indicated) CDI Prevention Strategies: 3a) Compliance with early recognition of CDI 3b) Compliance with Isolation Precautions 3c) Compliance with hand hygiene 3d) Compliance with environmental cleaning and disinfection of patient care equipment and the environment of CDI patients 3e) Compliance with antimicrobial stewardship

Road Map to a Comprehensive *Clostridium difficile* Infection (CDI) Prevention Program

	Safe from CDI Component	Specific Action(s)	Audit Questions
		4) Conduct CDI surveillance.	The facility has in place: 4a) Facility-wide CDI surveillance. 4b) Application of standardized National Healthcare Safety Network (NHSN) CDI surveillance definitions. 4c) Surveillance for colectomies associated with CDI. 4d) A process to conduct root-cause analyses for colectomies and deaths associated with CDI. 4e) Periodic monitoring of autopsy and mortality data for unrecognized CDI.
		5) Review and analyze CDI surveillance data.	The facility has a process in place to review and analyze: 5a) Facility-wide CDI surveillance data. 5b) Surveillance data and root-cause analyses for colectomies/deaths associated with CDI. 5c) Surveillance of autopsy and mortality data for unrecognized CDI.
		6) Disseminate the CDI Prevention Strategies audit and surveillance data.	The facility has a process in place to provide CDI audit and surveillance data to key stakeholders at least quarterly: 6a) Facility senior leadership 6b) Physicians 6c) Patient care staff 6d) Environmental services leadership 6e) Environmental services staff 6f) Pharmacy 6g) Laboratory
F	**Facility Expectations**	1) Set expectations for implementation of the CDI Prevention Strategies.	1a) The facility has outlined a roll-out plan for implementation (i.e. unit(s), evaluation, timelines, and prevention strategies). 1b) The facility has developed and clearly communicated HCP expectations for implementation of the CDI Prevention Strategies. 1c) The facility has defined provider (e.g. physician, physician assistant, nurse practitioner) expectations for implementation of the CDI Prevention Strategies.
		2) Set expectations for hand hygiene practices.	2a) The facility has developed and implemented a facility-wide hand hygiene program. 2b) The facility has clearly communicated HCP expectations for appropriate hand hygiene practices.
		3) Expect HCP to "speak up" about HCP behavior or facility issues that may increase patient infection risk (e.g. hand hygiene or Isolation Precautions are not followed).	3a) The facility has engaged HCP, including providers, in creating a culture that encourages HCP to inform each other if noncompliance with CDI Prevention Strategies is observed. 3b) The facility has engaged HCP, including providers, to create a culture that encourages HCP to provide positive feedback to each other when compliance with CDI Prevention Strategies is observed.
		4) Encourage patients and families to "speak up" about HCP/provider practices that may increase infection risk.	4a) The facility has a process in place to encourage patients and families to speak up if they have concerns about HCP/provider practices or other issues that may increase infection risk.

Road Map to a Comprehensive *Clostridium difficile* Infection (CDI) Prevention Program

	Safe from CDI Component	Specific Action(s)	Audit Questions
		5) Set expectations for the clinical management of CDI patients.	Facility expectations for prescribers/providers include the following: 5a) Discontinue inciting antibiotics, if possible, when CDI is suspected. 5b) Avoid antiperistaltic agents for patients suspected/diagnosed with CDI. 5c) Follow best practices for CDI treatment (e.g. 2010 SHEA-IDSA Guideline). 5d) Consult with specialists when recurrent or worsening CDI is identified (e.g. infectious disease physicians, general surgeons).
		6) Set expectations for environmental cleaning and disinfection.	6a) The facility has a process in place to implement environmental cleaning and disinfection as outlined by environmental services and infection prevention and other departments as needed. 6b) The facility has clearly communicated HCP expectations for environmental cleaning and disinfection.
		7) Set expectations for antimicrobial stewardship.	7a) The facility has a process in place to develop and implement an antimicrobial stewardship program.
E	**Educate Staff and Patients**	1) Provide CDI prevention education for all HCP.	1a) All HCP, including physicians, receive CDI prevention education at new employee orientation. 1b) All HCP including physicians, receive CDI prevention education at least annually.
		2) Provide cleaning and disinfection education for nursing and ancillary/support staff.	2a) The facility has a process is in place to provide cleaning and disinfection education for nursing and ancillary/support staff.
		3) Provide education and competency testing for environmental services trainers.	The facility has a process in place to require person(s) responsible for environmental services training to: 3a) Receive education on current environmental cleaning/disinfection practices at least annually. 3b) Complete a competency evaluation of cleaning/disinfection practices at least annually.
		4) Provide cleaning/ disinfection training and evaluation for environmental services staff.	4a) Training materials are provided in the staff's native language, or ensure communication of the information through other means. 4b) Environmental services staff training includes return demonstration. 4c) A systematic process is in place to periodically evaluate terminally-cleaned rooms. 4d) Processes are in place to address issues identified through cleaning/disinfection evaluations.
		5) Provide competency testing to environmental services staff.	5a) Environmental services staff training includes written or verbal competency testing. i) Competency testing includes demonstrated understanding of the rationale for cleaning/disinfection components. 5b) Expectations are in place for environmental services staff to pass a competency test prior to assignment to patient care areas. 5c) Expectations are in place for environmental services staff that do not pass the competency test to receive additional training or be assigned to non-patient care areas.
		6) Provide physician/ prescriber education on CDI prevention, diagnosis, management, and treatment.	6a) CDI prevention education, including the physician/prescriber role in antimicrobial stewardship, is provided at orientation for new physicians/prescribers. 6b) A process is in place for the CDI physician champion to educate physicians/prescribers about CDI clinical spectrum (including treatment and disease severity), current research, and the facility's CDI diagnostic methods. 6c) Best practices for CDI diagnosis and management are readily available to physicians/prescribers. 6d) A process is in place to monitor CDI diagnosis and management within the facility.

Road Map to a Comprehensive *Clostridium difficile* Infection (CDI) Prevention Program

	Safe from CDI Component	Specific Action(s)	Audit Questions
		7) Provide education on CDI laboratory diagnostic methods.	The facility has a process in place to: 7a) Educate laboratory staff regarding specimen testing (e.g. policy for testing only unformed stools). 7b) Educate laboratory leadership on current laboratory diagnostic research. 7c) Educate nursing staff on facility policies for specimen collection and specimen testing (e.g. test only unformed stools).
		8) Provide CDI prevention education to operational champion(s).	The facility has a process in place: 8a) To provide operational champions with CDI education, including best practices, management and infection prevention and control strategies, at least annually. 8b) For the operational champions to disseminate information throughout the organization (e.g. train-the-trainer).
		9) Educate patients and families about their role in CDI prevention.	9a) Infection prevention education is provided to patients and families.

CDI Prevention Strategies

CORE Prevention Strategies = Strategies that should always be in place.

ENHANCED Prevention Strategies = Strategies to be considered in addition to core strategies when:

a) There is evidence that the core strategies are being implemented and adhered to consistently.
And;
b) There is evidence of ongoing transmission of *C. difficile* and/or
c) There is evidence that CDI rates are not decreasing and/or
d) There is evidence of change in CDI pathogenesis (e.g. increased morbidity/mortality among CDI patients).

Specific Action(s)	CORE Prevention Strategies	Specific Action(s)	ENHANCED Prevention Strategies
Early Recognition of CDI			
1) Early identification of patients with suspect CDI	The facility has a standardized CDI identification process in place that includes the following: 1a) Nurses are trained to recognize the signs/ symptoms of CDI (see Bristol Stool Chart). 1b) Appropriate HCP are trained to obtain specimens for laboratory testing of patients suspected of having CDI. 1c) Timely communication to the provider of patients suspected of having CDI.	***Enhanced identification of patients with suspect CDI***	The facility has developed an **ENHANCED** CDI identification process that includes the following: 1a) Identification of previously unrecognized patients with symptoms of CDI (e.g. patient care rounds).
2) Laboratory testing	2a) PCR-based molecular assay is evaluated for *C. difficile* diagnostic testing.	***Enhanced laboratory testing***	2a) Implement PCR-based molecular assay for *C. difficile* diagnostic testing.

Specific Action(s)	CORE Prevention Strategies	Specific Action(s)	ENHANCED Prevention Strategies
	The facility has a standardized laboratory testing policy in place that includes the following: 2b) Reject formed stools. 2c) Avoid serial testing of patients.		
3) Diagnosis	The facility has a standardized diagnostic protocol in place that includes the following: 3a) Test unformed stools only (see Bristol stool chart types 5 – 7). 3b) Submit one stool specimen for initial CDI testing. 3c) Avoid serial testing when initial test is negative. 3d) Do not test asymptomatic patients. 3e) Do not conduct repeat testing during the same episode of diarrhea for confirmed CDI patients (e.g. electronic flag). 3f) Retest only if CDI symptoms continue or recur after 10 days of treatment. 3g) Do not perform "tests of cure" post treatment. 3h) Do not routinely test patients less than 1 year of age. 3i) For patients 1 - 2 years of age, consider diagnoses other than CDI first; if no recent antimicrobial exposure, use more than one diagnostic approach (including culture). 3j) For patients >2 years of age with recent antimicrobial exposure, test and treat as for adults.		
4) Communi-cation	The facility has a standardized communication process in place that includes timely communication of CDI test results to: 4a) Patient care unit/facility 4b) Provider 4c) Infection Prevention		
Isolation Precautions			
1) Place patient in Isolation Precautions	The facility has Isolation Precautions identified that include the following: 1a) Patient is placed in a private room with a bathroom or bedside commode solely for use by patient. 1b) Health care workers perform hand hygiene and don gloves and gown prior to entering patient room. 1c) Gloves are changed immediately if visibly soiled and after touching or handling surfaces/materials contaminated with feces. 1d) Gloves and gown are removed before exiting the patient room. 1e) Hand hygiene (soap and water preferred) is performed before exiting the patient room; alcohol-based hand rub is used if soap and water are not available. 1f) Patient transport or movement outside of the room is avoided unless medically necessary.	***Enhanced patient placement in Isolation Precautions***	The facility has **ENHANCED** Isolation Precautions identified that include the following: 1a) Patients with loose stools (e.g. ≥3 unformed stools in 24 hours) are preemptively placed in Isolation Precautions. 1b) Universal glove use is implemented on floors/units/areas with endemic rates or ongoing transmission of CDI. 1c) Frequency and/or scope of monitoring compliance with Isolation Precautions is increased.

Specific Action(s)	CORE Prevention Strategies	Specific Action(s)	ENHANCED Prevention Strategies
	1g) Single use patient care equipment is utilized when possible (e.g. blood pressure cuff). 1h) If private room availability is limited, incontinent patients are preferentially placed in private rooms. *NOTE: Asymptomatic patients are not placed in Isolation Precautions – even if they are colonized with C. difficile.*		
2) Cohort patients if private room is not available	2a) Cohorted patients each have a dedicated bedside commode. 2b) Health care workers change gown and gloves and perform hand hygiene when moving between cohorted patients. 2c) Patients with discordant status of infection or colonization with other epidemiologically important organisms (e.g. VRE, MRSA) are not cohorted.		
3) Isolation Precautions supplies are readily available	3a) Adequate supplies for compliance with Isolation Precautions (e.g. gowns, gloves) are readily accessible outside of the patient room. 3b) Responsibility is assigned for regularly checking and restocking supplies.		
4) Follow hand hygiene guidelines	4a) Hand hygiene practices follow CDC or WHO guidelines.	***Enhanced hand hygiene guidelines***	4a) Hand hygiene is performed with soap and water upon room exit. If hand-washing sink is not accessible, hand hygiene is performed with alcohol-based hand rub, and followed immediately with hand hygiene using soap and water after exiting the patient room. 4b) Frequency and/or scope of monitoring compliance with hand hygiene practices is increased.
5) Communicate Isolation Precautions status	5a) Isolation Precautions status is documented in the medical record. 5b) Isolation Precautions signage is immediately posted outside positive CDI patient rooms. 5c) Icons/symbols on Isolation Precautions signage include: i) Hand hygiene for entry and exit ii) Gown and gloves for room entry iii) Process for environmental cleaning/disinfection 5d) When CDI patients are transferred, Isolation Precautions status is communicated to receiving facilities.	***Enhanced communication of Isolation Precautions status***	5a) Environmental services staff is notified of patient rooms requiring **ENHANCED** cleaning and disinfection.
6) Discontinue Isolation Precautions as appropriate	6a) For patients preemptively placed in Isolation Precautions, patients are removed from Isolation Precautions if CDI test is negative and other infectious agents that require Isolation Precautions have been ruled out. 6b) Patients are removed from Isolation Precautions when CDI symptoms resolve (e.g. patient has <3 unformed stools in a 24 hour period).	***Enhanced discontinuation of Isolation Precautions as appropriate***	6a) Isolation Precautions are continued for the duration of the current hospitalization for confirmed CDI patients, even if diarrhea resolves.

Specific Action(s)	CORE Prevention Strategies	Specific Action(s)	ENHANCED Prevention Strategies
Environmental Cleaning and Disinfection			
1) Clean and disinfect patient rooms and patient care equipment	The facility has a standardized environmental cleaning and disinfection protocol in place that includes the following: 1a) Hospital grade EPA-registered germicide is used for routine disinfection. 1b) Manufacturer product recommendations are followed for use, including contact time and dilution. 1c) Standard disinfectant application protocols. i) Disinfecting wiper is changed when unable to achieve appropriate wet contact time and when visibly soiled. ii) Disinfecting wipers are not pre-soaked or re-dipped in the open bucket system. 1d) Routine cleaning/disinfection processes are assessed using observational audits before changing products or processes. 1e) Responsibility is assigned for monitoring and restocking cleaning/disinfection and personal protective equipment supplies. 1f) Responsibility is defined for which patient care equipment and high touch surfaces will be cleaned and disinfected by nursing. 1g) A cleaning/disinfection schedule is implemented for patient care equipment and patient environment. 1h) Shared patient care equipment is cleaned/disinfected between every patient use.	***Enhanced cleaning and disinfection of patient rooms and patient care equipment***	The facility has an **ENHANCED** cleaning and disinfection protocol in place that includes the following: 1a) Chlorine-containing or other sporicidal product/technology is used for daily and terminal environmental disinfection for *all CDI patient rooms* and patient care equipment. 1b) Evaluation of the use of chlorine-containing or other sporicidal product/technology used for daily and terminal environmental disinfection for *all* patient rooms and patient care equipment *on affected unit* if transmission is ongoing. 1c) Routine cleaning/disinfection processes are assessed using a biochemical product (e.g. ATP, bioluminescence, fluorescent dye/marker) before changing products or processes.
Antimicrobial Stewardship			
1) Implement antimicrobial stewardship program	*NOTE: An antimicrobial stewardship program includes clearly defined expectations for clinical management strategies of CDI patients (see "F4–Facility Expectations" in "SAFE").* The facility has in place: 1a) A multidisciplinary antimicrobial stewardship team including a physician with infectious diseases interest and representation from clinical pharmacy, infection prevention, microbiology, information technology, and/or hospitalist/intensivist. *NOTE: Facilities without HCP or other resources for an antimicrobial stewardship team should consider obtaining this expertise through a cooperative relationship or consultation.* 1b) A process to prospectively audit antimicrobial use within the facility, including volume and classes, and report this information to prescribers.	***Enhanced antimicrobial stewardship program***	The facility has a process is in place to: 1a) Evaluate the antimicrobial stewardship program to ensure that all recommended components are in place and identify areas for improvement. 1b) Evaluate clinical management strategies of CDI patients. 1c) Monitor antimicrobial prescribing practices for the treatment of CDI and provide feedback to prescribers.

Specific Action(s)	CORE Prevention Strategies	Specific Action(s)	ENHANCED Prevention Strategies
	1c) A process to monitor antimicrobial prescribing practices within the facility and provide feedback to prescribers highlighting the relationship of antimicrobial use to CDI. 1d) A process to provide antimicrobial utilization data to medical staff and facility leadership. 1e) Antimicrobial formularies and preauthorization requirements for non-formulary antimicrobial use. 1f) Guidelines or clinical treatment pathways based on local/regional and state antibiotic resistance data. 1g) A process for regular review of treatment pathways and order sets that includes antimicrobial prescribing. 1h) Clear expectations that empirically prescribed antibiotics are adjusted in a timely manner based on laboratory test results. 1i) Real-time surveillance of antimicrobial prescribing (e.g. frequency, duration, and number of antimicrobial agents prescribed per patient).		

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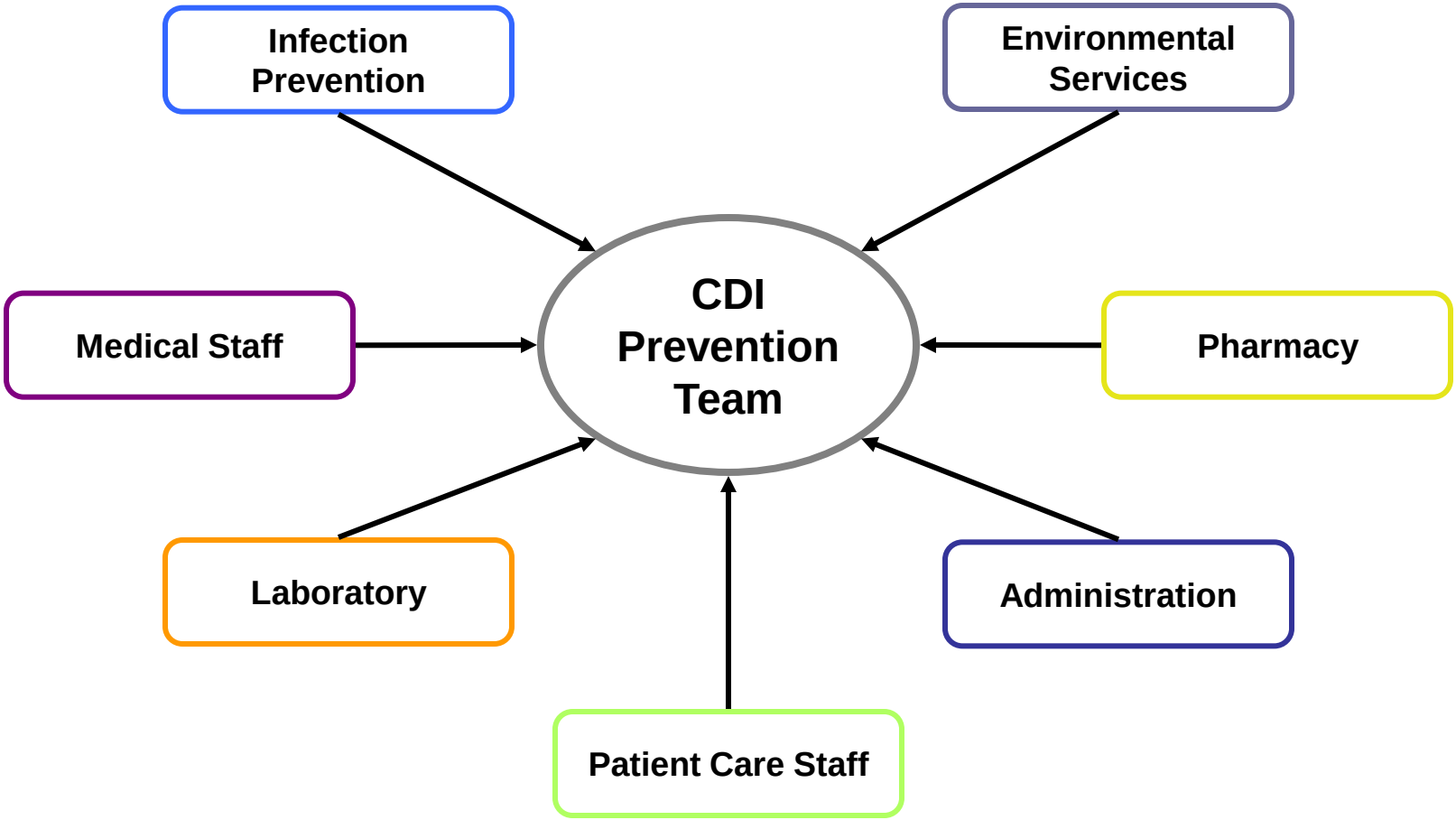
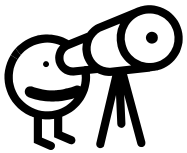
MN CDI Prevention Collaborative

CDI Prevention: A Systems Approach



CDI Facility Assessment



Step 1

Determine baseline CDI rates hospital-wide for the past year.

Do certain populations/units have higher rates?

Risk factors to consider:

- Age
- Recent Antibiotic use
- Underlying conditions
- Hospital units

Step 2

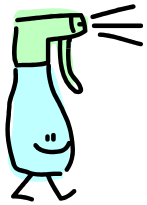
Is the hospital or unit following CDI Core Prevention Strategies? (at least 90% compliance)

- Audit hand hygiene compliance
- Audit Isolation Precautions compliance
- Audit environmental cleaning/disinfection compliance

Step 3

Is there is evidence of any of the following?

- Ongoing CDI transmission in the hospital or unit
- CDI rates are not decreasing in the hospital or unit
- Change morbidity or mortality in CDI patients



Step 4

Determine CDI Prevention Strategies to be implemented.

- Core: Always in place
- Enhanced: Considered in addition to core strategies when:

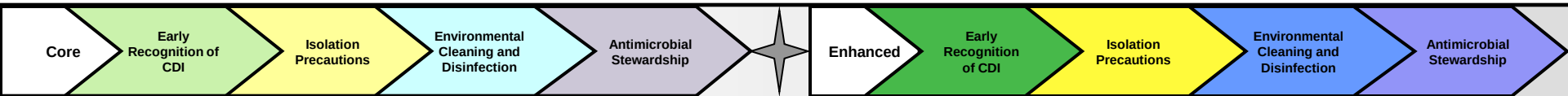
  a) Core strategies are being implemented and adhered to consistently

  And

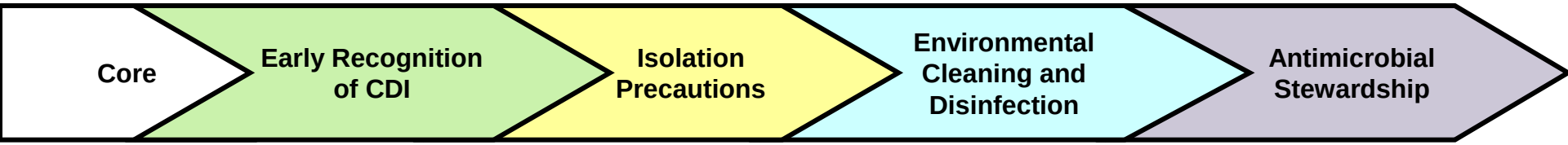
  b) There is evidence of ongoing transmission of and/or

  c) There is evidence that CDI rates are not decreasing and/or

  d) There is evidence of change in CDI morbidity/mortality among CDI patients



CDI Prevention: A Systems Approach



Early Identification of CDI Patients
Risk factors that increase suspicion for CDI:
- Antibiotic use in last 3 months
- Advanced age
- Long-term care facility resident

If CDI is suspected*:
- Patient has diarrhea: ≥3 unformed stools per 24 hours

Inform provider of suspected CDI

- Discontinue all non-essential antibiotics
- Discontinue all anti-peristaltic medications
- Consider empiric treatment**

- Order stool testing
- Confirm unformed stools (Bristol)
- Submit ONE specimen

Notify provider of test result

Negative

- Discontinue Isolation Precautions if other infectious agents requiring Isolation Precautions have been ruled out

- Discontinue empiric treatment for CDI
- Evaluate for other causes of diarrhea if appropriate

Positive

Implement Isolation Precautions:
- Place patient in private room
  - Cohort patient if private room is not available
- Place Isolation Precautions sign on patient's door
- Hand hygiene
- Dedicate patient care equipment

- Consider obtaining infectious disease consult
- Initiate treatment as indicated**

* For patients < 1 year: do not routinely test for CDI. For patients 1 - 2 years: consider diagnoses other than CDI first; if no recent antimicrobial exposure, use more than one diagnostic test (include culture)

** Clinical Practice Guidelines for *Clostridium difficile* Infection in Adults: 2010 Update by the Society for Healthcare Epidemiology of America (SHEA) and the Infectious Diseases Society of America (IDSA)

Core CDI Prevention Strategies

Early Recognition of CDI

- Train nurses to recognize CDI signs/symptoms
- Train appropriate staff to obtain stool specimens for laboratory testing
- Notify provider of suspected CDI patients
- Evaluate use of PCR-based molecular assay for *C. difficile* diagnostic testing
- Laboratory policy to reject formed stools
- Diagnosis protocol:
  - Test unformed stools only (Bristol Stool Chart types 5-7)
  - Submit one specimen only
  - Do not conduct repeat testing during same episode of diarrhea for confirmed CDI patients
  - Do not test asymptomatic patients
  - Do not perform "tests of cure"
  - Retest only if CDI symptoms continue or recur after 10 days of treatment
  - Consider other diagnoses in patients <2 years of age
- Communicate test results in a timely manner to:
  - Provider
  - Patient care unit/facility
  - IP department

Isolation Precautions

- Place patient in private room w/ bathroom or beside commode
- Limit patient transport/movement outside room
- Cohort patients if private room not available
- Preferentially place incontinent patients in private rooms if private rooms are limited
- Do not cohort patients co-infected w/ discordant epidemiologically important organisms
- Isolation Precautions supplies are readily available outside patient rooms
- Responsibility for checking & restocking supplies is assigned
- Follow CDC or WHO hand hygiene guidelines
- Immediately post Isolation Precautions sign outside suspected & confirmed CDI patient rooms
- Indicate Isolation Precautions status in medical record
- Communicate Isolation Precautions status to receiving units/facilities upon patient transfer
- Discontinue Isolation Precautions
  - If CDI test result is negative (for patients preemptively placed in Isolation Precautions); or
  - When CDI symptoms have resolved
- Do not place asymptomatic or *C. diff* colonized patients in Isolation Precautions

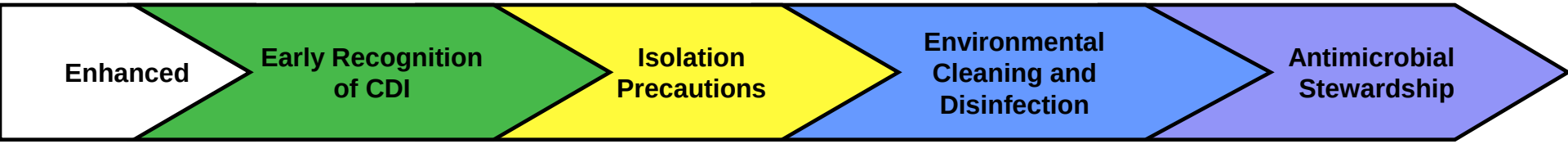
Environmental Cleaning and Disinfection

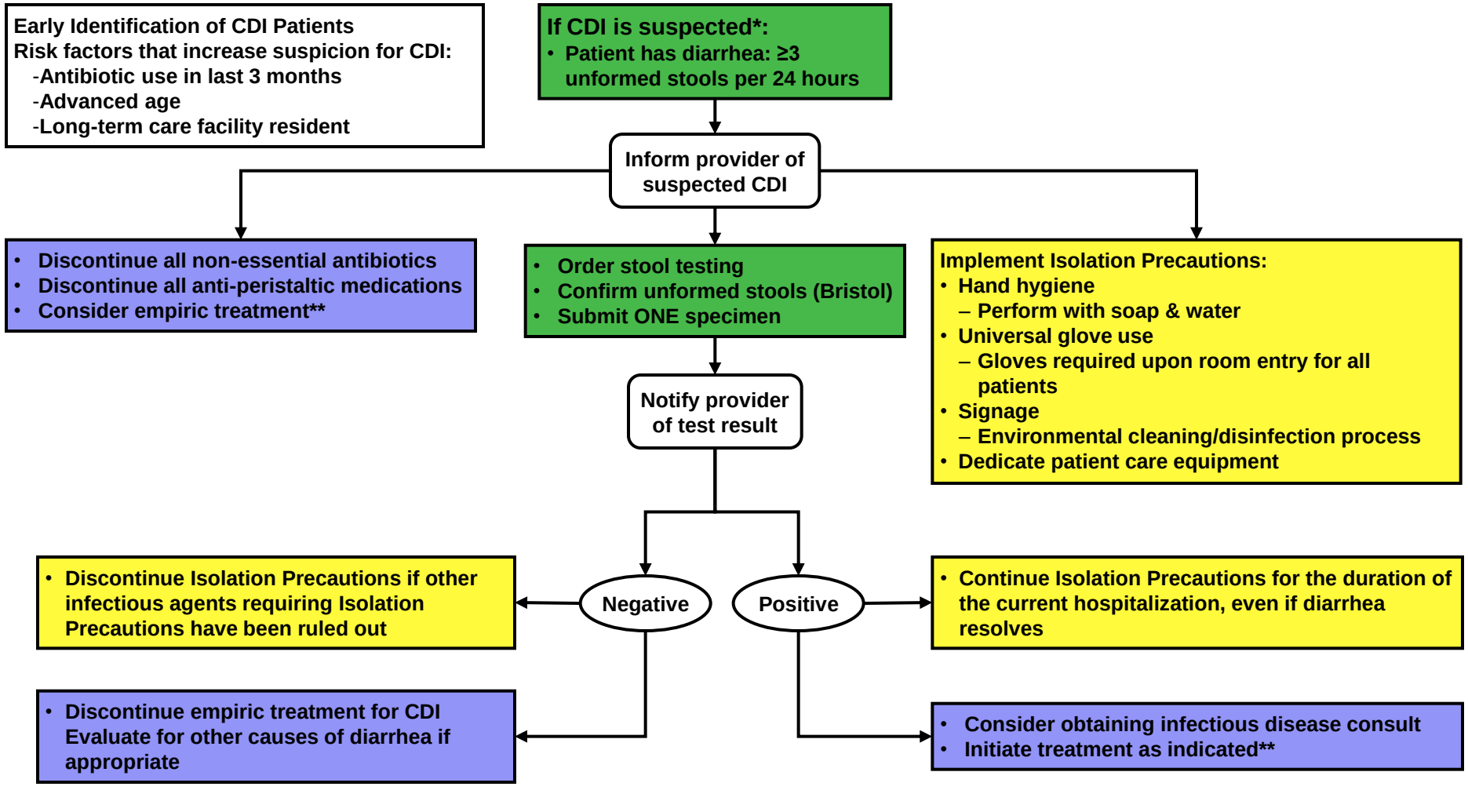
- Cleaning/disinfection protocol:
  - Use hospital grade EPA-registered germicide for routine disinfection (follow recommended contact time and dilution)
  - Use standard disinfectant application protocols (change disinfecting wiper when unable to achieve appropriate wet contact time or when visibly soiled; do not pre-soak or re-dip in open bucket system)
  - Assess routine processes using observational audits
  - Assign responsibility for monitoring/restocking supplies
  - Assign responsibility for cleaning/disinfecting patient care equipment, high-touch surfaces (nursing vs. ES staff)
  - Implement a cleaning/ disinfection schedule of patient care equipment and environment
  - Patient care equipment dedicated or cleaned/ disinfected between every patient use

Antimicrobial Stewardship

- Antimicrobial stewardship team includes, at a minimum, ID physician, CDI Prevention physician champion, and representation from pharmacy, IP, microbiology, IT and/or hospitalist/intensivist
- Prospectively audit facility level antimicrobial use (volume & classes); provide feedback to prescribers, medical staff, & facility leadership
- Monitor antimicrobial prescribing practices; provide feedback to prescribers
- Consider antimicrobial formularies & preauthorization requirements for non-formulary antimicrobial use
- Clinical treatment pathways developed based on local/regional and state antibiotic resistance data
- Review treatment pathways and order sets that include antimicrobial prescribing
- Prescribers adjust empirically prescribed antibiotics in a timely manner based on lab results
- Consider real-time surveillance of antimicrobial prescribing (frequency, duration, and number of antimicrobial agents prescribed per patient)

CDI Prevention: A Systems Approach





* For patients < 1 year: do not routinely test for CDI. For patients 1 - 2 years: consider diagnoses other than CDI first; if no recent antimicrobial exposure, use more than one diagnostic test (include culture)

** Clinical Practice Guidelines for *Clostridium difficile* Infection in Adults: 2010 Update by the Society for Healthcare Epidemiology of America (SHEA) and the Infectious Diseases Society of America (IDSA)

Enhanced CDI Prevention Strategies

Early Recognition of CDI

- **Identify previously unrecognized CDI patients through patient care rounds or electronic surveillance**
- **Implement PCR-based molecular assay for diagnostic testing**

Isolation Precautions

- **Preemptively place patients with ≥3 unformed stools in 24 hours in Isolation Precautions**
- **CDI positive patients remain in Isolation Precautions for duration of current hospitalization, even if diarrhea resolves**
- **Universal glove use on floors/units/areas with endemic rates or ongoing CDI transmission**
- **Increase frequency and/or scope of monitoring compliance with Isolation Precautions**
- **Soap and water for hand hygiene upon room exit**
  - **If sink not accessible, perform hand hygiene with alcohol-based hand rub; wash with soap and water immediately after exiting patient room**
- **Increase frequency and/or scope of monitoring compliance with hygiene practices**
- **Notify Environmental Services staff of patient rooms requiring ENHANCED cleaning/ disinfection**

Environmental Cleaning and Disinfection

- **Use a chlorine-containing or other sporicidal product/ technology for daily and terminal disinfection of *all CDI patient* rooms and patient care equipment**
- **Evaluate use of chlorine-containing or other sporicidal product/technology for daily and terminal disinfection of *all patient rooms* and patient care equipment on *affected unit***
- **Assess routine cleaning/ disinfection processes using a biochemical product before changing products or processes**

Antimicrobial Stewardship

- **Evaluate the antimicrobial stewardship program; ensure all recommended components are in place**
- **Evaluate clinical management strategies of CDI patients**
- **Monitor antimicrobial prescribing practices for the treatment of CDI and provide feedback to prescribers**

Safe from CDI Bibliography

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SAFE from CDI

S – "SAFE from CDI" Teams

Sample *Safe from CDI* Interdisciplinary Team Roles
Minnesota Department of Health, HAI Prevention Unit
(Adapted from National Health Service Guidance)

Example *Safe from CDI* Interdisciplinary Team Roles

Physician Champion

- Follow and promote hospital antimicrobial guidelines for primary care.
- Know major risk factors and symptoms of CDI.
- Have a decision-making role on the facility Antimicrobial Stewardship Team.
- Partner with operational champions.
- Ensure that staff are aware of CDI prevention and treatment issues (e.g., talks, email, or other opportunities).
- Follow and promote standard CDI treatment protocols.
- Ensure that all cases of CDI that result in severe disease (e.g., toxic megacolon, admission to ICU, or death) are fully investigated (i.e. root cause analysis).

CDI Interdisciplinary Team Coordinator

- Dedicated time to serve as Team Coordinator.
- Oversee implementation of CDI prevention initiative (e.g., schedule team meetings, plan staff education).
- Ensure individual roles in the CDI Prevention Strategies (i.e. patient care steps) are clearly defined and documented.
- Ensure that Isolation Precautions policies and trainings are in place for health care personnel (HCP) and that Isolation Precautions are instituted when appropriate.
- Ensure that a policy is in place for training HCP to recognize the major risk factors and symptoms of CDI.
- Ensure appropriate policies and procedures are in place for collecting stool specimens and ordering laboratory tests for *Clostridium difficile*.
- Coordinate with Infection Prevention/hospital epidemiologist to achieve effective surveillance including detection of new and recurrent cases and 'triggers for action' to prompt investigations when appropriate.
- Ensure that all cases of CDI resulting in severe disease (e.g., toxic megacolon, admission to ICU, or death) are fully investigated (i.e. root cause analysis) in conjunction with the Physician Champion.
- Promote antimicrobial stewardship in conjunction with the Antimicrobial Stewardship Team.
- Ensure that facility has a policy/procedure in place to provide adequate personal protective equipment (PPE) supplies.
- Ensure that a policy/procedure is in pace to provide adequate hand hygiene facilities and resources.
- Ensure that key facility personnel receive feedback from audits and reports.
- Promote use of educational tools (e.g., computer based learning) or educational sessions for CDI prevention.
- Ensure that a policy/protocol is in place that allows HCP with diarrhea or confirmed CDI to stay home from work and liaise with Employee Occupational Health – following standard sick leave policies.
- Ensure that a policy/procedure is in place to provide patients and relatives with information about *C. difficile*.

Operational Champions

- Develop and support the implementation of policies based on guidance provided in the *Safe from CDI* road map.
- Support the implementation of Isolation Precautions and other infection prevention measures.
- Support the implementation and operation of effective CDI surveillance.
- Inform senior management when increased numbers of cases or outbreaks of CDI are occurring.
- Ensure an effective CDI Prevention Team communication system is in place.
- Provide support when introducing changes in practice as a result of new guidance.
- Provide delivery of education on CDI prevention and control practices for all HCP.
- Participate in all CDI Interdisciplinary Team meetings.

Adapted from National Health Services Guidance on Prevention and Control of *Clostridium difficile* Infection (CDI) in Healthcare Settings in Scotland Health Protection Network Scottish Guidance September 2009

Senior Leadership Champion

- Support and ensure adherence to the *Safe from CDI r*oad map.
- Ensure an action plan is in place to support implementation of recommended CDI prevention strategies among all HCP.
- Ensure facility engagement with Infection Prevention, including sufficient resources and support for strategies aimed at reducing CDI throughout the facility.
- Ensure documentation of communication to key HCP.
- Ensure that an effective CDI surveillance system is in place that allows timely collection and feedback of data to key HCP, including Physician and Operational Champions.
- Ensure systems are in place to perform root cause analyses for severe cases of CDI and deaths due to CDI.
- Ensure reporting systems are in place to alert senior management to changes in CDI practices or surveillance data.
- Ensure information on adherence to antimicrobial prescribing policies and infection prevention strategies, including audits, is reviewed at senior management meetings.
- Facilitate and support cross-representation between the Infection Prevention Committee and Antimicrobial Stewardship Team.

Environmental Services Directors/Managers

- Communicate with Infection Prevention regarding cleaning and disinfection processes and protocols.
- Ensure resources are in place to maintain equipment and fabric.
- Ensure that existing and new buildings, furniture and equipment can be properly cleaned and disinfected.
- Ensure adequate hand hygiene and toilet facilities are available.
- Ensure there is a safe environment to allow Isolation Precautions to be applied.
- Ensure systems are in place to respond promptly to defects of buildings and equipment.
- Ensure cleaning schedules are in place including frequency of cleaning.
- Ensure defined terminal cleaning protocols in place are briefed to staff and implemented when required.

Healthcare Personnel

- Follow and adhere to hospital policies and protocols regarding CDI prevention.
- Obtain a stool specimen and request testing for *C. difficile* when appropriate.
- HCP authorized to prescribe antimicrobial agents should adhere to hospital antimicrobial prescribing policy.

Microbiology

- Ensure that laboratory antimicrobial reporting procedures support facility antimicrobial policy and stewardship.
- Support and advise clinical staff and physicians on testing and interpretation of results for CDI.
- Provide and interpret laboratory data to inform the Antimicrobial Stewardship Team.
- Support and advise Infection Prevention in laboratory-related CDI issues (e.g., increased number of cases or changes in practice).
- Support and advise Antimicrobial Management Teams on antimicrobial prescribing and implementation of stewardship program.

Antimicrobial Management Teams

- Ensure implementation, regular review, and measurement of compliance through audit of facility antimicrobial prescribing policy that minimizes the use of agents associated with CDI.
- Ensure implementation and audit of the facility CDI treatment protocol.
- Ensure that reports on adherence to antimicrobial prescribing policies are fed back to all relevant levels within the facility, including the senior management prescribers, and pharmacy staff.
- Interpret local/regional surveillance information on antimicrobial resistance and usage.
- Support and advise clinical staff on antimicrobial prescribing.
- Ensure implementation of multidisciplinary educational programs on antimicrobial stewardship and antimicrobial prescribing.

SAFE from CDI

A – Access to Information

Audit Tools

SAFE from CDI Road Map Checklist

Infection Prevention and Control Isolation Compliance Checklist
Association for Professionals in Infection Control and Epidemiology Guide to the Elimination of Clostridium difficile in Healthcare Settings, 2008

Novant Health Hand Hygiene Observation Tool
The Joint Commission Journal on Quality and Patient Safety, 2009

Hand Hygiene Monitoring Form
Hand Hygiene Resource Center (http://www.handhygiene.org/educational_tools.asp)

How-to Guide: Improving Hand Hygiene
Institute for Healthcare Improvement (www.ihi.org)

Surveillance Tools

National Healthcare Safety Network CDI Surveillance Definition
Minnesota Department of Health, HAI Prevention Unit
(http://www.cdc.gov/nhsn/PDFs/pscManual/12pscMDRO_CDADcurrent.pdf)

Laboratory-identified MDRO or CDI Event Form
National Healthcare Safety Network
(http://www.cdc.gov/nhsn/forms/57.128_LabIDEvent_BLANK.pdf)

Sample CDI Surveillance Spreadsheet
University of Minnesota Medical Center, Fairview

CDI Notification Form
University of Minnesota Medical Center, Fairview

Root Cause Analysis

Infection Control: Root Cause Analysis Briefing
National Health Services

CDI Root Cause Analysis Data Gathering Tool
National Health Services (http://hcai.dh.gov.uk/diagnosing/rca/)

Checklist:
Road Map to a Comprehensive *Clostridium difficile* Infection (CDI) Prevention Program

MINNESOTA MDH DEPARTMENT OF HEALTH

Minnesota Hospital Association

The ***Safe from CDI Road Map*** provides consistent recommendations/standards for Minnesota acute care hospitals in the development of comprehensive *Clostridium difficile* infection (CDI) prevention programs. The road map and companion tool kit were developed as part of the Minnesota CDI Prevention Collaborative, made possible with American Reinvestment and Recovery Act funds through the Centers for Disease Control and Prevention Epidemiology and Laboratory Capacity Program.

The CDI prevention strategies are presented as a two-tiered approach (core and enhanced). Enhanced strategies are to be considered in addition to core strategies when there is evidence that the core strategies are being implemented and adhered to consistently and there is evidence of ongoing transmission of *C. difficile* and/or evidence that CDI rates are not decreasing and/or evidence of a change in CDI pathogenesis. The prevention strategies address four topic areas: early recognition of patients with CDI, isolation precautions, environmental cleaning and disinfection, and antimicrobial stewardship. The road map is based on current (October 2011) guidelines, recommendations, and published literature for CDI prevention and control in acute care hospitals. The road map content will be reviewed regularly and updated, as indicated, through available published literature.

We would like to thank the following individuals and organizations for sharing their time, expertise, and experiences which made the road map and tool kit possible:

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LifeCare Medical Center, Roseau
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Definitions

Health care personnel (HCP): All persons, paid and unpaid, working in an acute care facility who have the potential for exposure to patients and/or infectious materials, including body substances, contaminated medical supplies and equipment, contaminated environmental surfaces, or contaminated air. This includes persons not directly involved in patient care (e.g., clerical, housekeeping, and volunteers) but potentially exposed to infectious agents that can be transmitted to and from HCP and patients. This term includes, but is not limited to, physicians, physician assistants, nurse practitioners, nurses, nursing assistants, therapists, technicians, emergency medical service personnel, dental personnel, pharmacists, laboratory personnel, autopsy personnel, students and trainees, and contractual personnel.

Prescriber: Health care personnel who are licensed to prescribe medications, including antimicrobial agents.

Road Map to a Comprehensive *Clostridium difficile* Infection (CDI) Prevention Program

	Safe from CDI Component	Specific Action(s)	Audit Questions	Yes	No
S	"Safe from CDI" Teams	1) Identify senior leadership champion for CDI prevention.	1a) The facility has identified a senior leadership champion(s) to provide support and ensure resources for the CDI prevention program.	☐	☐
			1b) Senior leadership is engaged in infection prevention, including CDI prevention, as evidenced by documented communication to key health care personnel (HCP).	☐	☐
		2) Provide support and expectations for CDI prevention champions.	2a) The facility has identified a physician champion(s) for CDI prevention.	☐	☐
			2b) The physician champion(s) has a decision-making role on the facility antimicrobial stewardship team.	☐	☐
			2c) The facility has identified an operational champion(s) for CDI prevention (e.g. environmental services director, infection preventionist, laboratorian, pharmacist, patient care director).	☐	☐
			2d) A process is in place for communication between the physician and operational champion(s).	☐	☐
			2e) A process is in place to partner the environmental services director and infection preventionist.	☐	☐
			2f) The facility has defined roles, set expectations, and provides support for the champion(s).	☐	☐
		3) Adopt an interdisciplinary team approach to CDI prevention with a designated coordinator to oversee implementation.	3a) A team, with participation by front-line staff, is in place to oversee and support CDI prevention work. Team members include, at a minimum: i) Environmental services director or designee ii) Infection preventionist iii) Laboratorian iv) Pharmacist v) Patient care director or designee	☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐
			3b) A coordinator is assigned to oversee CDI prevention implementation (e.g. schedule team meetings, plan HCP education).	☐	☐
			3c) The coordinator has dedicated time to serve in this role.	☐	☐
			3d) Individual roles in the CDI Prevention Strategies (patient care steps) are clearly defined and documented.	☐	☐
A	Access to Information	1) Verify implementation of the CDI Prevention Strategies.	**The facility has a process in place to:** 1a) Document implementation of the CDI Prevention Strategies.	☐	☐
		2) Audit the CDI Prevention Strategies.	**Monitor compliance with Core and Enhanced (if indicated) CDI Prevention Strategies:** 2a) Early recognition of CDI	☐	☐

Road Map to a Comprehensive *Clostridium difficile* Infection (CDI) Prevention Program

	Safe from CDI Component	Specific Action(s)	Audit Questions	Yes	No
			2b) Prompt implementation of Isolation Precautions	☐	☐
			2c) Hand hygiene	☐	☐
			2d) Environmental cleaning and disinfection of patient care equipment and the environment of CDI patients	☐	☐
			2e) Antimicrobial stewardship	☐	☐
		3) Review and analyze the CDI Prevention Strategies audit data.	**Review and analyze audit data for Core and Enhanced (if indicated) CDI Prevention Strategies:** 3a) Compliance with early recognition of CDI	☐	☐
			3b) Compliance with Isolation Precautions	☐	☐
			3c) Compliance with hand hygiene	☐	☐
			3d) Compliance with environmental cleaning and disinfection of patient care equipment and the environment of CDI patients	☐	☐
			3e) Compliance with antimicrobial stewardship	☐	☐
		4) Conduct CDI surveillance.	**The facility has in place:** 4a) Facility-wide CDI surveillance.	☐	☐
			4b) Application of standardized National Healthcare Safety Network (NHSN) CDI surveillance definitions.	☐	☐
			4c) Surveillance for colectomies associated with CDI.	☐	☐
			4d) A process to conduct root-cause analyses for colectomies and deaths associated with CDI.	☐	☐
			4e) Periodic monitoring of autopsy and mortality data for unrecognized CDI.	☐	☐
		5) Review and analyze CDI surveillance data.	**The facility has a process in place to review and analyze:** 5a) Facility-wide CDI surveillance data.	☐	☐
			5b) Surveillance data and root-cause analyses for colectomies/deaths associated with CDI.	☐	☐
			5c) Surveillance of autopsy and mortality data for unrecognized CDI.	☐	☐
		6) Disseminate the CDI Prevention Strategies audit and surveillance data.	**The facility has a process in place to provide CDI audit and surveillance data to key stakeholders at least quarterly:** 6a) Facility senior leadership	☐	☐
			6b) Physicians	☐	☐
			6c) Patient care staff	☐	☐
			6d) Environmental services leadership	☐	☐

Road Map to a Comprehensive *Clostridium difficile* Infection (CDI) Prevention Program

	Safe from CDI Component	Specific Action(s)	Audit Questions	Yes	No
			6e) Environmental services staff	☐	☐
			6f) Pharmacy	☐	☐
			6g) Laboratory	☐	☐
F	Facility Expectations	1) Set expectations for implementation of the CDI Prevention Strategies.	1a) The facility has outlined a roll-out plan for implementation (i.e. unit(s), evaluation, timelines, and prevention strategies).	☐	☐
			1b) The facility has developed and clearly communicated HCP expectations for implementation of the CDI Prevention Strategies.	☐	☐
			1c) The facility has defined provider (e.g. physician, physician assistant, nurse practitioner) expectations for implementation of the CDI Prevention Strategies.	☐	☐
		2) Set expectations for hand hygiene practices.	2a) The facility has developed and implemented a facility-wide hand hygiene program.	☐	☐
			2b) The facility has clearly communicated HCP expectations for appropriate hand hygiene practices.	☐	☐
		3) Expect HCP to "speak up" about HCP behavior or facility issues that may increase patient infection risk (e.g. hand hygiene or Isolation Precautions are not followed).	3a) The facility has engaged HCP, including providers, in creating a culture that encourages HCP to inform each other if noncompliance with CDI Prevention Strategies is observed.	☐	☐
			3b) The facility has engaged HCP, including providers, to create a culture that encourages HCP to provide positive feedback to each other when compliance with CDI Prevention Strategies is observed.	☐	☐
		4) Encourage patients and families to "speak up" about HCP/provider practices that may increase infection risk.	4a) The facility has a process in place to encourage patients and families to speak up if they have concerns about HCP/provider practices or other issues that may increase infection risk.	☐	☐
		5) Set expectations for the clinical management of CDI patients.	**Facility expectations for prescribers/providers include the following:** 5a) Discontinue inciting antibiotics, if possible, when CDI is suspected.	☐	☐
			5b) Avoid antiperistaltic agents for patients suspected/diagnosed with CDI.	☐	☐
			5c) Follow best practices for CDI treatment (e.g. 2010 SHEA-IDSA Guideline).	☐	☐
			5d) Consult with specialists when recurrent or worsening CDI is identified (e.g. infectious disease physicians, general surgeons).	☐	☐

Road Map to a Comprehensive *Clostridium difficile* Infection (CDI) Prevention Program

	Safe from CDI Component	Specific Action(s)	Audit Questions	Yes	No
		6) Set expectations for environmental cleaning and disinfection.	6a) The facility has a process in place to implement environmental cleaning and disinfection as outlined by environmental services and infection prevention and other departments as needed.	☐	☐
			6b) The facility has clearly communicated HCP expectations for environmental cleaning and disinfection.	☐	☐
		7) Set expectations for antimicrobial stewardship.	7a) The facility has a process in place to develop and implement an antimicrobial stewardship program.	☐	☐
E	Educate Staff and Patients	1) Provide CDI prevention education for all HCP.	1a) All HCP, including physicians, receive CDI prevention education at new employee orientation.	☐	☐
			1b) All HCP including physicians, receive CDI prevention education at least annually.	☐	☐
		2) Provide cleaning and disinfection education for nursing and ancillary/support staff.	2a) The facility has a process is in place to provide cleaning and disinfection education for nursing and ancillary/support staff.	☐	☐
		3) Provide education and competency testing for environmental services trainers.	**The facility has a process in place to require person(s) responsible for environmental services training to:** 3a) Receive education on current environmental cleaning/disinfection practices at least annually.	☐	☐
			3b) Complete a competency evaluation of cleaning/disinfection practices at least annually.	☐	☐
		4) Provide cleaning/ disinfection training and evaluation for environmental services staff.	4a) Training materials are provided in the staff's native language, or ensure communication of the information through other means.	☐	☐
			4b) Environmental services staff training includes return demonstration.	☐	☐
			4c) A systematic process is in place to periodically evaluate terminally-cleaned rooms.	☐	☐
			4d) Processes are in place to address issues identified through cleaning/disinfection evaluations.	☐	☐
		5) Provide competency testing to environmental services staff.	5a) Environmental services staff training includes written or verbal competency testing. i) Competency testing includes demonstrated understanding of the rationale for cleaning/disinfection components.	☐ ☐	☐ ☐
			5b) Expectations are in place for environmental services staff to pass a competency test prior to assignment to patient care areas.	☐	☐
			5c) Expectations are in place for environmental services staff that do not pass the competency test to receive additional training or be assigned to non-patient care areas.	☐	☐

Road Map to a Comprehensive *Clostridium difficile* Infection (CDI) Prevention Program

	Safe from CDI Component	Specific Action(s)	Audit Questions	Yes	No
		6) Provide physician/ prescriber education on CDI prevention, diagnosis, manage-ment, and treatment.	6a) CDI prevention education, including the physician/prescriber role in antimicrobial stewardship, is provided at orientation for new physicians/prescribers.	☐	☐
			6b) A process is in place for the CDI physician champion to educate physicians/prescribers about CDI clinical spectrum (including treatment and disease severity), current research, and the facility's CDI diagnostic methods.	☐	☐
			6c) Best practices for CDI diagnosis and management are readily available to physicians/prescribers.	☐	☐
			6d) A process is in place to monitor CDI diagnosis and management within the facility.	☐	☐
		7) Provide education on CDI laboratory diagnostic methods.	**The facility has a process in place to:** 7a) Educate laboratory staff regarding specimen testing (e.g. policy for testing only unformed stools).	☐	☐
			7b) Educate laboratory leadership on current laboratory diagnostic research.	☐	☐
			7c) Educate nursing staff on facility policies for specimen collection and specimen testing (e.g. test only unformed stools).	☐	☐
		8) Provide CDI prevention education to operational champion(s).	**The facility has a process in place:** 8a) To provide operational champions with CDI education, including best practices, management and infection prevention and control strategies, at least annually.	☐	☐
			8b) For the operational champions to disseminate information throughout the organization (e.g. train-the-trainer).	☐	☐
		9) Educate patients and families about their role in CDI prevention.	9a) Infection prevention education is provided to patients and families.	☐	☐

CDI Prevention Strategies

CORE Prevention Strategies = Strategies that should always be in place.

ENHANCED Prevention Strategies = Strategies to be considered in addition to core strategies when:

a) There is evidence that the core strategies are being implemented and adhered to consistently.
And;
b) There is evidence of ongoing transmission of *C. difficile* and/or
c) There is evidence that CDI rates are not decreasing and/or
d) There is evidence of change in CDI pathogenesis (e.g. increased morbidity/mortality among CDI patients).

Specific Action(s)	CORE Prevention Strategies	Yes	No	Specific Action(s)	ENHANCED Prevention Strategies	Yes	No
Early Recognition of CDI							
1) Early identification of patients with suspect CDI	**The facility has a standardized CDI identification process in place that includes the following:** 1a) Nurses are trained to recognize the signs/ symptoms of CDI (see Bristol Stool Chart).	☐	☐	***Enhanced identification of patients with suspect CDI***	**The facility has developed an ENHANCED CDI identification process that includes the following:** 1a) Identification of previously unrecognized patients with symptoms of CDI (e.g. patient care rounds).	☐	☐
	1b) Appropriate HCP are trained to obtain specimens for laboratory testing of patients suspected of having CDI.	☐	☐				
	1c) Timely communication to the provider of patients suspected of having CDI.	☐	☐				
2) Laboratory testing	2a) PCR-based molecular assay is evaluated for *C. difficile* diagnostic testing.	☐	☐	***Enhanced laboratory testing***	2a) Implement PCR-based molecular assay for C. difficile diagnostic testing.	☐	☐
	The facility has a standardized laboratory testing policy in place that includes the following: 2b) Reject formed stools.	☐	☐				
	2c) Avoid serial testing of patients.	☐	☐				
3) Diagnosis	**The facility has a standardized diagnostic protocol in place that includes the following:** 3a) Test unformed stools only (see Bristol stool chart types 5 – 7).	☐	☐				
	3b) Submit one stool specimen for initial CDI testing.	☐	☐				
	3c) Avoid serial testing when initial test is negative.	☐	☐				

Specific Action(s)	CORE Prevention Strategies	Yes	No	Specific Action(s)	ENHANCED Prevention Strategies	Yes	No
	3d) Do not test asymptomatic patients.	☐	☐				
	3e) Do not conduct repeat testing during the same episode of diarrhea for confirmed CDI patients (e.g. electronic flag).	☐	☐				
	3f) Retest only if CDI symptoms continue or recur after 10 days of treatment.	☐	☐				
	3g) Do not perform "tests of cure" post treatment.	☐	☐				
	3h) Do not routinely test patients less than 1 year of age.	☐	☐				
	3i) For patients 1 - 2 years of age, consider diagnoses other than CDI first; if no recent antimicrobial exposure, use more than one diagnostic approach (including culture).	☐	☐				
	3j) For patients >2 years of age with recent antimicrobial exposure, test and treat as for adults.	☐	☐				
4) Communi-cation	**The facility has a standardized communication process in place that includes timely communication of CDI test results to:** 4a) Patient care unit/facility	☐	☐				
	4b) Provider	☐	☐				
	4c) Infection Prevention	☐	☐				
Isolation Precautions							
1) Place patient in Isolation Precautions	**The facility has Isolation Precautions identified that include the following:** 1a) Patient is placed in a private room with a bathroom or bedside commode solely for use by patient.	☐	☐	***Enhanced patient placement in Isolation Precautions***	**The facility has ENHANCED Isolation Precautions identified that include the following:** 1a) Patients with loose stools (e.g. ≥3 unformed stools in 24 hours) are preemptively placed in Isolation Precautions.	☐	☐
	1b) Health care workers perform hand hygiene and don gloves and gown prior to entering patient room.	☐	☐		1b) Universal glove use is implemented on floors/units/areas with endemic rates or ongoing transmission of CDI.	☐	☐
	1c) Gloves are changed immediately if visibly soiled and after touching or handling surfaces/materials contaminated with feces.	☐	☐		1c) Frequency and/or scope of monitoring compliance with Isolation Precautions is increased.	☐	☐

Specific Action(s)	CORE Prevention Strategies	Yes	No	Specific Action(s)	ENHANCED Prevention Strategies	Yes	No
	1d) Gloves and gown are removed before exiting the patient room.	☐	☐				
	1e) Hand hygiene (soap and water preferred) is performed before exiting the patient room; alcohol-based hand rub is used if soap and water are not available.	☐	☐				
	1f) Patient transport or movement outside of the room is avoided unless medically necessary.	☐	☐				
	1g) Single use patient care equipment is utilized when possible (e.g. blood pressure cuff).	☐	☐				
	1h) If private room availability is limited, incontinent patients are preferentially placed in private rooms.	☐	☐				
2) Cohort patients if private room is not available	2a) Cohorted patients each have a dedicated bedside commode.	☐	☐				
	2b) Health care workers change gown and gloves and perform hand hygiene when moving between cohorted patients.	☐	☐				
	2c) Patients with discordant status of infection or colonization with other epidemiologically important organisms (e.g. VRE, MRSA) are not cohorted.	☐	☐				
3) Isolation Precautions supplies are readily available	3a) Adequate supplies for compliance with Isolation Precautions (e.g. gowns, gloves) are readily accessible outside of the patient room.	☐	☐				
	3b) Responsibility is assigned for regularly checking and restocking supplies.	☐	☐				
4) Follow hand hygiene guidelines	4a) Hand hygiene practices follow CDC or WHO guidelines.	☐	☐	***Enhanced hand hygiene guidelines***	4a) Hand hygiene is performed with soap and water upon room exit. If hand-washing sink is not accessible, hand hygiene is performed with alcohol-based hand rub, and followed immediately with hand hygiene using soap and water after exiting the patient room.	☐	☐
					4b) Frequency and/or scope of monitoring compliance with hand hygiene practices is increased.	☐	☐

Specific Action(s)	CORE Prevention Strategies	Yes	No	Specific Action(s)	ENHANCED Prevention Strategies	Yes	No
5) Communicate Isolation Precautions status	5a) Isolation Precautions status is documented in the medical record.	☐	☐	***Enhanced communication of Isolation Precautions status***	5a) Environmental services staff is notified of patient rooms requiring **ENHANCED** cleaning and disinfection.	☐	☐
	5b) Isolation Precautions signage is immediately posted outside positive CDI patient rooms.	☐	☐				
	5c) Icons/symbols on Isolation Precautions signage include: i) Hand hygiene for entry and exit ii) Gown and gloves for room entry iii) Process for environmental cleaning/disinfection	☐ ☐ ☐	☐ ☐ ☐				
	5d) When CDI patients are transferred, Isolation Precautions status is communicated to receiving facilities.	☐	☐				
6) Discontinue Isolation Precautions as appropriate	6a) For patients preemptively placed in Isolation Precautions, patients are removed from Isolation Precautions if CDI test is negative and other infectious agents that require Isolation Precautions have been ruled out.	☐	☐	***Enhanced discontinuation of Isolation Precautions as appropriate***	6a) Isolation Precautions are continued for the duration of the current hospitalization for confirmed CDI patients, even if diarrhea resolves.	☐	☐
	6b) Patients are removed from Isolation Precautions when CDI symptoms resolve (e.g. patient has <3 unformed stools in a 24 hour period).	☐	☐				
Environmental Cleaning and Disinfection							
1) Clean and disinfect patient rooms and patient care equipment	**The facility has a standardized environmental cleaning and disinfection protocol in place that includes the following:** 1a) Hospital grade EPA-registered germicide is used for routine disinfection.	☐	☐	***Enhanced cleaning and disinfection of patient rooms and patient care equipment***	**The facility has an ENHANCED cleaning and disinfection protocol in place that includes the following:** 1a) Chlorine-containing or other sporicidal product/technology is used for daily and terminal environmental disinfection for *all CDI patient rooms* and patient care equipment.	☐	☐

Specific Action(s)	CORE Prevention Strategies	Yes	No	Specific Action(s)	ENHANCED Prevention Strategies	Yes	No
	1b) Manufacturer product recommendations are followed for use, including contact time and dilution.	☐	☐		1b) Evaluation of the use of chlorine-containing or other sporicidal product/technology used for daily and terminal environmental disinfection for *all* patient rooms and patient care equipment *on affected unit* if transmission is ongoing.	☐	☐
	1c) Standard disinfectant application protocols. i) Disinfecting wiper is changed when unable to achieve appropriate wet contact time and when visibly soiled. ☐ ii) Disinfecting wipers are not pre-soaked or re-dipped in the open bucket system. ☐	☐ ☐	☐ ☐		1c) Routine cleaning/disinfection processes are assessed using a biochemical product (e.g. ATP, bioluminescence, fluorescent dye/marker) before changing products or processes.	☐	☐
	1d) Routine cleaning/disinfection processes are assessed using observational audits before changing products or processes.	☐	☐				
	1e) Responsibility is assigned for monitoring and restocking cleaning/disinfection and personal protective equipment supplies.	☐	☐				
	1f) Responsibility is defined for which patient care equipment and high touch surfaces will be cleaned and disinfected by nursing.	☐	☐				
	1g) A cleaning/disinfection schedule is implemented for patient care equipment and patient environment.	☐	☐				
	1h) Shared patient care equipment is cleaned/disinfected between every patient use.	☐	☐				
Antimicrobial Stewardship							
1) Implement antimicrobial stewardship program	**The facility has in place:** 1a) A multidisciplinary antimicrobial stewardship team including a physician with infectious diseases interest and representation from clinical pharmacy, infection prevention, microbiology, information technology, and/or hospitalist/intensivist. *NOTE: Facilities without HCP or other resources for an antimicrobial stewardship team should consider obtaining this expertise through a cooperative relationship or consultation.*	☐	☐	***Enhanced antimicrobial stewardship program***	**The** facility **has a process is in place to:** 1a) Evaluate the antimicrobial stewardship program to ensure that all recommended components are in place and identify areas for improvement.	☐	☐

Specific Action(s)	CORE Prevention Strategies	Yes	No	Specific Action(s)	ENHANCED Prevention Strategies	Yes	No
	1b) A process to prospectively audit antimicrobial use within the facility, including volume and classes, and report this information to prescribers.	☐	☐	***Enhanced antimicrobial stewardship program***	1b) Evaluate clinical management strategies of CDI patients.	☐	☐
	1c) A process to monitor antimicrobial prescribing practices within the facility and provide feedback to prescribers highlighting the relationship of antimicrobial use to CDI.	☐	☐	***Enhanced antimicrobial stewardship program***	1c) Monitor antimicrobial prescribing practices for the treatment of CDI and provide feedback to prescribers.	☐	☐
	1d) A process to provide antimicrobial utilization data to medical staff and facility leadership.	☐	☐				
	1e) Antimicrobial formularies and preauthorization requirements for non-formulary antimicrobial use.	☐	☐				
	1f) Guidelines or clinical treatment pathways based on local/regional and state antibiotic resistance data.	☐	☐				
	1g) A process for regular review of treatment pathways and order sets that includes antimicrobial prescribing.	☐	☐				
	1h) Clear expectations that empirically prescribed antibiotics are adjusted in a timely manner based on laboratory test results.	☐	☐				
	1i) Real-time surveillance of antimicrobial prescribing (e.g. frequency, duration, and number of antimicrobial agents prescribed per patient).	☐	☐				

NOTE: An antimicrobial stewardship program includes clearly defined expectations for clinical management strategies of CDI patients (see "F4– Facility Expectations" in "SAFE").

December 2011

SAFE from CDI

Audit Tools

Patient Safety

Infection Prevention and Control Isolation Compliance Checklist

Date and Time of Observation_____ Observer_____

Precaution/Isolation Type _____

Unit	Room #	Compliance with Hand Hygiene Practices		Person Observed (HCW or visitor) Please check appropriate box. KEY 1 = Physician, 2 = RN, 3 =Transporter, 4 = PA, 5 = Respiratory RX, 6 = Nursing assistant, 7= Rehab, 8 = Lab, 9 = Dietary, 10 = Housekeeping, 11 = Other HCW, 12 = Visitor												100% Compliant with isolation? Yes or No Identify variance by PPE or Signage				
																	YES	NO Check Observed Variance			
		ABHR	Soap + H_20	1	2	3	4	5	6	7	8	9	10	11	12			Gloves	Gown	Mask	Signs

Figure 8.1 – Infection Prevention and Control Isolation Compliance Checklist

Courtesy of Shands at the University of Florida, 2008

Appendix 1. Novant Health Hand Hygiene Observation Tool

Facility: ☐ FMC ☐ MPH ☐ TMC ☐ PH ☐ PHH ☐ PHM ☐ POH			
Date of Observations:		Shift of Observations:	
Performed by:		Unit of Observation:	
Person Observed (Code Below)	Opportunity Assessed a. before patient care b. during patient care c. after patient care	Type of Hand Hygiene HW – Hand wash HS – Hand Sanitize N – No hand hygiene	Comments / Incidental Observations (i.e., nail enhancements, empty soap, sanitizer dispensers)

Code:
1 – Physician
2 – Physician Support Staff
3 – Nursing (RN, LPN, CNAA, etc.
4 – Case Management
5 – Pastoral Care
6 – Radiology
7 – Respiratory Therapy
8 – Rehab Medicine
9 – Students
10 – Other
11- Hospitalist
12 – Laboratory
13 – Environmental Services

Hand Hygiene Monitoring Tool

Patient Care Unit/Dept.:_____ **Month/Year** _____

Initials of Monitor:_____

Healthcare Worker (HCW) Type:

1 = Physician
2A = House Officer
2B = Medical Student
2C = Physician Assistant
3 = Physician Support Staff
4 = Respiratory Therapist
5A = Registered Nurse
5B = Licensed Practical Nurse
5C = Clinical Technician
6 = IV Team
7 = Continuing Care/Social Worker
8 = Pastoral Care
9 = Physical Medicine Staff
10 = Environmental Services Worker
11 = Patient Transporter
12 = Radiology Tech.
13 = Dietitian
14 = Tray passer
15 = Other

HW = Hand Wash
HR = Alcohol Hand Rub
Y = Yes
N= No

# Obs	Date	Shift	HCW Type	Hand Hygiene BEFORE Touching Patient				Hand Hygiene AFTER Touching Patient, Environment, or Objects				Patient on Contact or Contact CD Precautions		Gloves Worn			Gown Worn		
		(Day, Eve, Night)	(See Key)	Yes HR	Yes HW	No	N/A	Yes HR	Yes HW	No	N/A	Y	N	Y	N	N/A	Y	N	N/A
1																			
2																			
3																			
4																			
5																			
6																			
7																			
8																			
9																			
10																			
	Totals																		

Hand Hygiene Resource Center

Hand Hygiene Monitoring Tool Instructions

The purpose of this hand hygiene audit tool is to determine health care worker (HCW) compliance with hand hygiene practice. Hand hygiene refers to cleaning your hands by using an alcohol-based hand rub (Purell), or by washing hands with soap (antimicrobial or plain) and water.
The audit will be performed by each departmental quality representative or designee. The quality representative records the occasions they observe where a staff member should have carried out hand hygiene, called "opportunities". Examples of hand hygiene opportunities include:

- Before touching a patient
- Before performing a clean or invasive procedure
- After handling body fluids
- After touching the patient, environment, or objects involved in the patients' care
- After removing gloves

A total of 10 observations should be performed each month. Submit completed forms to the Infection Control Department on or by the 5th of each month.

1. Write the name of your Unit/Department on the form, record the month and year, and write your initials on the line indicated.
2. Refer to the key on the tool for health care worker type and other abbreviations used on the monitoring form.
3. For each opportunity, the observer records the following:
    - **Date** – Include month, day, and year
    - **Shift** - Day, Evening, or Night
    - **Health Care Worker (HCW) type** – Use the number that corresponds with the title of the person you are observing.
    - **Hand Hygiene Before touching the patient:**
        - If a HCW cleans her/his hands with an alcohol hand rub Before touching a patient, place an **X** in the box labeled **Yes HR**
        - If a HCW washes her/his hands with soap and water Before touching a patient, place an **X** in the box labeled **Yes HW**
        - If a HCW did <u>not</u> clean their hands Before touching the patient, place an **X** in the box labeled **No**
        - If a HCW enters a patient's room, but does not touch the patient, then hand hygiene was not necessary, so put an **X** in the box labeled **N/A**
    - **Hand Hygiene AFTER touching the patient, environment, or objects:**
        - If a HCW cleans her/his hands After touching the patient, environmental surfaces or other objects in the room, put an **X** in the appropriate box (**Yes HR** or **Yes HW**)
        - If a HCW did not clean their hands after touching the patient, environmental surfaces or other objects in the room, put an **X** in the box labeled **No**
        - If a HCW enters the patient's room, but <u>does not touch anything</u>, mark the box **N/A**
    - **Contact Precautions** – If the patient is in *Contact Precautions*, place an **X** in the box labeled **Y**; otherwise put an **X** in the box labeled **N**
    - **Gloves Worn:**
        - If a HCW put on gloves Before touching the patient or any objects in the patient's room, place an **X** in the box labeled **Y**
        - HCWs should put on gloves <u>to enter the</u> <u>room</u> of a patient on *Contact Precautions*
        - If a HCW enters a patient's room without putting on gloves, mark the **N** box
    - **Gown Worn:**
        - If a HCW put on a gown when entering a patient's room, mark the **Y** box
        - If a HCW enters a patient's room without a gown, mark the **N** box
        - If a HCW enters a *Contact Precautions* room without a gown, but does not have substantial contact with the patient or objects in the room, mark the **N/A** box

INSTITUTE FOR HEALTHCARE IMPROVEMENT

How-to Guide:

Improving Hand Hygiene

A Guide for Improving Practices among Health Care Workers

This guide was prepared in collaboration with the Centers for Disease Control and Prevention (CDC), the Association for Professionals in Infection Control and Epidemiology (APIC), and the Society of Healthcare Epidemiology of America (SHEA), and has been endorsed by APIC and SHEA. Valuable input also was provided by the World Health Organization's World Alliance for Patient Safety through the Global Patient Safety Challenge.

CDC
CENTERS FOR DISEASE CONTROL AND PREVENTION

APIC
ASSOCIATION FOR PROFESSIONALS IN INFECTION CONTROL & EPIDEMIOLOGY, INC

SHEA
The Society for Healthcare Epidemiology of America

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The purpose of this guide is to help organizations reduce health-care-associated infections, including infections due to antibiotic-resistant organisms, by improving hand hygiene practices and use of gloves among health care workers.

The Case for Improving Hand Hygiene and Use of Gloves among Health Care Workers

Health-care-associated infections are an important cause of morbidity and mortality among hospitalized patients worldwide. Such infections affect nearly 2 million individuals annually in the United States and are responsible for approximately 80,000 deaths each year. Transmission of health-care-associated pathogens most often occurs via the contaminated hands of health care workers. Accordingly, hand hygiene (i.e., handwashing with soap and water or use of a waterless, alcohol-based hand rub) has long been considered one of the most important infection control measures for preventing health-care-associated infections. However, compliance by health care workers with recommended hand hygiene procedures has remained unacceptable, with compliance rates generally below 50% of hand hygiene opportunities.

- Jarvis WR. Selected aspects of the socioeconomic impact of nosocomial infections: Morbidity, mortality, cost, and prevention. *Infect Control Hosp Epidemiol.* 1996 Aug;17(8):552-557.
- Pittet D, Mourouga P, Perneger TV. Compliance with handwashing in a teaching hospital. *Ann Intern Med.* 1999;130:126-130.
- Lankford MG, Zemblower TR, Trick WE, Hacek DM, Noskin GA, Peterson LR. Influence of role models and hospital design on hand hygiene of healthcare workers. *Emerg Infect Dis.* 2003;9:217-23.

Many factors have contributed to poor handwashing compliance among health care workers, including a lack of knowledge among personnel about the importance of hand hygiene in reducing the spread of infection and how hands become contaminated, lack of understanding of correct hand hygiene technique, understaffing and overcrowding, poor access to handwashing facilities, irritant contact dermatitis associated with frequent exposure to soap and water, and lack of institutional commitment to good hand hygiene.

- Pittet D, Boyce JM. Hand hygiene and patient care: Pursuing the Semmelweis legacy. *Lancet Infect Dis.* 2001;1:9-20.

To overcome these barriers, the Centers for Disease Control and Prevention's (CDC's) Healthcare Infection Control Practices Advisory Committee (HICPAC) published a comprehensive *Guideline for Hand Hygiene in Health-Care Settings* in 2002. One of the principal recommendations of this guideline was that waterless, alcohol-based hand rubs (liquids, gels or foams) are the preferred method for hand hygiene in most situations due to the superior efficacy of these agents in rapidly reducing bacterial counts on hands and their ease of use. Alcohol preparations also rapidly kill many fungi and viruses that cause health-care-associated infections. The guideline recommended that health care facilities develop multidimensional programs to improve hand hygiene practices.

- Boyce JM, Pittet D, et al. Guideline for Hand Hygiene in Health-Care Settings: Recommendations of the Healthcare Infection Control Practices Advisory Committee and the HICPAC/SHEA/APIC/IDSA Hand Hygiene Task Force. *Morbid Mortal Wkly Rep.* 2002;51(RR16):1-45.

Recognizing a worldwide need to improve hand hygiene in health care facilities, the World Health Organization (WHO) launched its *Guidelines on Hand Hygiene in Health Care (Advanced Draft)* in October 2005. These global consensus guidelines reinforce the need for multidimensional strategies as the most effective approach to promote hand hygiene. Key elements include staff education and motivation, adoption of an alcohol-based hand rub as the primary method for hand hygiene, use of performance indicators, and strong commitment by all stakeholders, such as front-line staff, managers and health care leaders, to improve hand hygiene.

- *WHO Guidelines on Hand Hygiene in Health Care (Advanced Draft): A Summary.* World Health Organization; 2005. [Available online at http://www.who.int/patientsafety/events/05/HH_en.pdf]

Wearing gloves during patient care is an additional intervention to help reduce transmission of infectious agents in high-risk situations. Gloves protect patients by reducing contamination of the health care worker's hands and subsequent transmission of pathogens to other patients. In addition, when gloves are worn in compliance with CDC's Standard Precautions, gloves protect health care workers from exposure to bloodborne infections such as HIV and hepatitis B and C.

However, gloves must be used properly. Gloves can become contaminated during care and must be removed or changed when moving from a contaminated site to a clean site on the same patient. Gloved hands can also become contaminated due to tiny punctures in the glove material or during glove removal; therefore, hand hygiene must be performed immediately after glove removal. Consequently, use of gloves is an important adjunct to, but not a replacement for, proper hand hygiene practice.

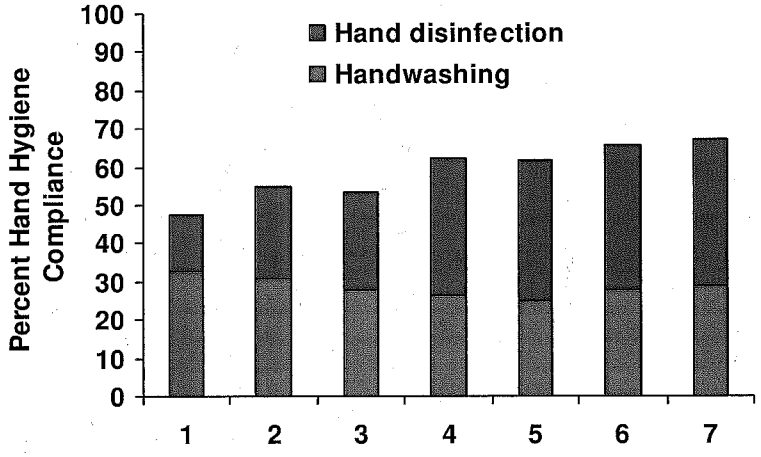
- Pittet D, et al. Bacterial contamination of the hands of hospital staff during routine patient care. *Arch Intern Med.* 1999;159:821-826.
- Pessoa-Silva CL, Richtmann R, Calil et al. Dynamics of bacterial hand contamination during routine neonatal care. *Infect Control and Hosp Epidemiol.* 2004;25:192-197.
- Tenorio AR, Badri SM, Sahgal NB, et al. Effectiveness of gloves in the prevention of hand carriage of vancomycin-resistant Enterococcus species by health care workers after patient care. *Clin Infect Dis.* 2001;32:826-829.
- Johnson S, Gerding DN, et al. Prospective, controlled study of vinyl glove use to interrupt Clostridium difficile nosocomial transmission. *Am J Med.* 1990;88:137-140.
- Garner JS, Hospital Infection Control Practices Advisory Committee. Guideline for isolation precautions in hospitals. *Infect Control Hosp Epidemiol.* 1996;17:53-80. [Available online at http://www.cdc.gov/ncidod/dhqp/gl_isolation.html]

The Potential Impact of Improving Hand Hygiene

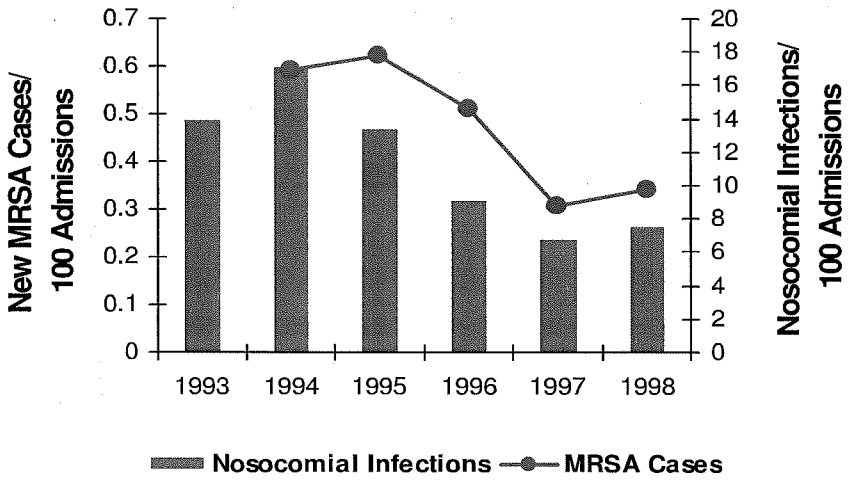
Numerous studies have suggested that hand hygiene compliance can be improved, at least modestly, by a variety of interventions, introduction of alcohol-based hand rub and educational and behavioral initiatives. Most authorities believe that multidimensional interventions are more effective. For example, Pittet et al. implemented a multidisciplinary, multimodal hand hygiene improvement program featuring promotion of alcohol-based hand rub and achieved substantial improvement in hand hygiene compliance. Much of the improvement in compliance was attributed to increased use of the alcohol-based hand rub. As hand hygiene compliance improved, both the incidence of nosocomial infections and new methicillin-resistant *Staphylococcus aureus* (MRSA) cases decreased, although the authors did not assert that they had rigorously demonstrated a causal link (see figures below).

- Pittet D, Hugonnet S, et al. Effectiveness of a hospital-wide programme to improve compliance with hand hygiene. *Lancet.* 2000;356:1307-1312.

Impact of Interventions on Handwashing and Hand Disinfection with an Alcohol-Based Hand Rub



Impact of Hand Hygiene on Incidence of Methicillin-Resistant *Staphylcoccus aureus* (MRSA) and Nosocomial Infections



The Hand Hygiene Intervention Package

The hand hygiene intervention package is a group of best practices that individually improve care, but when applied together should result in substantially greater improvement. The science supporting each intervention is sufficiently established to be considered a standard of care.

The following four components of the hand hygiene intervention package are critical aspects of a multidimensional hand hygiene program. Glove use is included in this package because proper glove use is inextricably linked to effective hand hygiene.

1. Clinical staff, including new hires and trainees, understand key elements of hand hygiene practice (demonstrate knowledge)
2. Clinical staff, including new hires and trainees, use appropriate technique when cleansing their hands (demonstrate competence)
3. Alcohol-based hand rub and gloves are available at the point of care (enable staff)

4. Hand hygiene is performed at the right time and in the right way and gloves are used appropriately as recommended by CDC's Standard Precautions (verify competency, monitor compliance, and provide feedback)

1. Clinical staff, including new hires and trainees, understand key elements of hand hygiene practice (demonstrate knowledge)

Health care workers' hands can become contaminated by touching the body secretions, excretions, nonintact skin, and wounds of patients; however, they can also become contaminated by touching intact skin of patients and environmental surfaces in the immediate vicinity of the patients. Health care workers should demonstrate accurate knowledge that their hands can become contaminated during all of these activities.

- Pittet D, Dharan S, Touveneau S, Savan V, Perneger TVI. Bacterial contamination of the hands of hospital staff during routine patient care. *Arch Intern Med.* 1999;159:821-826.
- Duckro AN, Blom DW, Lyle EA, Weinstein RA, Hayden MKI. Transfer of vancomycin-resistant enterococci via health care worker hands. *Arch Intern Med.* 2005;165:302-307.

Compared to handwashing, alcohol-based hand rubs have been shown to be more effective in reducing the number of viable bacteria and viruses on hands, require less time to use, can be made more accessible at the point of care, and cause less hand irritation and dryness with repeated use. Handwashing is required when hands are visibly contaminated and is also appropriate after caring for patients with diarrhea, including patients with *Clostridium difficile* associated diarrhea, before eating, and after use of the restroom. Health care workers should demonstrate accurate knowledge of the advantages of the use of hand rubs in most situations as well as the specific indications for handwashing.

- Boyce JM, Pittet D. Guideline for Hand Hygiene in Health-Care Settings: Recommendations of the Healthcare Infection Control Practices Advisory Committee and the HICPAC/SHEA/APIC/IDSA Hand Hygiene Task Force. *Morbid Mortal Wkly Rep.* 2002;51:1-45.

- *WHO Guidelines on Hand Hygiene in Health Care (Advanced Draft): A Summary.* World Health Organization; 2005. [Available online at http://www.who.int/patientsafety/events/05/HH_en.pdf]

»What changes can we make that will result in improvement?

Hospital teams across the United States and in other countries around the world have developed and tested change strategies that allowed them to improve knowledge of key elements of hand hygiene practice. Successful strategies include:

- Discussing the types of patient care activities that result in hand contamination as a supplement to educational material provided to health care workers
- Discussing with clinical staff the relative advantages and disadvantages of handwashing and use of alcohol-based hand rubs at the point of care
- Emphasizing the important role that contaminated hands play in transmission of health-care-associated pathogens, including multidrug-resistant pathogens and viruses
- Informing clinical staff of the morbidity and mortality caused by health-care-associated infections

2. Clinical staff, including new hires and trainees, use appropriate technique when cleansing their hands (demonstrate competency)

To be optimally effective, an appropriate volume of alcohol-based hand rub or soap must be applied to all surfaces of the hands and fingers for a sufficient length of time. Failure to do so will reduce the efficacy of the hand hygiene regimen. Accordingly, clinical staff should demonstrate competency in performing hand hygiene correctly. Competent hand rubbing requires that a sufficient volume of an alcohol-based rub is applied to cover all surfaces of the hands and fingers and that at least 15 seconds of rubbing is necessary before the hands are dry. Competent handwashing requires that a sufficient volume of soap is applied to cover all surfaces of the hands and fingers, and that at least 15 seconds of scrubbing with friction is performed before rinsing. Care should be taken to avoid contamination of hands after handwashing (paper towels or

single use cloth towels should be used; if the faucet is hand-operated, the towel should be used to turn of the spigot).

- Larson EL, Eke PI, Wilder MP, Laughon BE. Quantity of soap as a variable in handwashing. *Infect Control.* 1987;8:371-375.
- Widmer AE, Dangel M. Alcohol-based hand rub: Evaluation of technique and microbiological efficacy with international infection control professionals. *Infect Control Hosp Epidemiol.* 2004;25:207-209.

»What changes can we make that will result in improvement?

Hospital teams have developed and tested change strategies that allow them to improve competence with hand hygiene practices. Some of these changes include:

- Conducting live demonstrations of correct techniques for using an alcohol-based hand rub and handwashing during educational sessions for health care workers
- Providing videotape presentations of correct handwashing and hand rubbing technique in educational material for health care workers
- Emphasizing that an appropriate volume of hand rub or soap must be used if hand hygiene is to be effective
- Using fluorescent dye-based training methods to demonstrate correct hand hygiene techniques to clinical staff
- Periodically monitoring the adequacy of hand hygiene technique among clinical staff, and giving them feedback regarding their performance

3. Alcohol-based hand rub and gloves are available at the point of care (enable staff)

Placing alcohol-based hand rub dispensers near the point of care has been associated with increased compliance by health care workers with recommended hand hygiene procedures.

For example, Bischoff et al. found that compliance by health care workers was significantly greater when dispensers for alcohol-based hand rub were adjacent to each patient's bed than when there was only one dispenser for every four beds. In critical care, availability of alcohol-based hand rub at the point of care proved to minimize the time constraint associated with hand hygiene during patient care and to predict better compliance. In a study of hand hygiene among physicians, Pittet et al. found that easy access to an alcohol-based hand rub was an independent predictor of improved hand hygiene compliance.

- Bischoff WE, Reynolds TM, Sessler CN, Edmond MB, Wenzel RP. Handwashing compliance by health care workers: The impact of introducing an accessible, alcohol-based hand antiseptic. *Arch Intern Med.* 2000;160:1017-1021.
- Pittet D, Hugonnet S, et al. Effectiveness of a hospital-wide programme to improve compliance with hand hygiene. *Lancet.* 2000;356:1307-1312.
- Hugonnet S, Perneger TV, Pittet D. Alcohol-based hand rub improves compliance with hand hygiene in intensive care units. *Arch Int Med.* 2002;162:1037-1043.
- Pittet D, Simon A, Hugonnet S, et al. Hand hygiene among physicians: Performance, beliefs, and perceptions. *Ann Intern Med.* 2004;148:1-8.

Availability of alcohol-based products at the point of care should be supplemented by availability of gloves in appropriate sizes for use in the high-risk situations described previously for which barrier technique is indicated. Sterile gloves are not required for this purpose; studies have shown that clean single-use gloves have negligible numbers of non-pathogenic microorganisms when cultured.

»What changes can we make that will result in improvement?

Hospital teams that have developed and tested change strategies to make alcohol-based hand rub and clean gloves readily available to health care workers saw improved hand hygiene compliance. Some of these changes include:

- Placing dispensers for alcohol-based hand rub and boxes of clean gloves of various sizes near the point of care, such as:
  - Next to each patient's bed
  - Attached to the frame of patient beds

  - Near the door to each patient's room (either adjacent to the door in the corridor or just inside the door)
  - At nursing stations or on medication carts
  - Supplied as portable (pocket or belt) individual dispensers for personal use
- Installing alcohol-based hand rub dispensers in locations that are compliant with local and federal fire safety regulations
- Assigning responsibility for checking alcohol-based hand rub dispensers and glove boxes on a regular basis to assure that:
  - Dispensers and glove boxes are not empty
  - Dispensers are operational
  - Dispensers provide the correct amount of the product
- Evaluating the design and function of dispensers before selecting a product for use since poorly functioning dispensers may adversely affect hand hygiene compliance rates

4. Hand hygiene is performed and gloves are used appropriately as recommended by CDC's Standard Precautions (verify competency, monitor compliance, and provide feedback)

Clinical staff should clean their hands according to recommendations listed in the CDC *Guideline for Hand Hygiene in Health-Care Settings*. These recommendations include:

- Washing hands with plain soap or with antimicrobial soap and water, as follows:
  - When hands are visibly dirty or contaminated with proteinaceous material or with blood or other body fluids
  - Before eating
  - After using the restroom
  - After caring for patients colonized with *Clostridium difficile*
- If hands are not visibly soiled, use an alcohol-based hand rub for routinely decontaminating hands in the following situations:

  - Before direct contact with patients
  - Before donning sterile gloves when inserting a central intravascular catheter
  - Before inserting indwelling urinary catheters, peripheral vascular catheters, or other invasive devices
  - After direct contact with a patient's skin
  - After contact with body fluids, mucous membranes, nonintact skin, and wound dressings if hands are not visibly soiled
  - When moving from a contaminated body site to a clean body site during patient care
  - After contact with inanimate objects in the immediate vicinity of the patient
  - After removing gloves
- If there has been any contact with the patient or the patient's environment, hands should be decontaminated when leaving the patient's bedside or room

➢ Boyce JM, Pittet D, et al. Guideline for Hand Hygiene in Health-Care Settings: Recommendations of the Healthcare Infection Control Practices Advisory Committee and the HICPAC/SHEA/APIC/IDSA Hand Hygiene Task Force. *Morbid Mortal Wkly Rep.* 2002;51(RR16):1-45.

➢ *WHO Guidelines on Hand Hygiene in Health Care (Advanced Draft): A Summary*. World Health Organization; 2005. [Available online at http://www.who.int/patientsafety/events/05/HH_en.pdf]

Clinical staff should wear gloves according to recommendations listed in CDC's Standard Precautions. These recommendations include:

- Wearing gloves when contact with blood or other potentially infectious body fluids, excretions, secretions (except sweat), mucous membranes, and nonintact skin could occur
- Removing gloves after caring for a patient — personnel should not wear the same pair of gloves for the care of more than one patient
- Changing gloves during patient care when moving from a contaminated body site to a clean body site
- Performing hand hygiene immediately after removal of gloves

- Garner JS, Hospital Infection Control Practices Advisory Committee. Guideline for isolation precautions in hospitals. *Infect Control Hosp Epidemiol.* 1996;17:53-80. [Available online at http://www.cdc.gov/ncidod/dhqp/gl_isolation.html]
- *WHO Guidelines on Hand Hygiene in Health Care (Advanced Draft): A Summary.* World Health Organization; 2005. [Available online at http://www.who.int/patientsafety/events/05/HH_en.pdf]

»What changes can we make that will result in improvement?

Hospital teams have developed and tested change strategies that allow them to improve hand hygiene practice and use of gloves by health care workers. Some of these changes include:

- Incorporating the indications for hand hygiene and use of gloves in educational material presented to health care workers. Examples of educational materials include:
  - Periodic lectures given by knowledgeable personnel, including interactive, audience-response software, if possible
  - Videotapes and PowerPoint presentations that demonstrate the importance of proper hand hygiene techniques in health care settings
  - Interactive, computer-assisted learning available to clinical staff via the hospital's Intranet
- Conducting educational programs for personnel that include instructions for proper technique when washing hands with soap and water, or when using an alcohol-based hand rub
- Ensuring that providers understand the rationale for hand hygiene and gloves and can comply with best practices and improve patient outcomes (self-efficacy)
- Initiating a multi-component publicity campaign (e.g., posters with photos of celebrated hospital doctors/staff members recommending hand hygiene and use of gloves; drawings by children in pediatric hospitals; screen savers with targeted messaging)
- Using opinion leaders as role models and educators ("academic detailing")
- Creating a culture where reminding each other about hand hygiene and use of gloves is encouraged and makes compliance the social norm

- Enabling health care workers to comply with best hand hygiene and glove practices by creating reliable systems that ensure alcohol-based hand hygiene products and gloves in appropriate sizes are always readily available at the point of care
- Engage patients and families in hand hygiene efforts by providing patient safety "tip sheets" outlining appropriate hand hygiene and glove practices, and encouraging them to remind health care providers to comply with these standards
- Monitoring compliance by health care workers with recommended indications for hand hygiene and use of gloves, including real-time feedback to personnel and trending compliance over time

How to Begin Improvement in Your Organization

Forming the Team

The Institute for Healthcare Improvement (IHI) recommends a multidisciplinary team approach to improving hand hygiene among health care workers. Improvement teams should be heterogeneous in make-up, but unified in mindset. The value of bringing diverse personnel together is that all members of the care team are given a stake in the outcome and work together to achieve the same goal.

Including all stakeholders in the process to implement proper hand hygiene techniques will help gain buy-in and cooperation of all parties. For example, teams without nurses are bound to fail. Teams led by nurses and therapists may be successful, but often lack leverage; physicians must also be part of the team. The team should include, at a minimum, an administrator or senior leader who can help remove barriers to implementation, as well as a member of the department that supplies hand hygiene agents to clinical areas. Involve the team in designing or selecting hand hygiene posters or other motivational and educational materials.

Some suggestions for attracting and retaining excellent team members include: using data to define and solve the problem; finding champions and opinion leaders within the hospital to lend the effort immediate credibility; and engaging individuals who want to work on the project rather than trying to convince those who do not.

Commitment of institutional leadership is a key determinant of success. There must be alignment of leadership, including the board, executives, heads of clinical departments, and the infection control team. Leadership should give encouragement, set expectations, remove barriers, and celebrate success. Concrete, "raise-the-bar" goals (i.e., those that strive to achieve unprecedented levels of performance) set the stage for achieving rates of compliance well beyond historical levels. An "all-or-none" mentality for compliance (i.e., performing all elements of good practice) is necessary to achieve the highest possible levels of reliable performance. From the patient's perspective, compliance with all elements of appropriate hand hygiene and glove practice is a reasonable expectation.

Once high levels of compliance are achieved, a "process owner" must be identified — the person who will ensure that high levels of performance are maintained and help to troubleshoot key aspects of the hand hygiene program if the compliance rate falls.

Setting Aims

Dramatic improvement requires setting clear aims and quantitative time-specific improvement targets. An organization will not improve without a firm commitment and measurable goals. Teams are more successful when they have unambiguous, focused aims. Setting numerical goals clarifies the aims, creates tension for change, directs measurement, and focuses initial changes. Once aims have been established, the team needs to be careful not to back away from the aims deliberately or "drift" away unconsciously. Appropriate resources and personnel time must be allocated to achieve raise-the-bar targets.

An example of an appropriate aim for improving hand hygiene compliance can be as modest as, "Increase hand hygiene compliance by 25% within one year." However, more aggressive targets are desirable. Consistent with the JCAHO's National Patient Safety Goal #7, a raise-the-bar aim would be to improve hand hygiene compliance to greater than 90%. This latter goal helps change the focus from hand hygiene as a laudable practice to hand hygiene as a mandatory procedure. Regardless of the exact numeric target, the aim should be endorsed completely and enthusiastically by institutional leadership and opinion leaders.

Using the Model for Improvement

In order to move this work forward in your organization, IHI recommends using the Model for Improvement. Developed by Associates in Process Improvement, the Model for Improvement is a simple yet powerful tool for accelerating improvement that has been used successfully by hundreds of health care organizations to improve many different health care processes and outcomes.

The model has two parts:

- Three fundamental questions that guide improvement teams to: 1) set clear aims; 2) establish measures that will tell if changes are leading to improvement; and 3) identify changes that are likely to lead to improvement.
- Plan-Do-Study-Act (PDSA) cycles — small-scale tests of change in real work settings. Teams plan a test, try it, observe the results, and act on what is learned. It is critical for tests to be small and rapid (e.g., a test with two intensive care unit patients tomorrow). This is the scientific method applied to action-oriented learning.

Implementation:

After testing a change on a small scale, learning from each test, and refining the change through several PDSA cycles, the team can implement the change on a broader scale — for example, try to determine the best location for alcohol-based hand hygiene

products and gloves at the point of care in just one or two rooms in the ICU; try including checks on the availability of alcohol-based hand hygiene products and compliance with hand hygiene and glove policies in multidisciplinary rounds.

Spread:
After successful implementation of a change or package of changes for a pilot population or an entire unit, the team can spread the changes to other parts of the organization or to other organizations.

You can learn more about the Model for Improvement and how to spread improvements on IHI's website [http://www.IHI.org/IHI/Topics/Improvement].

Getting Started

Do not expect that the hand hygiene and glove intervention package can be implemented successfully overnight. A successful program involves careful planning, testing to determine if the processes are working, making modifications as needed, re-testing, and carefully implementing best practices.

- Select the team and the ward(s) for initial testing of change ideas.
- Assess current practice and compliance. Even if there is a hand hygiene and glove program currently in place, work with staff to begin preparing for changes to achieve raise-the-bar performance targets. Perform a survey to determine baseline hand hygiene and glove compliance rates. Determine how these compliance rates compare to those published in the literature.
- Organize an educational program. Teach the core principles of hand hygiene and glove practices to clinical staff throughout the hospital. Providing feedback to staff using baseline compliance data will open people's minds to opportunities for improvement.
- Assess satisfaction with current hand hygiene products. If an alcohol-based hand hygiene product is already available in the institution, interview caregivers about

their satisfaction with the product in terms of degree of skin irritation, consistency ("stickiness"), drying time, scent, and ease of use and reliability of dispensers.

- If an alcohol-based hand hygiene product is not currently available in the institution, have nurses and some physicians trial two or three products to determine which one(s) are most acceptable to clinical staff before selecting the product to be used. It is also important to evaluate the design and function of dispensers before selecting a product for use since poorly functioning dispensers may adversely affect hand hygiene compliance rates.
- Solicit input from clinical staff (including nurses, physicians, respiratory therapists, and others on the care team) about the best locations for installing alcohol-based hand hygiene product dispensers.
- Introduce the hand hygiene intervention package to all staff.

First Test of Change

Once a team has prepared the way for change by studying the current process and educating health care providers, the next step is to begin testing the hand hygiene intervention package.

- Select a few nursing units on which to begin using the intervention package.
- Make sure that alcohol-based hand hygiene product dispensers have been installed at the point of care and are functioning properly.
- Ensure that there is an adequate supply of clean gloves of various sizes available at the point of care.
- Conduct educational sessions on individual nursing units, or sessions that can be attended by personnel from multiple nursing units. Include patient care managers in early educational sessions.
- Give demonstrations on the appropriate techniques for using an alcohol-based hand rub and handwashing with soap and water.
- Have a member of the team (e.g., an infection control professional) visit the nursing unit(s) to answer any questions about using an alcohol-based hand hygiene product routinely for cleansing hands and appropriate use of gloves.

- Place hand hygiene promotion posters in highly visible locations throughout the hospital and begin a multi-modal campaign to improve performance.
- Engage patients and families by providing a patient safety "tip sheet," including information about hand hygiene best practices. Encourage patients and families to remind clinical staff to comply with hand hygiene and glove policies.

Measurement

Measurement tools have been included as appendices in this guide:

- Appendix 1. Hand Hygiene Knowledge Assessment Questionnaire
- Appendix 2. Checklist for the Availability of Alcohol-Based Hand Rub and Clean Gloves
- Appendix 3. Hand Hygiene and Glove Use Monitoring Form

For Appendices 2 and 3, please refer to the forms for specific information regarding the recommended process and outcome measures for improving hand hygiene.

Compliance with all aspects of each of the four interventions in the hand hygiene package should be measured as "all-or-none." In other words, if staff demonstrate correct knowledge of some, but not all, of the aspects of hand hygiene and glove use, they are not in compliance with the intervention package. If staff demonstrate only partial competency, they are not yet competent. If alcohol is present at the point of care but the dispenser is empty or gloves are not available, this is not compliant with the package. Similarly, all aspects of hand hygiene and glove use must be performed correctly during a patient encounter. This measurement strategy recognizes that raise-the-bar performance requires highly reliable care processes, and that from the patient's point of view, partial compliance is unacceptable.

Measurement is the only way to know whether a change represents an improvement. There are a number of measures that can be used to determine if hand hygiene and glove use are improving.

1. The percentage of caregivers who answer *all five questions* correctly on a standardized hand hygiene knowledge assessment survey

This measure assesses the proportion of clinical staff who demonstrate adequate knowledge of the key elements of hand hygiene and glove use. A simple, rapid, and low technology strategy is to assess the knowledge of caregivers in real time on the ward. Consider selecting a random sample of 10 clinical providers from diverse disciplines each month (or at other intervals specified by the hospital) to answer a five-question survey (see Appendix 1) in tandem with a competency check (see measure 2 below). Specific questions can be designated by the hospital and/or selected from examples in the survey in Appendix 1.

An alternative strategy is to assess knowledge using an Intranet-based learning or knowledge management system. Such electronic systems are being adopted rapidly by health care institutions in the United States. The clear advantage of this approach is that the entire clinical staff can be tested annually, or a sample may be tested at more frequent intervals. Completion of the assessment can be documented electronically and used for recredentialing purposes. Some systems can document which questions are being answered incorrectly, allowing direct measurement of the percent of caregivers who answer all of the questions correctly and facilitating design of targeted educational programs. However, some systems do not capture incorrect answers, and others allow personnel to retake the test as often as necessary to achieve a perfect score, making it impossible to calculate the required measure.

2. The percentage of caregivers who perform *all three* key hand hygiene procedures correctly

This is a simple, rapid, low technology strategy that can be used in tandem with the method described in measure 1. Randomly select a sample of 10 clinical providers from diverse disciplines each month (or at other intervals specified by the hospital) and

observe them to determine if they perform the three key hand hygiene procedures correctly: handwashing, alcohol-based hand rub, and gloves. This method has the strength of direct evaluation and feedback, but is time consuming. It also provides an opportunity to ensure that providers are not wearing artificial nails or nail extenders and have their nails trimmed to less than ¼ inch.

➢ Boyce JM, Pittet D. Guideline for Hand Hygiene in Health-Care Settings: Recommendations of the Healthcare Infection Control Practices Advisory Committee and the HICPAC/SHEA/APIC/IDSA Hand Hygiene Task Force. *Morbid Mortal Wkly Rep.* 2002;51:1-45.

Alternatively, competence can be assessed by monitoring hand hygiene practices during actual work (see measure 4 below). This has the advantage of being unobtrusive and integrated with other monitoring activities, but precludes direct feedback and adds complexity to the monitoring process.

- Handwashing: Wash hands with soap and water, including contact with soap for at least 15 seconds, covering all surfaces (palm, back of hand, fingers, fingertips, and fingernails); rub with friction
    - Turn off water without recontaminating hands: If the faucet is hand-operated, use paper towel to turn off the faucet; if the faucet is automatic, credit for compliance is given for correct performance
    - Dry hands with fresh paper towel
- Alcohol-based hand hygiene product (rub, gel, or foam): Use enough to cover all surfaces (palm, back of hand, fingers, fingertips, and fingernails); rub until dry (at least 15 seconds), which ensures sufficient volume has been applied
- Remove gloves using correct technique (so as not to contaminate the hands with a contaminated glove surface)

3. The percentage of bed spaces at which there are clean gloves in appropriate sizes *and* dispensers (wall-mounted or free-standing bottles) for alcohol-based hand rub/gel/foam that contain product, are functional, and dispense an appropriate volume of product

Make direct observations monthly (or at other intervals specified by the hospital) using a standardized procedure and form (see Appendix 2) on the same nursing units where measures 1 and 2 are monitored. Alternatively, availability can be assessed periodically as part of routine multidisciplinary rounds.

- Dispenser of alcohol-based product must be present, readily accessible at the point of care, not empty, functional, and capable of delivering the appropriate volume of product. If hand/pocket bottles are used, an adequate supply must be readily available and accessible on the ward.
- At least two sizes of gloves should be available and readily accessible at the point of care.

4. The percentage of patient encounters in which there is compliance by health care workers with all components of appropriate hand hygiene and glove practices

Compliance is monitored with direct observation by a trained observer using a standardized procedure and form (see Appendix 3). Independent observers are strongly recommended, preferably individuals who routinely are on the ward for other purposes and are not part of the care team. (This independent monitoring can be reinforced with monitoring by the care team during routine multidisciplinary rounds, which permits immediate assessment and feedback.) Observation periods should be 20-30 minutes (repeated if necessary) so that approximately 25-30 patient encounters are observed. The emphasis should be on observing complete encounters so that the proper measure of *complete* compliance with all components of the hand hygiene and glove intervention package can be calculated. Divide the number of encounters in which all components were performed correctly by the number of encounters observed and multiply by 100 to calculate the percentage compliance rate.

"Complete compliance" is defined by the adherence with the hand hygiene techniques and use of gloves as outlined in the table below. Gloves should be worn for all types of contact if the patient is on isolation precautions that require the use of gloves for contact with the patient and the environment, or if there is a unit-based procedure for universal gloving (wearing gloves for contact with all patients and their immediate environment).

Type of contact	Hand hygiene before	Hand hygiene after	Use of gloves
Patient contact that involves an invasive procedure (i.e., insertion of an intravascular catheter, urinary catheter, or other invasive device)	Yes	Yes	Yes
Patient contact that involves direct contact or potential contact with blood, body fluids, secretions (except sweat), excretions, mucous membranes, and nonintact skin (i.e., wounds, ulcers)	Yes	Yes	Yes
Patient contact not involving those noted above (i.e., taking vital signs, examination, repositioning, etc.)	Yes	Yes	*
Contact with the patient environment	--	Yes	*

** Gloves should be worn for all types of contact if the patient is on isolation precautions that require the use of gloves for contact with the patient and the environment, or if there is a unit-based procedure for universal gloving (wearing gloves for contact with all patients and their immediate environment).*

The following additional measure can also be used, but it does not replace direct observation of health care worker compliance during patient encounters:

- Volume of alcohol-based hand hygiene product consumed per week (or per month) divided by the number of patient days in the corresponding time period

Self-reporting by personnel or patients is not a reliable measure of compliance.

Barriers That May Be Encountered

- **Reluctance to change, tolerance of the status quo:** All change is difficult. The antidote is knowledge about the deficiencies of the present process and optimism about the potential benefits of a new process. The rate of compliance in most institutions is woeful, and dramatic improvement is possible.
- **Lack of leadership commitment and follow-through:** Hard work and good intentions cannot produce dramatic, long-term change without leadership buy-in and support.
- **Failure to educate and communicate:** Staff must understand the rationale for hand hygiene and glove practices, the danger of non-compliance to themselves and their patients, and the effectiveness and tolerability of hand hygiene products.
- **Failure to tailor product selection to staff preferences:** Staff should test products before they are introduced.
- **Lack of staff self-efficacy and empowerment:** Staff must believe that they have the ability and power to make major improvements.
- **Failure to make compliance a social norm and establish a culture of safety:** Staff must be empowered to remind other caregivers, regardless of rank or position, to practice hand hygiene. This should be reinforced by patients.
- **Failure to provide real time feedback of performance data:** Performance data should be communicated regularly and properly. Post trended data prominently.
- **Lack of a cohesive approach to behavior change:** A multi-factorial, creative approach to behavior change is essential.
- **Lack of physician buy-in:** Opinion leaders, role models, and physician champions, armed with educational materials and evidence, are essential.

Appendix 1. Hand Hygiene Knowledge Assessment Questionnaire

Use this questionnaire to periodically survey clinical staff about their knowledge of key elements of hand hygiene. Select 5 questions from this survey, or use other questions derived from your hospital's existing educational program. ***[NOTE: The correct answer for each question has been indicated below.]***

1. In which of the following situations should hand hygiene be performed? ***[Correct answer: #4]***

   A. Before having direct contact with a patient
   B. Before inserting an invasive device (e.g., intravascular catheter, foley catheter)
   C. When moving from a contaminated body site to a clean body site during an episode of patient care
   D. After having direct contact with a patient or with items in the immediate vicinity of the patient
   E. After removing gloves

Circle the number for the best answer:

1. B and E
2. A, B and D
3. B, D and E
4. All of the above

2. If hands are not visibly soiled or visibly contaminated with blood or other proteinaceous material, which of the following regimens is the most effective for reducing the number of pathogenic bacteria on the hands of personnel? ***[Correct answer: C]***

Circle the letter corresponding to the single best answer:

A. Washing hands with plain soap and water
B. Washing hands with an antimicrobial soap and water
C. Applying 1.5 ml to 3 ml of alcohol-based hand rub to the hands and rubbing hands together until they feel dry

3. How are antibiotic-resistant pathogens most frequently spread from one patient to another in health care settings? ***[Correct answer: C]***

Circle the letter corresponding to the single best answer:

A. Airborne spread resulting from patients coughing or sneezing
B. Patients coming in contact with contaminated equipment
C. From one patient to another via the contaminated hands of clinical staff
D. Poor environmental maintenance

4. Which of the following infections can be potentially transmitted from patients to clinical staff if appropriate glove use and hand hygiene are not performed? ***[Correct answer: E]***

Circle the letter corresponding to the single best answer:

A. Herpes simplex virus infection
B. Colonization or infection with methicillin-resistant *Staphylococcus aureus*
C. Respiratory syncytial virus infection
D. Hepatitis B virus infection
E. All of the above

5. *Clostridium difficile* (the cause of antibiotic-associated diarrhea) is readily killed by alcohol-based hand hygiene products ***[Correct answer: False]***

__ True
__ False

6. Which of the following pathogens readily survive in the environment of the patient for days to weeks? ***[Correct answer: #3]***

A. *E. coli*
B. *Klebsiella spp.*
C. *Clostridium difficile* (the cause of antibiotic-associated diarrhea)
D. Methicillin-resistant *Staphyloccus aureus* (MRSA)
E. Vancomycin-resistant enterococcus (VRE)

Circle the number for the best answer:

1. A and D
2. A and B
3. C, D, E
4. All of the above

7. Which of the following statements about alcohol-based hand hygiene products is accurate? ***[Correct answer: C]***

Circle the letter corresponding to the single best answer:

A. They dry the skin more than repeated handwashing with soap and water
B. They cause more allergy and skin intolerance than chlorhexidine gluconate products
C. They cause stinging of the hands in some providers due to pre-existing skin irritation
D. They are effective even when the hands are visibly soiled
E. They kill bacteria less rapidly than chlorhexidine gluconate and other antiseptic containing soaps

Appendix 2. Checklist for the Availability of Alcohol-Based Hand Rub and Clean Gloves

Unit/Dept.: _____ **Day of Week:** _____ **Date:** ____/____/____ **Time:** ____:____**AM/PM to** ____:____**AM/PM Initials** _____

	Room #	Bedspace #	Hand rub bottle or dispenser				Clean gloves near patient	Adherence to all elements	Comments
			Near patient	Not empty	Functional	Dispenses correct volume			
1			Y N	Y N	Y N	Y N	Y N	Y N	
2			Y N	Y N	Y N	Y N	Y N	Y N	
3			Y N	Y N	Y N	Y N	Y N	Y N	
4			Y N	Y N	Y N	Y N	Y N	Y N	
5			Y N	Y N	Y N	Y N	Y N	Y N	
6			Y N	Y N	Y N	Y N	Y N	Y N	
7			Y N	Y N	Y N	Y N	Y N	Y N	
8			Y N	Y N	Y N	Y N	Y N	Y N	
9			Y N	Y N	Y N	Y N	Y N	Y N	
10			Y N	Y N	Y N	Y N	Y N	Y N	
11			Y N	Y N	Y N	Y N	Y N	Y N	
12			Y N	Y N	Y N	Y N	Y N	Y N	
13			Y N	Y N	Y N	Y N	Y N	Y N	
14			Y N	Y N	Y N	Y N	Y N	Y N	
15			Y N	Y N	Y N	Y N	Y N	Y N	
16			Y N	Y N	Y N	Y N	Y N	Y N	
17			Y N	Y N	Y N	Y N	Y N	Y N	
18			Y N	Y N	Y N	Y N	Y N	Y N	
19			Y N	Y N	Y N	Y N	Y N	Y N	
20			Y N	Y N	Y N	Y N	Y N	Y N	
21			Y N	Y N	Y N	Y N	Y N	Y N	
22			Y N	Y N	Y N	Y N	Y N	Y N	
23			Y N	Y N	Y N	Y N	Y N	Y N	
24			Y N	Y N	Y N	Y N	Y N	Y N	
25			Y N	Y N	Y N	Y N	Y N	Y N	
26			Y N	Y N	Y N	Y N	Y N	Y N	
27			Y N	Y N	Y N	Y N	Y N	Y N	
28			Y N	Y N	Y N	Y N	Y N	Y N	
29			Y N	Y N	Y N	Y N	Y N	Y N	
30			Y N	Y N	Y N	Y N	Y N	Y N	
		Total # Y							
		% Present	%	%	%	%	%	%	

Appendix 2. Checklist for the Availability of Alcohol-Based Hand Rub and Clean Gloves (continued)

Instructions:

1. Each row should be used to record data regarding the availability of an alcohol-based hand rub (liquid, gel, or foam) and clean gloves at the point of care for an individual patient. A point of care is a bedspace, exam room, or treatment/procedure area. If multiple hand rub bottles or dispensers are available at a specific point of care, only one need be assessed. If pocket/belt bottles or dispensers are the primary way hand rub is dispensed in the unit or department, each row should be used to assess the bottle or dispenser for an individual health care worker providing care to patients in this unit or department during the assessment period.
2. The room number and bedspace fields are used to facilitate a complete assessment of all points of care in a unit or department and for reference if problems are noted with the availability of hand-rub bottles or dispensers or clean gloves, or if additional comments are recorded.
3. To qualify as being near the patient, a hand-rub bottle or dispenser and clean gloves should be accessible to a health care worker who is standing or sitting at the point of care (i.e., close to the patient's bed or attached to the frame of the bed) or to a health care worker who approaches the point of care (i.e., inside the patient's room just inside the door or in the corridor adjacent to door).
4. For the purposes of this measurement exercise, each bottle or dispenser should be assessed with regard to its capacity to dispense the correct volume into the hand of the user when activated once (i.e., that the bottle is not empty, is functional and does not spray aberrantly, and dispenses correct volume of product). Additional comments regarding bottles that are poorly placed, nearly empty, or functioning incorrectly can be noted in the comments section of the form to facilitate remedial action.
5. Codes are: Y = Yes, N = No.
6. In the Adherence field, use the following rule: Y = if **all** elements are Y (that is, Near patient, Not empty, Functional, Dispenses correct volume, and Clean gloves near patient are **all** Y); N = if not.
7. Count the total number of Y for each column and record the total in box at the bottom of each column.
8. Calculate the percent adherence using the formula below and record the percent in the box at the bottom of each column.

   Total # of Y ÷ Total # of Points of Care (number of rows with data recorded) x 100

Appendix 3. Hand Hygiene and Glove Use Monitoring Form

Unit/Dept.: _____ **Day of Week:** _____ **Date:** ____/____/____ **Time:** ____:____**AM/PM to** ____:____**AM/PM Initials** _____

	Type of Healthcare Worker (circle only one)	Type of contact		Hand hygiene before	Gloves		Hand hygiene after	Adherence		
		Patient	Environment		Required	Used		Hand hygiene	Glove use	Overall
1	D N TH PH XR ES TR OT	Y N	Y N	Alc HW N	Y N	Y N	Alc HW N	Y N	Y N NA	Y N
2	D N TH PH XR ES TR OT	Y N	Y N	Alc HW N	Y N	Y N	Alc HW N	Y N	Y N NA	Y N
3	D N TH PH XR ES TR OT	Y N	Y N	Alc HW N	Y N	Y N	Alc HW N	Y N	Y N NA	Y N
4	D N TH PH XR ES TR OT	Y N	Y N	Alc HW N	Y N	Y N	Alc HW N	Y N	Y N NA	Y N
5	D N TH PH XR ES TR OT	Y N	Y N	Alc HW N	Y N	Y N	Alc HW N	Y N	Y N NA	Y N
6	D N TH PH XR ES TR OT	Y N	Y N	Alc HW N	Y N	Y N	Alc HW N	Y N	Y N NA	Y N
7	D N TH PH XR ES TR OT	Y N	Y N	Alc HW N	Y N	Y N	Alc HW N	Y N	Y N NA	Y N
8	D N TH PH XR ES TR OT	Y N	Y N	Alc HW N	Y N	Y N	Alc HW N	Y N	Y N NA	Y N
9	D N TH PH XR ES TR OT	Y N	Y N	Alc HW N	Y N	Y N	Alc HW N	Y N	Y N NA	Y N
10	D N TH PH XR ES TR OT	Y N	Y N	Alc HW N	Y N	Y N	Alc HW N	Y N	Y N NA	Y N
11	D N TH PH XR ES TR OT	Y N	Y N	Alc HW N	Y N	Y N	Alc HW N	Y N	Y N NA	Y N
12	D N TH PH XR ES TR OT	Y N	Y N	Alc HW N	Y N	Y N	Alc HW N	Y N	Y N NA	Y N
13	D N TH PH XR ES TR OT	Y N	Y N	Alc HW N	Y N	Y N	Alc HW N	Y N	Y N NA	Y N
14	D N TH PH XR ES TR OT	Y N	Y N	Alc HW N	Y N	Y N	Alc HW N	Y N	Y N NA	Y N
15	D N TH PH XR ES TR OT	Y N	Y N	Alc HW N	Y N	Y N	Alc HW N	Y N	Y N NA	Y N
16	D N TH PH XR ES TR OT	Y N	Y N	Alc HW N	Y N	Y N	Alc HW N	Y N	Y N NA	Y N
17	D N TH PH XR ES TR OT	Y N	Y N	Alc HW N	Y N	Y N	Alc HW N	Y N	Y N NA	Y N
18	D N TH PH XR ES TR OT	Y N	Y N	Alc HW N	Y N	Y N	Alc HW N	Y N	Y N NA	Y N
19	D N TH PH XR ES TR OT	Y N	Y N	Alc HW N	Y N	Y N	Alc HW N	Y N	Y N NA	Y N
20	D N TH PH XR ES TR OT	Y N	Y N	Alc HW N	Y N	Y N	Alc HW N	Y N	Y N NA	Y N
21	D N TH PH XR ES TR OT	Y N	Y N	Alc HW N	Y N	Y N	Alc HW N	Y N	Y N NA	Y N
22	D N TH PH XR ES TR OT	Y N	Y N	Alc HW N	Y N	Y N	Alc HW N	Y N	Y N NA	Y N
23	D N TH PH XR ES TR OT	Y N	Y N	Alc HW N	Y N	Y N	Alc HW N	Y N	Y N NA	Y N
24	D N TH PH XR ES TR OT	Y N	Y N	Alc HW N	Y N	Y N	Alc HW N	Y N	Y N NA	Y N
25	D N TH PH XR ES TR OT	Y N	Y N	Alc HW N	Y N	Y N	Alc HW N	Y N	Y N NA	Y N
26	D N TH PH XR ES TR OT	Y N	Y N	Alc HW N	Y N	Y N	Alc HW N	Y N	Y N NA	Y N
27	D N TH PH XR ES TR OT	Y N	Y N	Alc HW N	Y N	Y N	Alc HW N	Y N	Y N NA	Y N
28	D N TH PH XR ES TR OT	Y N	Y N	Alc HW N	Y N	Y N	Alc HW N	Y N	Y N NA	Y N
29	D N TH PH XR ES TR OT	Y N	Y N	Alc HW N	Y N	Y N	Alc HW N	Y N	Y N NA	Y N
30	D N TH PH XR ES TR OT	Y N	Y N	Alc HW N	Y N	Y N	Alc HW N	Y N	Y N NA	Y N
							Total # of Y			
							% Adherence	%	%	%

Type of Healthcare Worker: **D** = attending, fellow, resident, PA, med stud; **N** = nurse, aide, **TH** = therapist (RT, PT, OT); **PH** = phlebotomy/IV team; **XR** = radiology technician; **ES** = environmental services; **TR** = transporter; **OT** = other

Hand hygiene before/after: Alc = alcohol-based hand rub; HW = handwashing with soap and water; N = none

Gloves Required: Y if isolation requiring gloves or contact involves an invasive procedure or contact with blood, body fluids, secretions/excretions, mucous membranes, or non-intact skin; N if not

Adherence: Hand hygiene -- Y if patient contact and hand hygiene before and after are both Y or if environmental contact only and hand hygiene after is Y; N = if not / **Glove use --** Y if Gloves Required and Used are both Y; N if Gloves Required is Y and Used is N; NA if Gloves Required is N / **Overall adherence --** Y if Hand hygiene is Y and glove use is Y or NA; N if not

Appendix 3. Hand Hygiene and Glove Use Monitoring Form (continued)

Instructions:

1. Each row should be used to record an encounter between one healthcare worker (HCW) and one patient that involves touching by the HCW of the patient or the patient's immediate environment. In situations involving and extended or complicated encounter, it is appropriate to use more than one row (see #4 below). Encounters that do not involve touching (i.e., only verbal communication between the HCW and the patient) should not be recorded.
2. An encounter may involve patient contact, environmental contact or both.
3. Patient contact involves touching the patient's body, gown, or clothes. Environmental contact involves touching the patient's bed or bed linen, bedside equipment, or other equipment, supplies, articles, or surfaces in the patient's bedspace or room.
4. For the purposes of this measurement exercise, an encounter begins when a healthcare worker enters the patient's room or approaches the patient's bedside (for multibed rooms) and ends when the healthcare worker leaves the room or bedside. In a situation where a patient requires extended or complicated care (such as in an ICU), an encounter may involve multiple contacts and it may be appropriate to record these individually if they are distinct activities. For example, a nurse may perform multiple patient care tasks at the bedside, complete this care, and then begin a series of contacts with the patient's environment. Or a nurse may complete a task that involves contact with mucous membranes and secretions, such as suctioning a patient, and then take on a separate task at a separate body site, such as changing a dressing. To the extent that these contacts can be observed and distinguished clearly, they may be recorded separately on separate rows.
5. The observer must be aware of whether a patient is on any type of isolation precautions that require the use of gloves. This information is necessary to determine whether gloves are required (see below).
6. For patient contact, the observer should be aware of the nature of the contact. This information is necessary to determine whether gloves are required (see below). It is important to distinguish three general subtypes of patient contact:
    a. contact that involves performing an invasive procedure (i.e., inserting an intravascular catheter or indwelling urinary catheter);
    b. contact that involves actual or potential contact with blood, body fluids, secretions (except sweat), excretions, mucous membranes or non-intact skin (i.e., suctioning an intubated patient, emptying a urinal or bedpan, changing an dressing on an open wound);
    c. other patient contact that does not qualify for a or b (i.e., measuring vital signs, examining a patient, repositioning a patient, etc.).
7. Use the following codes to record data (Note: Y = Yes, N = No, unless otherwise noted):
    Type of Healthcare Worker: D = attending physician, fellow, resident, physician's assistant, medical student; N = nurse, aide, TH = therapist (respiratory therapist, physical therapist, occupational therapist); PH = phlebotomy/IV team; XR = radiology technician; ES = environmental services; TR = transporter; OT = other;
    Hand hygiene before/after: Alc = alcohol-based hand rub (liquid, gel, or foam); HW = handwashing with soap and water; N = none;
    Gloves Required: Y if the patient is on any type of isolation precautions requiring gloves or the Type of Contact involved an invasive procedure or actual/potential contact with blood, body fluids, secretions/excretions, mucous membranes, or non-intact skin; N if not.
8. In the Adherence section, use the following rules to record Y or N for Hand Hygiene, Glove Use, and Overall Adherence:
    Hand hygiene: Y if the Type of Contact was patient contact and Hand hygiene before and after are both Y or if the Type of Contact was Environmental Contact only and Hand hygiene after is Y; N = if not;
    Glove use: Y if Gloves Required and Used are both Y; N if Gloves Required is Y and Used is N; NA if Gloves Required is N;
    Overall: Y if Hand hygiene is Y and Glove Use is Y or NA; N if not.
9. In the Adherence section, count the number of Y for Hand hygiene, Glove use, and Overall and record the total in box at the bottom of each column.
10. In the Adherence section, calculate the percent adherence using the formulas below and record the percent in the box at the bottom of each column
    Hand hygiene: Total # of Y ÷ Total # of Encounters (number of rows with data recorded) x 100
    Glove use: Total # of Y ÷ [Total # of Encounters (number of rows with data recorded) – Total # of NA] x 100
    Overall: Total # of Y ÷ Total # of Encounters (number of rows with data recorded) x 100

SAFE from CDI

Surveillance Tools

Patient Safety

Clostridium difficile Infection Surveillance
Using National Healthcare Safety Network (NHSN) Definitions

C. difficile Infection (CDI) Definition

C. difficile positive laboratory assay:

A positive result for a laboratory assay for *C. difficile* toxin A and/or B,

Or

A toxin-producing *C. difficile* organism detected in the stool sample by culture or other laboratory means.

- Duplicate *C. difficile* positive test: Any *C. difficile* positive laboratory assay from the same patient following a previous *C. difficile* positive laboratory assay within the past 2 weeks.
- Recurrent CDI: positive specimen obtained > 2 weeks and ≤ 8 weeks after most positive specimen.
- Incident CDI: positive specimen obtained > 8 weeks after most recent positive specimen.

CDI Surveillance Methods

Surveillance must be performed either facility-wide or in selected inpatient locations, where *C. difficile* testing in the laboratory is performed routinely only on unformed (i.e., conforming to the shape of the container) stool samples. Do on conduct surveillance in neonatal intensive care units (NICU) or well baby nurseries.

A. Facility-Wide by Location (do not include NICU):
   - Report separately from all locations of a facility.
   - Separate denominators (patient days, admissions) for all locations.

B. Selected Locations:
   - Report separately from 1 or more specific locations of a facility.
   - Separate denominators (patient days, admissions) for each location.

CDI Categorization and Rate Calculations

CDI Categorization Based on Date Admitted to Facility and Date Specimen Collected:

Community-Onset (CO):
Specimen collected ≤ 3 days after admission to the facility (i.e., days 1, 2, or 3 of admission).

Community-Onset Healthcare Facility-Associated (CO-HCFA):
Infection in a patient discharged from the facility ≤ 4 weeks prior to date specimen collected.

Healthcare Facility-Onset (HO):
Specimen collected > 3 days after admission to the facility (i.e., on or after day 4).

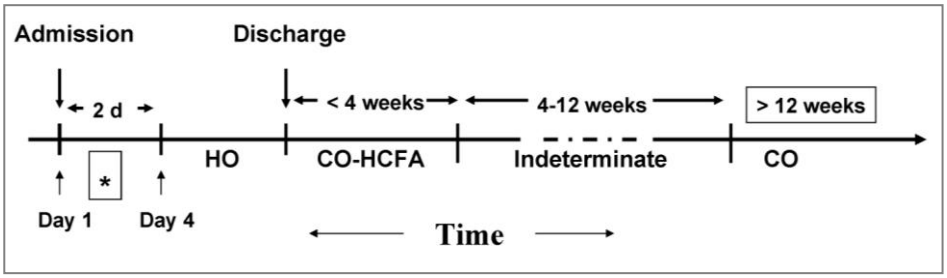


Figure. A patient with symptom onset during the window of hospitalization marked by an asterisk (*) would be classified as community-onset (CO) or community-onset healthcare facility–associated (CO-HCFA), depending on whether the patient had been discharged from a healthcare facility within the previous 4 weeks. A patient would be classified as having indeterminate disease, if the patient had been discharged from a healthcare facility within the previous 4–12 weeks. The case would be classified as having CO-CDI, if the patient had not been discharged from a healthcare facility in the previous 12 weeks.
Source: Modified from CDC CDI Toolkit http://www.cdc.gov/hai/pdfs/toolkits/CDItoolkitwhite_clearance_edits.pdf

CDI Rate Calculations

Numerator: The total number of CDI cases identified during the surveillance month.

Denominator: The total number of patient-days during the surveillance month.

$$\textit{C. difficile}\text{ infection rate} = \frac{\text{Number of CDI cases}}{\text{Number of patient days}} \times 10{,}000$$

Calculated CDI Prevalence Rates:

Note: Include only non-duplicate CDI events when calculating rates.

Admission Prevalence Rate =
Number of CDI events per patient per month identified ≤ 3 days after admission to the location or facility / Number of patient admissions to the location or facility x 100

Location Percent Admission Prevalence that is Community-Onset =
Number of admission prevalent events to a location that are CO / Total number admission prevalent events x 100

Location Percent Admission Prevalence that is Community-Onset Healthcare Facility-Associated =
Number of admission prevalent events to a location that are CO-HCFA / Total number admission prevalent events x 100

Location Percent Admission Prevalence that is Healthcare Facility-Onset =
Number of admission prevalent events to a location that are HO / Total number of admission prevalent events x 100

Overall Prevalence Rate =
Number of CDI events per patient per month regardless of time spent in location or facility / Number of patient admissions to the location or facility x 100

Calculated CDI Incidence Rates (see categorization of incident, HO, and CO-HCFA above):

CDI Incidence Rate = Number all incident CDI events per patient per month identified > 3 days after admission to the location or facility / Number of patient days for the location or facility x 10,000

Facility CDI Healthcare Facility-Onset Incidence Rate = Number of all Incident HO CDI events per patient per month / Number of patient days for the facility x 10,000

Facility CDI Combined Incidence Rate = Number of all incident HO and CO-HCFA CDI events per patient per month / Number of patient days for the facility x 10,000

Source: NHSN, MDRO & CDAD Protocol V4.1 (p. 23)

Additional Resources

- MDRO and CDAD Module Protocol
  http://www.cdc.gov/ncidod/dhqp/nhsn_MDRO_CDAD.html
- Multidrug-Resistant Organism (MDRO) and Clostridium difficile-Associated Disease (CDAD) Module
  http://www.cdc.gov/nhsn/PDFs/slides/MDRO_CDAD_IS_LabID_TrainSlides.pdf
- CDC/NHSN surveillance definition of health care–associated infection and criteria for specific types of infections in the acute care setting
  http://www.cdc.gov/ncidod/dhqp/pdf/NNIS/NosInfDefinitions.pdf

OMB No. 0920-0666
Exp. Date: 05-31-2014

Laboratory-identified MDRO or CDI Event

*required for saving Facility ID:	Event #:
*Patient ID:	Social Security #:
Secondary ID:	
Patient Name, Last:	First: Middle:
*Gender: M F	*Date of Birth:
Ethnicity (Specify):	Race (Specify):

Event Details

*Event Type: LabID	*Date Specimen Collected:	
*Specific Organism Type: (Check one) ☐ MRSA ☐ MSSA ☐ VRE ☐ *C. difficile* ☐ CephR-*Klebsiella* ☐ CRE-*Ecoli* ☐ CRE-*Klebsiella* ☐ MDR-*Acinetobacter*		
*Outpatient: Yes No	*Specimen Body Site/System:	*Specimen Source:
*Date Admitted to Facility:	*Location:	*Date Admitted to Location:
*Has patient been discharged from your facility in the past 3 months? Yes No		
If Yes, date of last discharge from your facility:		

Custom Fields

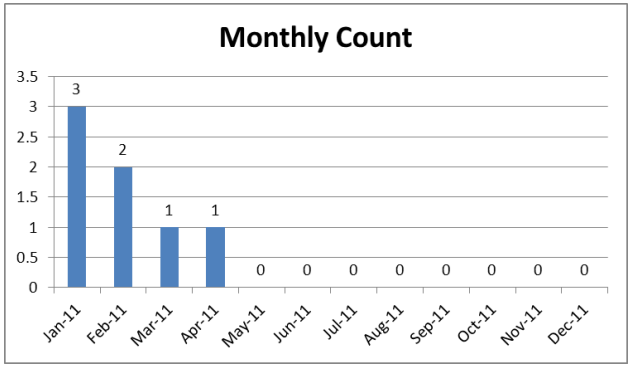
Label		Label	
_____	___/___/___	_____	___/___/___
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

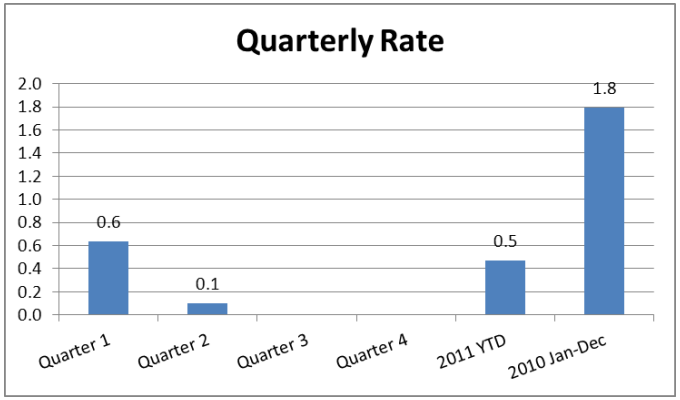
Comments

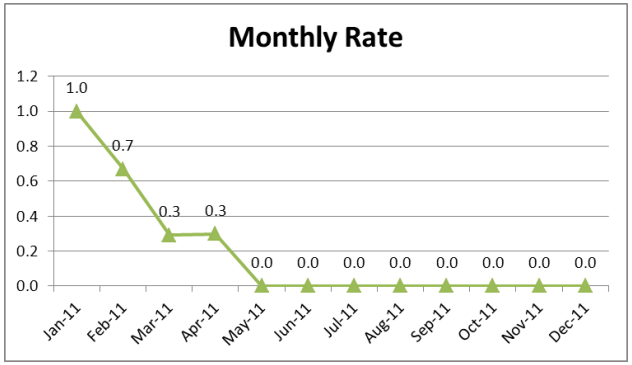
UMMC/UMACH *Clostridium difficile* Surveillance Spreadsheet

	Jan-11	Jan-11	Jan-11	Feb-11	Feb-11	Feb-11	Mar-11	Mar-11	Mar-11	Apr-11	Apr-11	Apr-11
Unit	CDI	Pt Days	Rate	CDI	Pt Days	Rate	CDI	Pt Days	Rate	CDI	Pt Days	Rate
1A	0	573	**0.0**	0	591	0.0	0	814	0.0	1	811	1.2
1B	1	543	1.8	1	496	2.0	0	597	0.0	0	489	0.0
1C	0	381	0.0	0	417	0.0	0	365	0.0	0	397	0.0
2A	1	557	1.8	0	617	0.0	1	617	1.6	0	601	0.0
2B	0	607	**0.0**	0	629	0.0	0	667	0.0	0	639	0.0
2C	1	339	**2.9**	1	238	4.2	0	367	0.0	0	418	0.0
TOTAL	**3**	**3000**	**1.0**	**2**	**2988**	**0.7**	**1**	**3427**	**0.3**	**1**	**3355**	**0.3**

	CDI	Pt Days	Rate
Quarter 1	6	9415	0.6
Quarter 2	4	10038	0.4
Quarter 3	0	0	
Quarter 4	0	0	
2011 YTD	11	23430	0.5
2010 Jan-Dec	44	29868	1.5







Sample data

University of Minnesota Medical Center, Fairview

Clostridium difficile Infection (CDI)

Notification of >2 cases

Patient	MRN	Date of Onset
1.		
2.		
3.		
4.		

Unit:_____Manager:

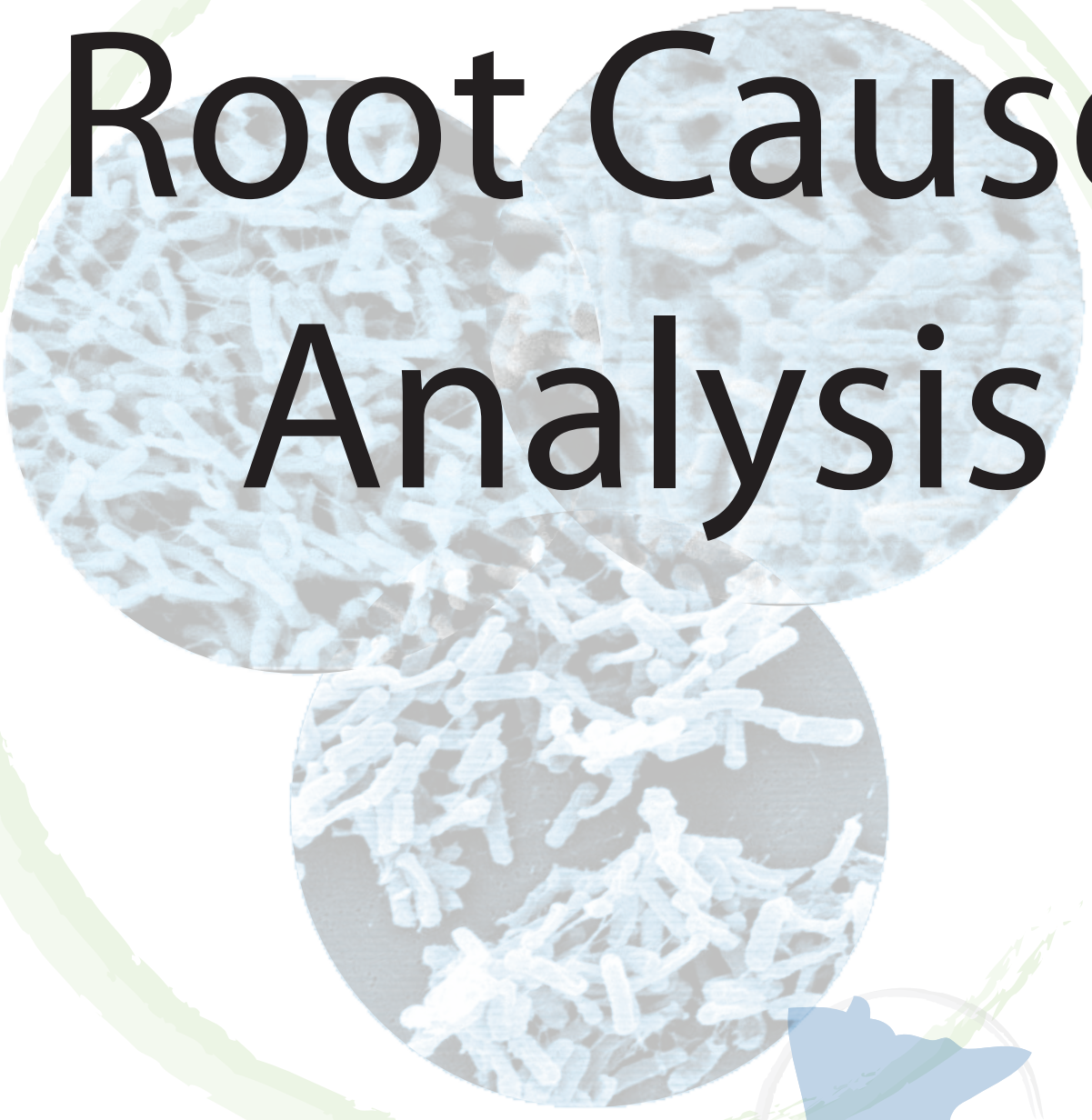
Date:_____Infection Preventionist:

Make sure patients with CDI are promptly placed into Enteric Isolation and monitor compliance with isolation practices.

- Single room required.
- Gloves and gowns for staff entering the room beyond the swing of the door.
- Hand Hygiene is performed by using soap and water when exiting the room. Foams and gels do not fully remove or kill the *C. diff.* spores. Friction and running water will help remove the spores from hands.

SAFE from CDI

Root Cause Analysis



Patient Safety

Infection Control: Root Cause Analysis (RCA) briefing

V1.6 Dec 2008

What is a RCA?

Root Cause Analysis (RCA) is a process of structured team-based review to determine the factors that were relevant in the care of an individual patient that ultimately lead to an adverse outcome. It leads on to an ***Action Plan***, with defined responsibilities and deadlines, aimed at minimising the risk of the adverse event occurring again in the future. As well as its role in identifying sub-optimal aspects of care, the RCA should also highlight any good practice that might be identified by the investigation. The RCA and Action Plan should be shared with other clinical teams as appropriate to ensure that learning is shared across the organisation.

Which patients will get a RCA?

RCAs will be undertaken for;

- All MRSA bacteraemias
- All MRSA venflon site infections
- All *C difficile* infections
- Other cases of infection as advised by the Infection Control Team

SDHFT staff will lead in cases of infection identified from a sample taken more than 48 hours after admission, but some may also be asked to participate in other community lead RCAs if appropriate.

How soon should a RCA be done?

An RCA must be formed within 10 working days of the positive report that generated the need. The report of the significant findings of the investigation and the Action Plan must be prepared within 3 working days of the RCA meeting. The RCA Lead will be responsible for arranging the RCA meeting and writing up the meeting notes and Action Plan; the relevant Associate Director of Nursing will sign off the final report.
The RCA review meeting itself will typically take around one hour, but there may be many hours preparatory work collating the background information (see appendix 3 and 4) for the RCA team to review.

Who takes part in a RCA?

- RCA Lead (Matron - Chair)
- Doctor from team responsible for patient's care
- Nurse from care setting
- Infection Control Doctor / Microbiologist
- Infection Control Nurse
- Antimicrobial pharmacist
- Clinical Governance Co-ordinator
- Admin support
- Others as appropriate

The RCA Lead will be the matron for the clinical area involved, and they will also lead the collection of supporting background information that the review will team consider in generating its Action Plan. For a RCA to be valid, there must be at least one doctor and one nurse from the clinical area, and a member of the Infection Control Team.
The patient, or the patient's relatives, should be invited to express a view / story of their experience, which will be presented as a written document to the review; there must also be an appropriate process for feedback to the patient / relatives with the results of the review.

What should happen in a RCA?

The review team will examine the sequence of care using the patient's medical notes to establish a timeline and identify the principal factors, both positive and negative, that may have had a significant bearing upon the final outcome. Trigger questions may be used to assist the process of investigation (see appendices 1 and 2). The patient's, or their representative's, comments should also be reviewed. When the timeline examination is complete, the team will then examine the background information regarding standard processes for care delivery to patients within the clinical area (see appendix 3 and 4). Finally, an Action Plan should be prepared.

What goes into a RCA Action Plan?

It is no use reviewing the care that a patient received, finding things that were wrong, and then doing nothing about it! Improvement will be brought about by pulling together an effective Action Plan and then conscientiously putting this into practice. To allow this, the objectives within the Action Plan must be **SMART** (see separate guidance document).

What should happen after a RCA?

- The agreed Action Plan is signed off as appropriate by the relevant Associate Director of Nursing and Clinical Director. The Associate Director of Nursing is then responsible for monitoring its implementation through normal operational channels, eg speciality, directorate or divisional meetings, and also for reporting on progress to the quarterly Healthcare Associated Infections Group (HAIG).
- The RCA Lead will arrange for appropriate feedback to be given to the patient or their relatives.
- The RCA Lead will share the report of significant findings from the RCA and the Action Plan with relevant clinical teams; clinical teams should discuss these in existing clinical meetings, eg Clinical Governance or Audit meetings, as appropriate.
- The RCA Lead will share the report of significant findings from the RCA and the Action Plan with the Serious Adverse Event subgroup of the Patient Safety and Quality Committee (Workstream 1). Where the case has been associated with a fatal or other very serious adverse outcome, the relevant consultant will be invited to present the report to the subgroup in person.

(F) CDI RCA Data Gathering Tool: Instructions

Examine each of the areas below. Indicate the relevance of each issue to this CDI by putting a ✓ or x in each box. Questions overleaf prompt further information to be collected.

Patient History

1 Previous CDI history	2 Episodes of health and social care	3 Prior treatments / interventions
Relevant (✓ / x):	Relevant (✓ / x):	Relevant (✓ / x):
4 Contact with *C.difficile*	5 Transfers	6 Antibiotic history
Relevant (✓ / x):	Relevant (✓ / x):	Relevant (✓ / x):

Patient Management

7 Diagnosis of CDI	8 Treatment of CDI	9 Prolonged symptoms
Relevant (✓ / x):	Relevant (✓ / x):	Relevant (✓ / x):
10 Patient awareness and behaviour	11 Location and isolation	
Relevant (✓ / x):	Relevant (✓ / x):	

Organisational Environment

12 CDI policy	13 Antibiotic prescribing policy	14 Isolation policy
Relevant (✓ / x):	Relevant (✓ / x):	Relevant (✓ / x):
15 Cleaning and decontamination policy		
Relevant (✓ / x):		

Practice Environment

16 High impact intervention No. 7	17 Hand Hygiene	18 Cleaning and equipment decontamination
Relevant (✓ / x):	Relevant (✓ / x):	Relevant (✓ / x):
19 Unifrom and PPE	20 Care environment	
Relevant (✓ / x):	Relevant (✓ / x):	

Trust name: **Patient identifier:** **Date:**

Trust name:	Patient identifier:	Date:

Reason for RCA, eg. Death, cluster, outbreak:

PATIENT HISTORY

1. Previous CDI history	Yes/No	Details
Has the patient been confirmed as *C. difficile* positive within the last 6 months?		
2. Episodes of health and social care last 12 months	**Yes/No**	**Details**
Has the patient been hospitalised?		
Been resident in a nursing or care home?		
Been in contact with primary care? (eg.GP)		
3. Prior treatment / interventions last 12 months	**Yes/No**	**Details**
Has the patient received antibiotics?		
Has the patient taken PPIS?		
Has the patient received chemotherapy?		
Has the patient been taking anti diarrhoeal medicine?		
4. Contact with *C. difficile* in last 28 days	**Yes/No**	**Details**
Has the person been in direct contact with someone with known CDI?		
Is there evidence that this patient may be part of a cluster or outbreak of CDI?		
In a hospital bay/shared room?		
Ward/open plan environment?		
5. Has the patient been transferred between care settings within the last 6 months?	**Yes/No**	**Details**
Intra hospital?		
Inter hospital?		
Between residential /nursing homes?		
Between day services?		
By patient transport?		

6. Antibiotic history : has the patient been prescribed antibiotics within the last 3 months?

Drug		Dose	Route	Start date	Finish date	Indications

Trust name:	Patient identifier:	Date:

PATIENT MANAGEMENT		
7. Diagnosis of CDI	**Yes/No**	**Details**
Date of onset of symptoms?		
Has current antibiotic prescription been reviewed?		
Were antibiotics prescribed in accordance with Trust policy?		
Date and time of specimen		
Date and time specimen result reported		
Date and time result received on ward		
Is this a new episode/ a relapse or recurrence/unknown?		
Has the patient had laxatives?		
Does the patient have a naso gastric tube?		
Is the patient receiving nutritional supplements?		
8. Treatment of CDI	**Yes/No**	**Details**
Has treatment of CDI started in accordance with Trust policy?		
Is a stool chart in use?		
Is CDI care plan/pathway in use?		
Is fluid balance chart in use?		
Has the patient been reviewed by MDT?		
Is patient's condition reviewed daily by a doctor?		
9. Prolonged symptoms	**Yes/No**	**Details**
In the case of prolonged symptoms has there been a full MDT review?		
Has antibiotic treatment been changed to reflect prolonged symptom management?		
10. Patient awareness and behaviour	**Yes/No**	**Details**
Have patients/relatives/carers been given information regarding *C. difficile* ?		
Is the patient confused or disoriented?		
Is the patient compliant with staff instructions regarding isolation (including use of toilet facilities) ?		
11. Location and isolation	**Yes/No**	**Details**
Date and time of isolation		
Was the patient isolated according to Trust Policy?		
If unable to isolate, was patient cohort nursed?		

Trust name:	Patient identifier:	Date:

ORGANISATIONAL ENVIRONMENT			
Policy	**Is policy compliant with best practice?**	**Date of last revision**	**Was there any breach of policy, if so, what?**
12. CDI policy			
13. Antibiotic prescribing policy			
14. Isolation policy			
15. Cleaning & decontamination policy			

PRACTICE ENVIRONMENT			
16. CDI Care bundle			
Date of last audit		Compliance score	
Elements of non compliance			
Actions to improve compliance			
17. Hand hygiene	**Details**		
When was the last hand hygiene audit undertaken?			
What is the level of compliance with hand hygiene?			
Are hand hygiene facilities readily available?			
Are all staff compliant with trust dress code?			
18. Cleaning / cleaning products and equipment decontamination	**Details**		
When was the last environmental cleaning audit?			
What was the score?			
How do you know if bed space was clean before admission?			
Are roles, responsibilities and accountabilities with regards to cleaning and decontamination clear (Y/N)?			
Are chlorine based products used for environmental decontamination?			
Are chlorine based products used for equipment decontamination?			
Is enhanced cleaning available 24/7? (Y/N)			
If no, what arrangements are in place out of hours?			
19. PPE	**Details**		
What was the compliance score for the PPE element in the last HII audit?			
20. Health Care Setting activity during the week beforeCDI was reported	**Details**		
Was the ward staffed to its full establishment?			
What was the ratio of permanent /temporary staff?			
What was the bed occupancy?			
Is the environment clean and free from clutter?			
Is bed spacing adequate to deliver clinical care?			

CDI RCA Data Gathering Tool: Summary Sheet
Please record all the issues identified as being relevant from page 1 into the summary box below, together with brief details explaining the issue.
Copy this document to all attendees of the RCA review meeting in advance

Trust name:	**Patient identifier:**	**Date:**

Key Issue	Details

Data prepared by:	**Job title:**

....

SAFE from CDI

F – Facility Expectations

Strategic Priority: *C. difficile* Reduction Plan
Allina Hospitals and Clinics, Mercy Hospital

Hand Hygiene Survey
Park Nicollet Health Services

Speak Up Initiative Posters
The Joint Commission

CDI Management Policy
Allina Hospitals and Clinics

CDI Prevention/Treatment Physician Expectations
LifeCare Medical Center

Clostridium difficile Treatment Recommendations
LifeCare Medical Center

Clostridium difficile Associated Diarrhea (CDAD) Guidelines
University of Minnesota Medical Center, Fairview

Clostridium difficile Order Form
Park Nicollet Health Services, Methodist Hospital

Clostridium difficile Protocol
Windom Area Hospital

Clostridium difficile Protocol (Recurrent Episode)
Windom Area Hospital

Clinical Practice Guidelines for *Clostridium difficile* Infection in Adults: 2010 Update by the Society for Healthcare Epidemiology of America (SHEA) and the Infectious Diseases Society of America (IDSA)
Infection Control and Hospital Epidemiology, 2010

High Touch Surface Areas Policy
Queen of Peace Hospital

Strategic Priority: *C Difficile* Reduction Plan

Tactic	Action Plan	Lead(s)	Target Date	Completion Date	PROGRESS
OBJECTIVE: Develop a 90 day organizational change plan to engage physicians and employees in the 2010 goal of the elimination of C Difficile Infections (CDI) of XXX Hospital inpatients.					
1. Develop framework for organizational change (employees and medical staff).	Develop draft plan to increase engagement and change behavior of key stakeholders. • Request input from PC & Operational Directors to maximize effectiveness of plan - Schedule meeting with PC Directors (July 20, 2010) - Schedule meeting with Operations Directors & Radiology Mgr or invite to PC Operations weekly meeting • Present plan to XXX Hospital Quality Council to solicit feedback regarding physician involvement and to define behavioral expectations (August 02, 2010).	VPPC (VP Patient Care) IP	7/25/10	August 02, 2010	
2. Identify existing communication / education Mechanisms to increase organizational awareness	• Use Fall Employee Forum Hot Topic to share current infection control statistics and methods to eliminate C Difficile patient contamination. • Incorporate feedback from Directors into communication strategies • Work with VPMA to finalize strategies regarding physician leadership / communication involvement and accountabilities.	CEO VPMA VPPC	7/25/10		
STATUS REPORT:	IP provided CEO with High Performing Slides and CDI story update for Quarterly Employee Forum	IP		8/5/10	
3. Senior Leadership Support	1. Schedule time on SLT agenda to present plan, solicit input, and create ownership of plan: - Develop strategies to create organization-wide safe environment to **coach each other** at the time of identified non-compliance with established procedures (at all levels) to become a high reliability organization. - Communicate expectations and timeline for behavior changes to leaders, medical staff, and employees. - Integrate CDI reduction plan strategies into situational	CEO	3Q10 forum 2nd Week of August		

Strategic Priority: *C Difficile* Reduction Plan

Tactic	Action Plan	Lead(s)	Target Date	Completion Date	PROGRESS
	awareness and safety culture initiatives through Employee Forums, Staff Newsletters, and other means of communication. - Create mechanism to support an environment of staff safety when employees encounter arrogant or defensive behaviors associated with coaching non-compliant employees or physicians. (Call CEO for MD issues, Director for Patient Care issues when they need backup).		August 2nd Week		
STATUS	1. Quality Council concerns about coaching approach, and expectations for when to wash hands 2. LDI action plans included CDI reduction on several units 3. Quality Safety Risk department retreat topic includes coaching and "influencers" to create action plans on how to improve HH and safety 4. Communication Committee developing "coaching" tips	Communication Committee			
4. Organizational Change Plan	**Proposal to Operations Directors** 1. Leader responsibilities: a. Rounding to identify and remove barriers for attaining unit safety goals b. Patient rounding to confirm safe practices are practiced c. Assure unit completes and enters 5 HH and Contact Precaution compliance audit into survey monkey d. Develop compliance requirements for non-inpatient care services e. Execute accountability and responsibility plan f. Use huddle format to communicate strategies to staff g. Incorporate work into Unit Councils and/or Staff Meetings 2. Infection preventionist responsibilities: a. Clinical and technical advisor for leaders and unit councils or clinical action teams b. Develop and populate score card in shared leaders	PCD IP	7/21/10		

Strategic Priority: *C Difficile* Reduction Plan

Tactic	Action Plan	Lead(s)	Target Date	Completion Date	PROGRESS
	data folder c. Communicate plan and content for 4Q10 mandatory education for all care givers d. Unit council attendance to review specific results and educate staff regarding how to engage colleagues 3. Investigate feasibility of volunteers conducting hand hygiene audits on patient care units and departments. 4. Expand project to Medical Services, CV, Volunteers, Chaplains a. Identify required educational support (education module development) 5. Provide costs associated with CDI and project cost avoidance for budget planning				
5. Medical Staff Change Plan	**Proposal to Quality Council for defining medical staff expectations** 1. Define Medical Director and Medical Advisor responsibilities 2. Medical champion role to reinforce environment that supports coaching when procedures not followed 3. Define Medical Staff behavioral expectations 4. Create physician communication plan 5. Medical staff education plan for MN State CDI Action Plan participation 6. Use Department Meetings and Newsletters to share information and engage physicians to support coaching and other strategies.	HE VPMA QC Chair	8/2/10		
6. Infection Preventionist Change Plan	1. Meet with Process Improvement Department to integrate CDI action plan into existing Situational Awareness and Safety Culture initiatives 2. Populate weekly and quarterly score card data 3. Provide clinical and technical expertise for unit and department leaders to incorporate CDI tactics into 90-day action plans	IP	4th week of July		

Strategic Priority: *C Difficile* Reduction Plan

Tactic	Action Plan	Lead(s)	Target Date	Completion Date	PROGRESS
	4. Integrate strategies into Readmission project (CDI=5th leading cause for readmission)				
STATUS REPORT	1. Provided CDI information and addressed questions for XXX Unit Council on 8/17 2. Reviewed XXX Unit Council CDI poster on 8/11 3. Sent CDI PPT for XXX Unit Council meeting 8/4 4. XXX Clinical Action Team completed CEA 8/10 5. Attended Social Services staff meeting on their role in CDI prevention 6. Presented CEA to Patient Care Managers 8/26 7. IP observations reports sent real time to PCMs 8. Working on better XL gown 9. Working with OR and ES on cleaning improvements 10. Provide monthly updates and weekly score cards 8/13	IP			
7. Culture of Excellence Change Plan	1. Create shared leaders folder to post weekly and quarterly CDI unit-based score cards for leaders to increase awareness and accountability (and to post on units and in depts.). 2. Managers will update current Q3 90-day plans to include CDI strategies	PI dept Hospital Leaders	2nd week of August		
8. Patient Care and Safety Committee	1. Identify huddle content 2. Work with PCSC to incorporate topic into attached prioritization grid 3. Develop mechanisms to recognize and reward unit success and implement	PCSC members PCM and PCS IP	Last Week of July		
9. Capital Equipment	1. Present capital request for purchase of portable cleaning equipment for wheel chairs and commodes.	CES IP	8/10		
10. Environmental	1. Increase Environmental Post Cleaning Surveys using DAZO	IP			

Strategic Priority: *C Difficile* Reduction Plan

Tactic	Action Plan	Lead(s)	Target Date	Completion Date	PROGRESS
Services	methodology 2. Expand surveys to support ancillary areas	ES			
11. Blood Pressure Cuff Project	1. Purchase remaining cuffs to fully implement program (approved to add to operational budget).	PCD VPPC	8/10		
12. Add Sani-Hand wipes to Patient Trays	1. Resubmit proposal to place Sani Hand wipes on every patient tray 2. Expand to other areas where they provide food for patients.	PCD IP	9/10		
13. Isolation	1. Pilot new door signage for all precautionary warnings on XXX 2. Evaluate need for isolation signage revisions 3. Implement 4Q policy revisions for enteric precautions of all CDI for duration of hospitalization	PCM PCS CDI committee	9/10		
14. Commode and bedpan containment devices	1. Evaluate commode and bedpan containment devices	CDI committee	9/10		

Park Nicollet Health Services

Hand Hygiene Survey **Your dept: _____**

Please circle the number that best represents your thoughts. Thank you!

1. Performing hand hygiene 100% of the time we're supposed to is not always easy. Why do you think this is?	**Strongly Agree**	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**
A. Soap is irritating to the skin	5	4	3	2	1
B. Alcohol foam is irritating to the skin	5	4	3	2	1
C. Soap & sinks are not available	5	4	3	2	1
D. Alcohol foam is not available	5	4	3	2	1
E. People just forget to clean their hands	5	4	3	2	1
F. Hand hygiene before patient care isn't necessary	5	4	3	2	1
G. People don't know when they should clean their hands	5	4	3	2	1
H. People are too busy to clean their hands	5	4	3	2	1
I. If I wear gloves for patient contact, I don't need to clean my hands <u>before</u> patient care.	5	4	3	2	1
J. If I wear gloves for patient contact, I don't need to clean my hands <u>after</u> patient care.	5	4	3	2	1
K. It's hard to put gloves on after hand hygiene	5	4	3	2	1
L. Managers don't think hand hygiene is important	5	4	3	2	1
2. I believe that hand hygiene is an important part of my job	5	4	3	2	1
3. I feel comfortable reminding my peers to clean their hands	5	4	3	2	1
4. The best person to remind me to clean my hands is: (circle one)	coworker		manager		patient
5. The best time to remind me to clean my hands is (circle one)	Immediately after I missed cleaning my hands		At a later time		

6. If PNHS could do one thing to help healthcare workers clean their hands 100% of the time, what would it be?

Comments:

SpeakUP™

Help Prevent Errors in Your Care

To prevent health care errors, patients are urged to...

SpeakUP™

The Joint Commission is the largest health care accrediting body in the United States that promotes quality and safety.

Helping health care organizations help patients

Everyone has a role in making health care safe. That includes doctors, health care executives, nurses and many health care technicians. Health care organizations all across the country are working to make health care safe. As a patient, you can make your care safer by being an active, involved and informed member of your health care team.

An Institute of Medicine report says that medical mistakes are a serious problem in the health care system. The IOM says that public awareness of the problem is an important step in making things better.

The “Speak Up™” program is sponsored by The Joint Commission. They agree that patients should be involved in their own health care. These efforts to increase patient awareness and involvement are also supported by the Centers for Medicare & Medicaid Services.

This program gives simple advice on how you can help make health care a good experience. Research shows that patients who take part in decisions about their own health care are more likely to get better faster. To help prevent health care mistakes, patients are urged to “Speak Up.”

The Joint Commission

S peak up if you have questions or concerns. If you still don't understand, ask again. It's your body and you have a right to know.

- Your health is very important. Do not worry about being embarrassed if you don't understand something that your doctor, nurse or other health care professional tells you. If you don't understand because you speak another language, ask for someone who speaks your language. You have the right to get free help from someone who speaks your language.
- Don't be afraid to ask about safety. If you're having surgery, ask the doctor to mark the area that is to be operated on.
- Don't be afraid to tell the nurse or the doctor if you think you are about to get the wrong medicine.
- Don't be afraid to tell a health care professional if you think he or she has confused you with another patient.

P ay attention to the care you get. Always make sure you're getting the right treatments and medicines by the right health care professionals. Don't assume anything.

- Tell your nurse or doctor if something doesn't seem right.
- Expect health care workers to introduce themselves. Look for their identification (ID) badges. A new mother should know the person who she hands her baby to. If you don't know who the person is, ask for their ID.
- Notice whether your caregivers have washed their hands. Hand washing is the most important way to prevent infections. Don't be afraid to remind a doctor or nurse to do this.
- Know what time of the day you normally get medicine. If you don't get it, tell your nurse or doctor.
- Make sure your nurse or doctor checks your ID. Make sure he or she checks your wristband and asks your name before he or she gives you your medicine or treatment.

E ducate yourself about your illness. Learn about the medical tests you get, and your treatment plan.

- Ask your doctor about the special training and experience that qualifies him or her to treat your illness.
- Look for information about your condition. Good places to get that information are from your doctor, your library, support groups, and respected Web sites, like the Centers for Disease Control & Prevention (CDC) Web site.
- Write down important facts your doctor tells you. Ask your doctor if he or she has any written information you can keep.
- Read all medical forms and make sure you understand them before you sign anything. If you don't understand, ask your doctor or nurse to explain them.
- Make sure you know how to work any equipment that is being used in your care. If you use oxygen at home, do not smoke or let anyone smoke near you.

A sk a trusted family member or friend to be your advocate (advisor or supporter).

- Your advocate can ask questions that you may not think about when you are stressed. Your advocate can also help remember answers to questions you have asked or write down information being discussed.
- Ask this person to stay with you, even overnight, when you are hospitalized. You may be able to rest better. Your advocate can help make sure you get the correct medicines and treatments.
- Your advocate should be someone who can communicate well and work cooperatively with medical staff for your best care.
- Make sure this person understands the kind of care you want and respects your decisions.
- Your advocate should know who your health care proxy decision-maker is; a proxy is a person you choose to sign a legal document so he or she can make decisions about your health care when you are unable to make your own decisions. Your advocate may also be your proxy under these circumstances. They should know this ahead of time.
- Go over the consents for treatment with your advocate and health care proxy, if your proxy is available, before you sign them. Make sure you all understand exactly what you are about to agree to.
- Make sure your advocate understands the type of care you will need when you get home. Your advocate should know what to look for if your condition is getting worse. He or she should also know who to call for help.

K now what medicines you take and why you take them. Medicine errors are the most common health care mistakes.

- Ask about why you should take the medication. Ask for written information about it, including its brand and generic names. Also ask about the side effects of all medicines.
- If you do not recognize a medicine, double-check that it is for you. Ask about medicines that you are to take by mouth before you swallow them. Read the contents of the bags of intravenous (IV) fluids. If you're not well enough to do this, ask your advocate to do it.
- If you are given an IV, ask the nurse how long it should take for the liquid to run out. Tell the nurse if it doesn't seem to be dripping right (too fast or too slow).
- Whenever you get a new medicine, tell your doctors and nurses about allergies you have, or negative reactions you have had to other medicines.
- If you are taking a lot of medicines, be sure to ask your doctor or pharmacist if it is safe to take those medicines together. Do the same thing with vitamins, herbs and over-the-counter drugs.
- Make sure you can read the handwriting on prescriptions written by your doctor. If you can't read it, the pharmacist may not be able to either. Ask somebody at the doctor's office to print the prescription, if necessary.
- Carry an up-to-date list of the medicines you are taking in your purse or wallet. Write down how much you take and when you take it. Go over the list with your doctor and other caregivers.
- If you think you have taken an overdose, or a child has taken medicine by accident, call your local poison control center or your doctor immediately.

U se a hospital, clinic, surgery center, or other type of health care organization that has been carefully checked out. For example, The Joint Commission visits hospitals to see if they are meeting The Joint Commission's quality standards.

- Ask about the health care organization's experience in taking care of people with your type of illness. How often do they perform the procedure you need? What special care do they provide to help patients get well?
- If you have more than one hospital to choose from, ask your doctor which one has the best care for your condition.
- Before you leave the hospital or other facility, ask about follow-up care and make sure that you understand all of the instructions.
- Go to Quality Check at www.qualitycheck.org to find out whether your hospital or other health care organization is "accredited." Accredited means that the hospital or health care organization works by rules that make sure that patient safety and quality standards are followed.

P articipate in all decisions about your treatment. You are the center of the health care team.

- You and your doctor should agree on exactly what will be done during each step of your care.
- Know who will be taking care of you. Know how long the treatment will last. Know how you should feel.
- Understand that more tests or medications may not always be better for you. Ask your doctor how a new test or medication will help.
- Keep copies of your medical records from previous hospital stays and share them with your health care team. This will give them better information about your health history.
- Don't be afraid to ask for a second opinion. If you are unsure about the best treatment for your illness, talk with one or two additional doctors. The more information you have about all the kinds of treatment available to you, the better you will feel about the decisions made.
- Ask to speak with others who have had the same treatment or operation you may have to have. They may help you prepare for the days and weeks ahead. They may be able to tell you what to expect and what worked best for them.
- Talk to your doctor and your family about your wishes regarding resuscitation and other life-saving actions.

The goal of the Speak Up™ program is to help patients become more informed and involved in their health care.

SpeakUP™

5 Five Things You Can Do To Prevent Infection

Five Things You Can Do To Prevent Infection is supported by

American Hospital Association

Association for Professionals in Infection Control and Epidemiology, Inc.

Centers for Disease Control and Prevention

Infectious Diseases Society of America

The Joint Commission

Society for Healthcare Epidemiology of America

The Joint Commission is the largest health care accrediting body in the United States that promotes quality and safety.

The Joint Commission

Helping health care organizations help patients

1.

Clean your hands.

- Use soap and warm water. Rub your hands really well for at least 15 seconds. Rub your palms, fingernails, in between your fingers, and the backs of your hands.
- Or, if your hands do not look dirty, clean them with alcohol-based hand sanitizers. Rub the sanitizer all over your hands, especially under your nails and between your fingers, until your hands are dry.
- Clean your hands before touching or eating food. Clean them after you use the bathroom, take out the trash, change a diaper, visit someone who is ill, or play with a pet.

2.

Make sure health care providers clean their hands or wear gloves.

- Doctors, nurses, dentists and other health care providers come into contact with lots of bacteria and viruses. So before they treat you, ask them if they've cleaned their hands.
- Health care providers should wear clean gloves when they perform tasks such as taking throat cultures, pulling teeth, taking blood, touching wounds or body fluids, and examining your mouth or private parts. Don't be afraid to ask them if they should wear gloves.

3.

Cover your mouth and nose.

Many diseases are spread through sneezes and coughs. When you sneeze or cough, the germs can travel 3 feet or more! Cover your mouth and nose to prevent the spread of infection to others.

- Use a tissue! Keep tissues handy at home, at work and in your pocket. Be sure to throw away used tissues and clean your hands after coughing or sneezing.
- If you don't have a tissue, cover your mouth and nose with the bend of your elbow or hands. If you use your hands, clean them right away.

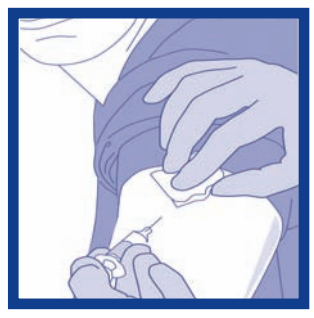
4.

If you are sick, avoid close contact with others.

- If you are sick, stay away from other people or stay home. Don't shake hands or touch others.
- When you go for medical treatment, call ahead and ask if there's anything you can do to avoid infecting people in the waiting room.

5.

Get shots to avoid disease and fight the spread of infection.



Make sure that your vaccinations are current—even for adults. Check with your doctor about shots you may need. Vaccinations are available to prevent these diseases:

- Chicken pox
- Measles
- Tetanus
- Shingles
- Mumps
- Diphtheria
- Hepatitis
- Meningitis
- Flu (also known as influenza)
- Whooping cough (also known as Pertussis)
- German measles (also known as Rubella)
- Pneumonia (*Streptococcus pneumoniae*)
- Human papillomavirus (HPV)

To prevent health care errors, patients are urged to...

SpeakUP™

Everyone has a role in making health care safe. That includes doctors, health care executives, nurses and many health care technicians. Health care organizations all across the country are working to make health care safe. As a patient, you can make your care safer by being an active, involved and informed member of your health care team.

The Joint Commission is the largest health care accrediting body in the United States that promotes quality and safety.

S **peak up** if you have questions or concerns. If you still don't understand, ask again. It's your body and you have a right to know.

P **ay attention** to the care you get. Always make sure you're getting the right treatments and medicines by the right health care professionals. Don't assume anything.

E **ducate** yourself about your illness. Learn about the medical tests you get, and your treatment plan.

A **sk** a trusted family member or friend to be your advocate (advisor or supporter).

K **now** what medicines you take and why you take them. Medicine errors are the most common health care mistakes.

U **se** a hospital, clinic, surgery center, or other type of health care organization that has been carefully checked out. For example, The Joint Commission visits hospitals to see if they are meeting The Joint Commission's quality standards.

P **articipate** in all decisions about your treatment. You are the center of the health care team.

The Joint Commission

Helping health care organizations help patients

Appendix G

Clostridium difficile infection (CDI)

I. Patient placement

A. Place patients with diarrhea into Contact Precautions while *C.difficile* laboratory tests are pending.

1. Gown and glove on room entry
2. Change gloves immediately if visibly soiled or after touching or handling surfaces or materials contaminated with feces
3. Remove gown and gloves, and perform hand hygiene before exiting room
4. Dedicate patient care equipment
5. Post Contact Precautions signage on the room door
6. Place patients with known or suspected CDI in private rooms, if possible. If single rooms are unavailable, cohort with other patients with CDI.
7. Note: Facilities experiencing ongoing transmission of *C.difficile* may opt to empirically use Enteric Contact Precautions while laboratory tests are pending as outbreak control measure. See Enhanced Precautions section below.

B. Laboratory confirmed CDI patients

1. On positive CDI lab test
   a. Initiate Enteric Contact Precautions. Follow Enteric Contact Precautions protocol.
   b. Post Enteric Precautions signage on the room door
   c. Use soap and water handwashing on room exit when in-room handwashing sinks are present
   d. Use alcohol based hand rub on room exit when in-room handwashing sink is not available and wash hands at sink or hand hygiene station as soon as possible after room exit.
   e. Use bleach product or sporacidal disinfectant as outlined in Section III below.

C. Duration of precautions

1. Confirmed CDI patients to stay in Enteric Contact Precautions for duration of hospital stay. Exceptions must be cleared by Infection Prevention and Control.
2. Enteric Contact Precautions can be discontinued on symptomatic patient as directed by Infection Prevention and Control if c.diff PCR negative and other infectious etiology ruled out (e.g., norovirus).
3. Patients with diarrhea and no laboratory testing can be removed from precautions 24 hrs after diarrhea ceases or patient returns to a normal bowel pattern if low suspicion for CDI (no risk factors).

II. Identifying patients with CDI

A. Diagnostic testing

1. Perform *C. difficile* testing on diarrheal stools only.
    a. If testing performed on non-diarrheal (i.e. soft) stools, confirm patient has symptoms consistent with CDI
2. Do not routinely test infants <1 year of age
3. Do not treat or attempt to decolonize asymptomatic carriers
4. Do not give prophylactic antimicrobial therapy to patients at high risk for CDI
    a. See Use of Probiotics position statement
5. If *C.difficile* PCR test is negative, and other infectious etiology for diarrhea (i.e. norovirus) has been ruled out, Enteric Contact Precautions can be discontinued as directed by infection control.
6. Repeat C.diff PCR testing is not recommended
    a. Do not repeat C.diff PCR testing if patient has positive stool unless symptoms resolved with treatment and then returned after treatment
    b. Do not conduct serial C.diff PCR testing when initial test is negative
    c. Do not repeat C.diff PCR test within 7 days of initial negative test unless patient has a change in stool volume or consistency.

III. Environmental and equipment cleaning

A. Initiate disinfection using a bleach product or an EPA approved sporocidal agent in place of routine disinfection for daily and terminal cleaning (replace hospital approved quat product)

B. Using a two step cleaning and disinfection procedure
    1. If using freshly diluted 1:10 bleach solution
        a. Clean surface with Quat disinfectant to mechanically remove spores from the environment (Bleach is not a detergent.)
        b. Liberally apply bleach product to disinfect surface. Surface must remain wet for 10 minutes after disinfection step to assure adequate contact time.
        c. Discard diluted bleach solution every 24 hours

    2. Using pre-diluted, stable bleach or sporicidal product (e.g., Dispatch)
        a. Wipe each surface twice using same product. First wipe cleans surface, second wipe disinfects.
        b. Surface must remain wet for 10 minutes after disinfection step to assure adequate contact time.

C. Patient care Equipment
    1. Use pre-moistened bleach wipes (e.g., Sanicloth bleach wipes or Dispatch wipes) for equipment or small surfaces, as appropriate, using 2-step method described above.
    2. Use adequate amount of disinfectant for surface size, using more than one wipe for larger surfaces.

IV. Patient transport

A. Transport of essential purposes only, following instructions for patient transport in Contact Precautions

B. Clean and disinfect transport equipment as outlined in section III above.

V. Surveillance (Infection Control personnel only)

A. Case definitions
1. Hospital-acquired infection
a. Symptom onset >48 hrs after admission
2. Community onset, healthcare associated
a. Symptom onset in the community or <=48 hrs after admission, provided that symptom onset was <4 weeks after the last discharge from a healthcare facility
3. Community associated
a. Symptom onset in the community or <=48 hrs after admission,, provided that symptom onset was >12 weeks after the last discharge from a healthcare facility
4. Indeterminate onset
a. Case does not fit any of the above criteria for exposure
5. Recurrent
a. Episode occurred <=8 weeks after the onset of a previous episode, provided that the CDI symptoms from the earlier episode had resolved
6. Laboratory-identified (LabID) Events
a. Symptom onset >3 days after admission to facility (i.e., on or after day 4) and >8 weeks after the most recent positive LabID Event. Signs and symptoms are not considered.

B. CDI rates
1. Infection surveillance method
a. Rate reported as number of cases per 1000 patient days
(1) $\frac{\text{Number of cases}}{\text{Number of patient days}} \times 1000$

2. LabID Event
a. CDI Incidence Rate = Number of non-duplicate Incident CDI LabID Events per patient per month identified > 3 days after admission (on or after day 4) and > 8 weeks after the most recent positive LabID Event/ Number of patient days for the facility x 10,000
b. LabID Event rates are calculated and reported monthly as part of Allina surveillance plan, and reported on the Allina scorecard

3. In absence of established benchmarks, experiential rates are used to monitor for ongoing transmission.
a. Outbreak measures are instituted when rates are significantly above predefined threshold or persistently elevated when compared to past rates.

VI. Enhanced Precautions (Outbreak measures)

A. Implement outbreak management strategies when surveillance indicates ongoing transmission, or rates exceed a predefined threshold on any unit/department within a 30 day period.

1. Consult MD supervising IC program and review cases, timing, and recommended interventions
2. Implement empiric use of Enteric Contact Precautions with symptomatic patients.
3. CDI is transmitted via the fecal-oral route. Control measures focus on reducing environmental contamination and direct and indirect contact with surfaces contaminated with *C. diff* spores.
    a. Use bleach or sporicidal disinfection cleaning and disinfecting procedures as outlined in Section III above for all surfaces on nursing unit.
        (1) Focus on pyxis machines and other commonly touched surfaces
    b. Implement an environmental cleaning and disinfection assessment using tool from Appendix O.
        (1) Ensure adequate cleaning and disinfection of environmental surfaces and reusable devices, especially items likely to be contaminated with feces and surfaces that are touched frequently.
            (a) Surfaces contaminated with feces serve as potential reservoir for *C. diff* spores
        (2) Partner with Environmental Service manager to:
            (a) Directly observe room cleaning procedure
            (b) Identify gaps in cleaning and disinfection processes
                (1) Ensure that used cleaning rags are not re-dipped in disinfectant bucket
                (2) Use Environmental Cleaning Assessment tool Appendix O
            (c) Increase frequency of cleaning and disinfection focusing on highly contaminated and frequently touched surfaces
    c. Hand hygiene recommendations
        (1) Evaluate compliance with hand hygiene recommendations through direct observation
            (a) Provide feedback to staff regarding opportunities for improvement
    d. Compliance with Enteric Contact Precautions
        (1) Evaluate compliance with Enteric Contact Precautions through direct observation (i.e. gown and glove on room entry)
        (2) Dedicate equipment where possible, including commodes
    e. Communicate with leadership, staff and physicians, clearly defining outbreak measures and rationale for enhanced enteric contact precautions
    f. Continue outbreak management measures for at least 2 weeks and until surveillance confirms no further disease transmission.

g. If transmission continues in spite of enhanced infection control interventions, consider the following:

(1) Analyze antibiotic utilization. Studies have associated certain classes of antibiotics (e.g., fluoroquinolones) with increased risk of CDI.

(2) Consider replacing privacy curtains between patients

Reference:

Centers for Disease Control and Prevention (2004). Clostridium difficile - Information for Healthcare Providers.

SHEA/IDSA Practice recommendation (2008). Strategies to prevent Clostridium difficile infections in acute care hospitals. Infection Control and Hospital Epidemiology, 29(1), S81-S92.

SHEA/IDSA Clinical Practice Guidelines for Clostridium difficile Infection in Adults: (2010). *Infect Control Hosp Epidemiology*;31:431–455.

LifeCare Medical Center

CDI (*Clostridium difficile* infection) Prevention/Treatment

LifeCare Medical Center is committed to prevent Healthcare acquired CDI (*Clostridium difficile* Infection). CDI prevention is a Patient Safety issue. *Clostridium difficile* testing is available at LifeCare Hospital laboratory with turnaround time of 2 hours. The Infection Prevention department tracks and reports hospital acquired antibiotic resistant bacterial infections including *C-difficile* infection. The Pharmacy and Therapeutics committee monitors and reports appropriate antibiotic use.

All Staff at LifeCare have a very important role in preventing healthcare acquired CDI.

Expectations for Physicians at LifeCare include

1. Discontinuing inciting antibiotics and PPI (proton pump inhibitor), if possible when CDI is suspected.
2. Avoiding antiperistaltic agents for patients suspected/diagnosed with CDI.
3. Follow best practices for CDI treatment. (use SHEA ISDA Guidelines)
4. Consult with specialists when recurrent or worsening CDI is identified (e.g. Infectious disease, General surgery)

Further expectations are - follow the Prevention strategies

1. Early and accurate recognition.
2. Compliance with Isolation Precautions- gloves and gown required to enter CDI patient room.
3. Compliance with Hand Hygiene- soap and water hand washing preferred-if sink not available at door, first use alcohol product then go to nearest staff sink for soap and water wash.
4. Cleaning and disinfection of patient care equipment (e.g. stethoscopes) and the environment of CDI patients is performed with sporicidal agent. Sporicidal wipes are available on Isolation carts.
5. Antimicrobial stewardship – appropriate use of antimicrobials.

LIFECARE MEDICAL CENTER
***Clostridium difficile* Treatment Recommendation**

Reference: Clinical Practice guidelines for Clostridium difficile Infection in Adults: 2010 Update by the Society for Healthcare Epidemiology of America (SHEA) and the Infectious Diseases Society of America (IDSA)

Clinical Definition	Supportive Clinical Data	Recommended Treatment
Initial episode, mild or moderate	Leukocytosis with a WBC of 15,000 or lower and a Scr < 1.5 times the pre-morbid level.	Metronidazole 500 mg PO TID for 10-14 days
Initial episode, severe	Leukocytosis with a WBC of 15,000 or higher or a Scr > 1.5 times the pre-morbid level.	Vancomycin 125 mg PO QID for 10-14 days
Initial episode, severe, complicated	Hypotension or shock, ileus, megacolon	Vancomycin 500 mg PO/NG QID, plus metronidazole 500 mg IV every 8 hours. If complete ileus, consider adding rectal instillation of vancomycin
First recurrence		Same as for initial episode
Second recurrence		Vancomycin in a tapered and/or Pulsed regimen

Probiotics:

- Not recommended to prevent primary C. difficile infection due to limited data and risk of bloodstream infection.
- Patients with **recurrent** *Clostridium difficile*
  - *Saccharomyces boulardii* 500mg po bid
- ICU or immunocompromised patients
  - Not a treatment option

Alternatives:

- Anion-exchange resinins, e.g., cholestyramine, colestipol => NOT recommended
- Rifaximin – very limited data; resistance is a concern
- Nitazoxanide – limited data; however, data favors efficacy
- IVIG – limited data

Clostridium difficile Associated Diarrhea (CDAD) Guidelines

Purpose

To help guide: diagnosis, treatment and preventions of *C. difficile* diarrhea in patients at UMMC/UMACH, Fairview. There are > 300,000 cases/year reported in the United States and annual healthcare costs of $3.2 billion. *C. difficile* is responsible for antibiotic associated diarrhea including 15-25% of healthcare antibiotic-associated diarrhea, antibiotic associated colitis and pseudomenbranous colitis.

Background

- *C. difficile* is an anaerobic gram positive spore forming organism which can cause mild to severe/ fulminant disease
- Transmission is via fecal-to-oral route by contaminated environment and hands of healthcare providers.
- **Risk factors include**:
    - Any antimicrobial exposure disrupts that normal colonic flora, antimicrobials w/in the previous 3 months of symptoms
    - The following antimicrobials have been directly related to the development of CDAD:
        - clindamycin
        - penicillins
        - cephalosporins
        - fluoroquinolones
    - Prolonged hospitalization or stay in long-term care facility
    - Advance age ($\geq$ 65 y.o.a)
    - Gastrointestinal manipulation/surgery
    - Gastric acid suppressive agents-*controversial*
        - Proton pump inhibitors (e.g. Protonix (pantoprazole))
        - Histamine 2 blockers (e.g. Zantac (ranitidine))

Diagnosis

- Definition of CDAD- presence of symptoms (usually diarrhea) and one of the following positive tests:
    - Diarrhea
        - $\geq$ 3 liquid stools in a 24 hour period for 2 days *OR*
    - Ileus without diarrhea a swab can be collected
        - Send C. difficile Toxin B PCR
    - Stool culture for *C. difficile* and Toxin B PCR
    - Endoscopy revealing pseudomembranous formation
- Disease classification: mild to moderate, severe uncomplicated and severe complicated

Definitions

- Mild to Moderate Disease:
    - Presence of diarrhea
    - Confirmed positive culture and toxin A and/or B
    - WBC < 15,000 cells/mm3 or unchanged
    - Normal Serum creatinine (SCr $\leq$ 1)

- Severe, Uncomplicated Disease
    - Presence of diarrhea
    - Confirmed positive culture and toxin A and/or B

        - WBC $\geq$ 15,000 cells/mm3 or unchanged
        - Increasing Serum creatinine-50% higher than the level prior to infection

    - Severe, Complicated Disease
        - Same criteria as severe, uncomplicated ***plus***
        - Hypotension or shock
        - Evidence of megacolon, colonic perforation or severe colitis on CT

Treatment Strategies

- **Discontinue therapy with the inciting antimicrobial agent(s) as soon as possible**
- **Antimotility agents (i.e. Imodium) should be discontinued/avoided when suspecting or treating C difficile**
- **Narcotics can slow GI motility/induce constipation and use should be monitored closely**
- **Probiotics (Lactobacillus, Saccromyces boulardii)-administration of probiotics is not recommended to prevent primary CDI, as there is limited data to this approach. ***Saccromyces boulardii has been associated w/ fungemia in immunocompromised patients.**

Mild to Moderate Treatment

Empiric treatment/Initial Treatment:

- If patient develops diarrhea and meets risk factors (see above), send stool specimen to microbiology lab for culture and immunoassay for toxin A and B.
- Metronidazole 500 mg PO TID for 10-14 days
    - It is not recommended to use beyond 14 days

Relapse post-treatment/Relapse #1:

- Of note: relapse occurs in 10-20% of patients
- Send Cdiff Toxin B PCR
- Re-initiate Metronidazole 500 mg PO TID for 10-14 days

Relapse post-treatment/Relapse #2:

- Vancomycin 125 mg PO QID for 10-14 days

Relapse post-treatment/ Relapse #3:

- Vancomycin taper $\pm$ pulse dosing:
    - Week 1: 125 mg PO QID
    - Week 2: 125 mg PO BID
    - Week 3: 125 mg PO Daily
    - Week 4: 125 mg PO Q 48 hours
    - Week 5 & 6: 125 mg PO Q3 days
    - Pulse: 125 mg Q2-3 days for 2-8 weeks in addition to taper

Severe, Uncomplicated Treatment

- Same as mild to moderate treatment
- If ileus is present may add Vancomcyin enema 500 mg in 1 liter NS and perfuse at 1-3 ml/min x 2-3 days. ***Do not exceed 2 gm Vancomycin/ 24 hours
    - Risk versus benefit for bowel perforation

- Frequent assessment for disease severity/progression
    - Early surgical consultation for patients who may have severe disease progressing to severe/fulminant

Severe, Complicated Treatment

- Immediate surgical consultation
    - Colectomy may be life saving
    - Total abdominal colectomy with end ileostomy is procedure of choice

- Metronidazole 500 mg IV Q6 hours ***plus***
- Vancomycin 250-500 mg PO QID +
- Vancomycin enema 500 mg in 1 liter NS perfused 1-3 ml/min x 2-3 days

***Do not exceed 2 gm Vancomycin/ 24 hours

Prevention/Infection Control

- **For Isolation Policy go to: INSERT POLICY INFORMATION OR ATTACHMENT**
- Enteric Isolation: System Standard Precaution & Isolation policy.
    - Glove and gown to enter the room past the swing of the door.
    - Hand washing: Use soap and water
        - Alcohol based hand rubs do not kill *C. difficile* spores
    - Private room.
- Environmental disinfection with hospital grade disinfectant.
- Dedicated equipment if possible, if not ensure equipment is cleaned and disinfected between patients
- Antimicrobial Stewardship

Clinical Pearls

- It takes ~ 2-4 days for diarrhea to resolve once treatment is initiated
- Anti-motility agents should NOT be used
- Cost
- Lactobacillus and saccharomyces little evidence

References

- Cohen SH, Gerding DN, et al. Clinical practice guidelines for *Clostridium difficile* infections in adults: 2010 update by SHEA and IDSA. *Infection Control and Hospital Epidimiology*.2010: 31(5).

Methodist Hospital

6500 Excelsior Blvd.
St. Louis Park, MN 55426

314883ORDINF

NAME:

DOB:

MR#: HCL#:

LABEL or ADDRESSOGRAPH

Date / Time Ordered

Clostridium Difficile Infection (CDI) Orders

Indicate appropriate orders by placing an "X" in the box ☐

Target Patient Population: This orderset is intended for use in the diagnosis and treatment of patients with suspected or proven *Clostridium difficile* infection.

Admit Unit: _____ **Attending Clinician:** _____

☐ Transfer to ICU

1. **ADVERSE DRUG REACTIONS:**
   - ☐ None
   - ☐ Yes, List: _____

2. **VITAL SIGNS:**
   - ☐ Vital signs per nursing unit routine

3. **ACTIVITY:**
   - ☐ Activity as tolerated
   - ☐ Up with assistance
   - ☐ Bedrest
   - ☒ Bedside commode

4. **NURSING ORDERS:**
   - ☒ Intake and output every eight hour shift and 24 hour totals
   - ☒ Document stool volume, frequency and consistency (formed/unformed)
   - ☒ Enteric contact precautions for patients with confirmed CDI
   - ☐ Enteric precautions for patients with uncontrolled diarrhea, but without confirmed CDI diagnosis

5. **NUTRITION/DIET:**
   - ☐ Regular
   - ☐ Carbohydrate controlled
   - ☐ Cardiac
   - ☐ Carbohydrate controlled cardiac
   - ☐ No added salt
   - ☐ Full Liquid
   - ☐ Clear liquid
   - ☐ NPO

6. **IVs:**
   - ☐ INT

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7. MEDICATIONS:

☒ Discontinue all antiperistaltic agents

Current Antibiotic Therapy:

☐ Discontinue current antimicrobial therapy

☐ Attending physician to assess length and choice of current antibiotic therapy

☐ ***Antibiotics for Mild CDI – ALL criteria must be met:***

A. WBC less than 15,000
B. Afebrile
C. Diarrhea less than 6 bowel movements per day
D. No evidence of sepsis or peritoneal signs

☒ metroNIDAZOLE (FLAGYL) PO 500 mg three times daily x 14 days (42 doses)

If no clinical improvement in 72 hours, reassess patient and consider treatment for moderate or severe Clostridium difficile infection

☐ ***Antibiotics for Moderate CDI – One or more criteria must be met:***

A. WBC between 15, 000 – 25,000
B. Diarrhea 6 – 12 bowel movements per day
C. Albumin <2.5 (25g/L)
D. Temperature greater than 100.5
E. Evidence of GI bleeding that is STABLE

☒ Vancomycin (VANCOCIN) po 125 mg four times daily x 14 days (56 doses).

☐ ***Antibiotics for Severe CDI – One or more criteria must be met:***

A. WBC greater than 25,000
B. Diarrhea greater than 10 bowel movements per day
C. Temperature greater than 100.5 F
D. Hemodynamic instability
E. Marked and continuous abdominal pain
F. Ileus
G. Absence of bowel sounds
H. Evidence of sepsis or ICU level of care required

Use rectal administration of vancomycin by enema if patient is unable to reliably take oral vancomycin or has ileus

☐ Vancomycin 250 mg po four times daily x 14 days (or for 10 days after symptom resolution, whichever is longer)

☐ Vancomycin 500 mg po four times daily x 14 days (or for 10 days after symptom resolution, whichever is longer)

☐ Vancomycin 500 mg in 500 ml NS administer rectally by enema every six hours until able to take po

☐ metroNIDAZOLE (FLAGYL) IV 500 mg IV every eight hours

Probiotic therapy has been inadequately studied and is not recommended for the treatment of CDI. Existing studies are of low quality and do not demonstrate benefit in terms of hastening resolution of active CDI. Furthermore, use of probiotics in patients with severe CDI has been associated with worse outcomes including increased morbidity and mortality due to fungemia(Saccharomyces boulliardi).

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NAME:

DOB:

MR#: HCL#:

LABEL or ADDRESSOGRAPH

Date / Time Ordered	

8. DIAGNOSTIC TESTS (lab, X-ray):

- ☒ Stool Clostridium Difficile PCR
- ☐ Stool routine enteric pathogens
- ☐ Stool for ova and parasites
- ☒ CBC with differential
- ☒ Electrolytes
- ☒ BUN
- ☒ Creatinine

Imaging: CT scan imaging is recommended for severe CDI

- ☐ CT abdomen and pelvis with oral and IV contrast
- ☐ CT abdomen and pelvis without IV contrast
- ☐ Abdominal x-ray Reason: _____

9. CONSULTS:

- ☐ Infectious disease consult Reason: Severe or recurrent clostridium Difficile infection (CDI)
- ☐ Surgery consult Reason: Immediate consultation for Severe clostridium Difficile infection (CDI), risk of perforation
- ☐ Gastroenterology (consider for diagnostic uncertainty) Reason: Need endoscopic evaluation

10. CODE STATUS: Complete Limited Life Support orders if other than full code.

11. DISCHARGE PLANNING:

- ☒ Anticipate Discharge _____

Clinician Signature: _____ **LW User Number:** _____

☐ **STAT**

Drug Allergies	
Date / Time	Medication orders: Another brand of a generically equivalent product, or a medical staff approved formulary equivalent, may be administered unless physician writes “dispense as written” or Brand Name” checked.

Clostridium Difficile Protocol

Notify:

☒ Notify primary care physician of the actions taken

Nursing Orders:

☒ For patients over 9 months of age who have **three (3) episodes** of Type 5, 6, or 7 Stool (see Bristol Stool Chart) within 24 hours

☒ Place the patient in Contact Level C Precautions, pending lab results of the Clostridium difficile specimen

Labs:

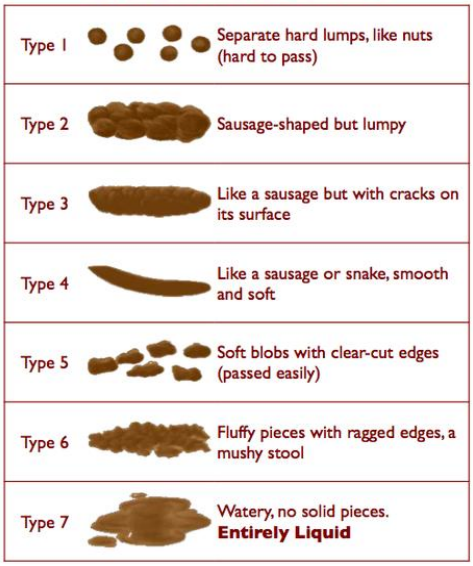
☒ Obtain a Stool Specimen for Clostridium difficile

RN Completing

Date Time

Chief Medical Officer
Medical Executive Committee approval
12-17-10

Bristol Stool Chart



WINDOM AREA HOSPITAL
CLOSTRIDIUM DIFFICLILE PROTOCOL
REOCCURING EPISODE

Notify:

- ☒ Notify primary care physician of actions taken

Orders:

- ☒ For patients over 9 months of age who have had Clostridium difficile within the last 8 weeks AND who have had one (1) episode of Type 5,6, or 7 stool (see Bristol Stool Chart)
- ☒ Place the patient on Contact Level C Precautions, pending lab results of stool specimen

Labs:

- ☒ Obtain a stool specimen for Clostridium Difficile

_____ _____

RN completing Medical Staff Director

_____ _____

Date Time

Bristol Stool Chart

Type 1		Separate hard lumps, like nuts (hard to pass)
Type 2		Sausage-shaped but lumpy
Type 3		Like a sausage but with cracks on its surface
Type 4		Like a sausage or snake, smooth and soft
Type 5		Soft blobs with clear-cut edges (passed easily)
Type 6		Fluffy pieces with ragged edges, a mushy stool
Type 7		Watery, no solid pieces. **Entirely Liquid**

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SHEA-IDSA GUIDELINE

Clinical Practice Guidelines for *Clostridium difficile* Infection in Adults: 2010 Update by the Society for Healthcare Epidemiology of America (SHEA) and the Infectious Diseases Society of America (IDSA)

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Since publication of the Society for Healthcare Epidemiology of America position paper on *Clostridium difficile* infection in 1995, significant changes have occurred in the epidemiology and treatment of this infection. *C. difficile* remains the most important cause of healthcare-associated diarrhea and is increasingly important as a community pathogen. A more virulent strain of *C. difficile* has been identified and has been responsible for more-severe cases of disease worldwide. Data reporting the decreased effectiveness of metronidazole in the treatment of severe disease have been published. Despite the increasing quantity of data available, areas of controversy still exist. This guideline updates recommendations regarding epidemiology, diagnosis, treatment, and infection control and environmental management.

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EXECUTIVE SUMMARY

This guideline is designed to improve the diagnosis and management of *Clostridium difficile* infection (CDI) in adult patients. A case of CDI is defined by the presence of symptoms (usually diarrhea) and either a stool test positive for *C. difficile* toxins or toxigenic *C. difficile,* or colonoscopic or histopathologic findings revealing pseudomembranous colitis. In addition to diagnosis and management, recommended methods of infection control and environmental management of the pathogen are presented. The recommendations are based on the best available evidence and practices, as determined by a joint Expert Panel appointed by SHEA and the Infectious Diseases Society of America (IDSA) (the SHEA-IDSA Expert Panel). The use of these guidelines can be impacted by the size of the institution and the resources, both financial and laboratory, available in the particular clinical setting.

I. Epidemiology: What are the minimum data that should be collected for surveillance purposes and how should the data be reported?

1. To increase comparability between clinical settings, use available standardized case definitions for surveillance of (1) healthcare facility (HCF)-onset, HCF-associated CDI; (2) community-onset, HCF-associated CDI; and (3) community-associated CDI (Figure 1) **(B-III).**
2. At a minimum, conduct surveillance for HCF-onset, HCF-associated CDI in all inpatient healthcare facilities, to detect outbreaks and monitor patient safety **(B-III).**
3. Express the rate of healthcare-associated CDI as the number of cases per 10,000 patient-days **(B-III).**
4. If CDI rates are high compared with those at other facilities or if an outbreak is noted, stratify rates by patient location in order to target control measures **(B-III).**

II. Diagnosis: What is the best testing strategy to diagnose CDI in the clinical laboratory and what are acceptable options?

5. Testing for *C. difficile* or its toxins should be performed only on diarrheal (unformed) stool, unless ileus due to *C. difficile* is suspected **(B-II).**

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6. Testing of stool from asymptomatic patients is not clinically useful, including use as a test of cure. It is not recommended, except for epidemiological studies. **(B-III)**

7. Stool culture is the most sensitive test and is essential for epidemiological studies **(A-II)**.

8. Although stool culture is not clinically practical because of its slow turnaround time, the sensitivity and specificity of stool culture followed by identification of a toxigenic isolate (ie, toxigenic culture), as performed by an experienced laboratory, provides the standard against which other clinical test results should be compared **(B-III)**.

9. Enzyme immunoassay (EIA) testing for *C. difficile* toxin A and B is rapid but is less sensitive than the cell cytotoxin assay, and it is thus a suboptimal alternative approach for diagnosis **(B-II)**.

10. Toxin testing is most important clinically, but is hampered by its lack of sensitivity. One potential strategy to overcome this problem is a 2-step method that uses EIA detection of glutamate dehydrogenase (GDH) as initial screening and then uses the cell cytotoxicity assay or toxigenic culture as the confirmatory test for GDH-positive stool specimens only. Results appear to differ based on the GDH kit used; therefore, until more data are available on the sensitivity of GDH testing, this approach remains an interim recommendation. **(B-II)**

11. Polymerase chain reaction (PCR) testing appears to be rapid, sensitive, and specific and may ultimately address testing concerns. More data on utility are necessary before this methodology can be recommended for routine testing. **(B-II)**

12. Repeat testing during the same episode of diarrhea is of limited value and should be discouraged **(B-II)**.

III. Infection Control and Prevention: What are the most important infection control measures to implement in the hospital during an outbreak of CDI?

A. Measures for Healthcare Workers, Patients, and Visitors

13. Healthcare workers and visitors must use gloves **(A-I)** and gowns **(B-III)** on entry to a room of a patient with CDI.

14. Emphasize compliance with the practice of hand hygiene **(A-II)**.

15. In a setting in which there is an outbreak or an increased CDI rate, instruct visitors and healthcare workers to wash hands with soap (or antimicrobial soap) and water after caring for or contacting patients with CDI **(B-III)**.

16. Accommodate patients with CDI in a private room with contact precautions **(B-III)**. If single rooms are not available, cohort patients, providing a dedicated commode for each patient **(C-III)**.

17. Maintain contact precautions for the duration of diarrhea **(C-III)**.

18. Routine identification of asymptomatic carriers (patients or healthcare workers) for infection control purposes is not recommended **(A-III)** and treatment of such identified patients is not effective **(B-I)**.

B. Environmental Cleaning and Disinfection

19. Identification and removal of environmental sources of *C. difficile,* including replacement of electronic rectal thermometers with disposables, can reduce the incidence of CDI **(B-II)**.

20. Use chlorine-containing cleaning agents or other sporicidal agents to address environmental contamination in areas associated with increased rates of CDI **(B-II)**.

21. Routine environmental screening for *C. difficile* is not recommended **(C-III)**.

C. Antimicrobial Use Restrictions

22. Minimize the frequency and duration of antimicrobial therapy and the number of antimicrobial agents prescribed, to reduce CDI risk **(A-II)**.

23. Implement an antimicrobial stewardship program **(A-II)**. Antimicrobials to be targeted should be based on the local epidemiology and the *C. difficile* strains present, but restricting the use of cephalosporin and clindamycin (except for surgical antibiotic prophylaxis) may be particularly useful **(C-III)**.

D. Use of Probiotics

24. Administration of currently available probiotics is not recommended to prevent primary CDI, as there are limited data to support this approach and there is a potential risk of bloodstream infection **(C-III)**.

IV. Treatment: Does the choice of drug for CDI matter and, if so, which patients should be treated and with which agent?

25. Discontinue therapy with the inciting antimicrobial agent(s) as soon as possible, as this may influence the risk of CDI recurrence **(A-II)**.

26. When severe or complicated CDI is suspected, initiate empirical treatment as soon as the diagnosis is suspected **(C-III)**.

27. If the stool toxin assay result is negative, the decision to initiate, stop, or continue treatment must be individualized **(C-III)**.

28. If possible, avoid use of antiperistaltic agents, as they may obscure symptoms and precipitate toxic megacolon **(C-III)**.

29. Metronidazole is the drug of choice for the initial episode of mild-to-moderate CDI. The dosage is 500 mg orally 3 times per day for 10–14 days. **(A-I)**

30. Vancomycin is the drug of choice for an initial episode of severe CDI. The dosage is 125 mg orally 4 times per day for 10–14 days. **(B-I)**

31. Vancomycin administered orally (and per rectum, if ileus is present) with or without intravenously administered metronidazole is the regimen of choice for the treat-

ment of severe, complicated CDI. The vancomycin dosage is 500 mg orally 4 times per day and 500 mg in approximately 100 mL normal saline per rectum every 6 hours as a retention enema, and the metronidazole dosage is 500 mg intravenously every 8 hours. **(C-III)**

32. Consider colectomy for severely ill patients. Monitoring the serum lactate level and the peripheral blood white blood cell count may be helpful in prompting a decision to operate, because a serum lactate level rising to 5 mmol/L and a white blood cell count rising to 50,000 cells per μL have been associated with greatly increased perioperative mortality. If surgical management is necessary, perform subtotal colectomy with preservation of the rectum. **(B-II)**

33. Treatment of the first recurrence of CDI is usually with the same regimen as for the initial episode **(A-II)** but should be stratified by disease severity (mild-to-moderate, severe, or severe complicated), as is recommended for treatment of the initial CDI episode **(C-III).**

34. Do not use metronidazole beyond the first recurrence of CDI or for long-term chronic therapy because of potential for cumulative neurotoxicity **(B-II).**

35. Treatment of the second or later recurrence of CDI with vancomycin therapy using a tapered and/or pulse regimen is the preferred next strategy **(B-III).**

36. No recommendations can be made regarding prevention of recurrent CDI in patients who require continued antimicrobial therapy for the underlying infection **(C-III).**

INTRODUCTION

Summary Definition of CDI

A case definition of CDI should include the presence of symptoms (usually diarrhea) and either a stool test result positive for *C. difficile* toxins or toxigenic *C. difficile,* or colonoscopic findings demonstrating pseudomembranous colitis.

Definition of CDI

The diagnosis of CDI should be based on a combination of clinical and laboratory findings. A case definition for the usual presentation of CDI includes the following findings: (1) the presence of diarrhea, defined as passage of 3 or more unformed stools in 24 or fewer consecutive hours[1-8]; (2) a stool test result positive for the presence of toxigenic *C. difficile* or its toxins or colonoscopic or histopathologic findings demonstrating pseudomembranous colitis. The same criteria should used to diagnose recurrent CDI. A history of treatment with antimicrobial or antineoplastic agents within the previous 8 weeks is present for the majority of patients.[9] In clinical practice, antimicrobial use is often considered part of the operative definition of CDI, but it is not included here because of occasional reports of CDI in the absence of antimicrobial use, usually in community-acquired cases.[10] A response to specific therapy for CDI is suggestive of the diagnosis. Rarely (in fewer than 1% of cases), a symptomatic patient will present with ileus and colonic distension with minimal or no diarrhea.[11] Diagnosis in these patients is difficult; the only specimen available may be a small amount of formed stool or a swab of stool obtained either from the rectum or from within the colon via endoscopy. In such cases, it is important to communicate to the laboratory the necessity to do a toxin assay or culture for *C. difficile* on the nondiarrheal stool specimen.

Background

The vast majority of anaerobic infections arise from endogenous sources. However, a number of important clostridial infections and intoxications are caused by organisms acquired from exogenous sources. It is the ability of these organisms to produce spores that explains how *C. difficile,* a fastidiously anaerobic organism in its vegetative state, can be acquired from the environment. *C. difficile* is recognized as the primary pathogen responsible for antibiotic-associated colitis and for 15%–25% of cases of nosocomial antibiotic-associated diarrhea.[12-14]

C. difficile can be detected in stool specimens of many healthy children under the age of 1 year[15,16] and a few percent of adults.[17,18] Although these data support the potential for endogenous sources of human infection, there was early circumstantial evidence to suggest that this pathogen could be transmissible and acquired from external sources. Cases often appear in clusters and outbreaks within institutions.[19,20] Animal models of disease also provide evidence for transmissibility of *C. difficile.*[21,22] Subsequently, many epidemiologic studies of CDI confirm the importance of *C. difficile* as a transmissible nosocomial pathogen.[1,9,23-25]

Clinical Manifestations

The clinical manifestations of infection with toxin-producing strains of *C. difficile* range from symptomless carriage, to mild or moderate diarrhea, to fulminant and sometimes fatal pseudomembranous colitis.[13,14,26] Several studies have shown that 50% or more of hospital patients colonized by *C. difficile* are symptomless carriers, possibly reflecting natural immunity.[1,3,5,27] Olson et al[28] reported that 96% of patients with symptomatic *C. difficile* infection had received antimicrobials within the 14 days before the onset of diarrhea and that all had received an antimicrobial within the previous 3 months. Symptoms of CDI usually begin soon after colonization, with a median time to onset of 2–3 days.[1,5,23,27]

C. difficile diarrhea may be associated with the passage of mucus or occult blood in the stool, but melena or hematochezia are rare. Fever, cramping, abdominal discomfort, and a peripheral leukocytosis are common but found in fewer than half of patients.[11,13,14,29] Extraintestinal manifestations, such as arthritis or bacteremia, are very rare.[30-33] *C. difficile* ileitis or pouchitis has also been rarely recognized in patients who have previously undergone a total colectomy (for complicated CDI or some other indication).[34] Clinicians should

TABLE 1. Definitions of the Strength of Recommendations and the Quality of the Evidence Supporting Them

Category and grade	Definition
Strength of recommendation	
A	Good evidence to support a recommendation for *or against* use
B	Moderate evidence to support a recommendation for *or against* use
C	Poor evidence to support a recommendation
Quality of evidence	
I	Evidence from at least 1 properly randomized, controlled trial
II	Evidence from at least 1 well-designed clinical trial without randomization, from cohort or case-controlled analytic studies (preferably from more than 1 center), from multiple time-series, or from dramatic results from uncontrolled experiments
III	Evidence from opinions of respected authorities, based on clinical experience, descriptive studies, or reports of expert committees

NOTE. Adapted and reproduced from the Canadian Task Force on the Periodic Health Examination,[39] with the permission of the Minister of Public Works and Government Services Canada, 2009.

consider the possibility of CDI in hospitalized patients who have unexplained leukocytosis, and they should request stool be sent for diagnostic testing.[35,36] Patients with severe disease may develop a colonic ileus or toxic dilatation and present with abdominal pain and distension but with minimal or no diarrhea.[11,13,14] Complications of severe *C. difficile* colitis include dehydration, electrolyte disturbances, hypoalbuminemia, toxic megacolon, bowel perforation, hypotension, renal failure, systemic inflammatory response syndrome, sepsis, and death.[11,24,25]

Clinical Questions for the 2010 Update

In 1995, the Society for Healthcare Epidemiology of America (SHEA) published a clinical position paper on *C. difficile*–associated disease and colitis.[37] For the current update, the epidemiology, diagnosis, infection control measures, and indications and agents for treatment from the 1995 position paper were reviewed by a joint Expert Panel appointed by SHEA and the Infectious Diseases Society of America (IDSA). The previous document is a source for a more detailed review of earlier studies.

The SHEA-IDSA Expert Panel addressed the following clinical questions in this update:

I. What are the minimum data that should be collected for surveillance purposes, and how should the data be reported? Have the risk factors for CDI changed?

II. What is the best testing strategy to diagnose CDI in the clinical laboratory and what are acceptable options?

III. What are the most important infection control measures to implement in the hospital during an outbreak of CDI?

IV. Does the choice of drug for treatment of CDI matter and, if so, which patients should be treated and with which agent?

PRACTICE GUIDELINES DEFINITION

"Practice guidelines are systematically developed statements to assist practitioners and patients in making decisions about appropriate health care for specific clinical circumstances.[38(p8)] Attributes of good guidelines include validity, reliability, reproducibility, clinical applicability, clinical flexibility, clarity, multidisciplinary process, review of evidence, and documentation."[38(p8)]

UPDATE METHODOLOGY

Panel Composition

The SHEA Board of Directors and the IDSA Standards and Practice Guidelines Committee convened a panel of experts in the epidemiology, diagnosis, infection control, and clinical management of adult patients with CDI to develop these practice guidelines.

Literature Review and Analysis

For the 2010 update, the SHEA-IDSA Expert Panel completed the review and analysis of data published since 1994. Computerized literature searches of PubMed were performed. The searches of the English-language literature from 1994 through April 2009 used the terms "*Clostridium difficile*," "epidemiology," "treatment," and "infection control" and focused on human studies.

Process Overview

In evaluating the evidence regarding the management of CDI, the Expert Panel followed a process used in the development of other SHEA-IDSA guidelines. The process included a systematic weighting of the quality of the evidence and the strength of each recommendation (Table 1).[39]

Guidelines and Conflict of Interest

All members of the Expert Panel complied with the SHEA and IDSA policy on conflicts of interest, which requires disclosure of any financial or other interest that might be construed as constituting an actual, potential, or apparent conflict. Members of the Expert Panel were provided with the SHEA and IDSA conflict of interest disclosure statement and

were asked to identify ties to companies developing products that might be affected by promulgation of the guideline. Information was requested regarding employment, consultancies, stock ownership, honoraria, research funding, expert testimony, and membership on company advisory boards or committees. The Expert Panel made decisions on a case-by-case basis as to whether an individual's role should be limited as a result of a conflict. No limiting conflicts were identified.

Revision Dates

At annual intervals, SHEA and IDSA will determine the need for revisions to the guideline on the basis of an examination of the current literature and the likelihood that any new data will have an impact on the recommendations. If necessary, the entire Expert Panel will be reconvened to discuss potential changes. Any revision to the guideline will be submitted for review and approval to the appropriate Committees and Boards of SHEA and IDSA.

GUIDELINE RECOMMENDATIONS FOR *CLOSTRIDIUM DIFFICILE* INFECTION (CDI)

I. WHAT ARE THE MINIMUM DATA THAT SHOULD BE COLLECTED FOR SURVEILLANCE PURPOSES, AND HOW SHOULD THE DATA BE REPORTED?

Recommendations

1. To increase comparability between clinical settings, use available standardized case definitions for surveillance of (1) healthcare facility (HCF)-onset, HCF-associated CDI; (2) community-onset, HCF-associated CDI; and (3) community-associated CDI (Figure 1) **(B-III)**.
2. At a minimum, conduct surveillance for HCF-onset, HCF-associated CDI in all inpatient healthcare facilities, to detect outbreaks and monitor patient safety **(B-III)**.
3. Express the rate of healthcare-associated CDI as the number of cases per 10,000 patient-days **(B-III)**.
4. If CDI rates are high compared with those at other facilities or if an outbreak is noted, stratify rates by patient location in order to target control measures **(B-III)**.

Evidence Summary

Prevalence, incidence, morbidity, and mortality. *C. difficile* accounts for 20%–30% of cases of antibiotic-associated diarrhea[12] and is the most commonly recognized cause of infectious diarrhea in healthcare settings. Because *C. difficile* infection is not a reportable condition in the United States, there are few surveillance data. However, based upon surveys of Canadian hospitals conducted in 1997 and 2005, incidence rates range from 3.8 to 9.5 cases per 10,000 patient-days, or 3.4 to 8.4 cases per 1,000 admissions, in acute care hospitals.[40,41]

Although there are no regional or national CDI surveillance data for long-term care facilities, patients in these settings are often elderly and have been exposed to antimicrobials, both important risk factors for CDI, suggesting that rates of disease and/or colonization[42,43] could potentially be high.[43] A recent analysis of US acute care hospital discharges found that the number of patients transferred to a long-term care facility with a discharge diagnosis of CDI doubled between 2000 and 2003; in 2003, nearly 2% of patients transferred on discharge from an acute care hospital to a long-term care facility carried the diagnosis of CDI. Historically, the attributable mortality of CDI has been low, with death as a direct or indirect result of infection occurring in less than 2% of cases.[28,40,44] However, the attributable excess costs of CDI suggest a substantial burden on the healthcare system. From 1999–2003 in Massachusetts, a total of 55,380 inpatient-days and $55.2 million were consumed by management of CDI. An estimate of the annual excess hospital costs in the US is $3.2 billion per year for the years 2000–2002.[45]

Changing epidemiology. Recently, the epidemiology of CDI changed dramatically; an increase in overall incidence has been highlighted by outbreaks of more-severe disease than previously observed. An examination of US acute care hospital discharge data revealed that, beginning in 2001, there was an abrupt increase in the number and proportion of patients discharged from the hospital with the diagnosis of "intestinal infection due to *Clostridium difficile*" (*International*

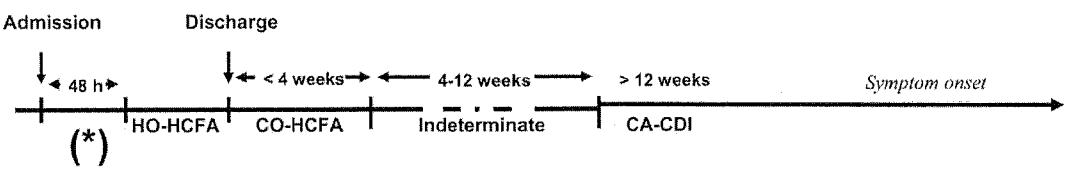

FIGURE 1. Time line for surveillance definitions of *Clostridium difficile*–associated infection (CDI) exposures. A case patient who had symptom onset during the window of hospitalization marked by an asterisk (*) would be classified as having community-onset, healthcare facility–associated disease (CO-HCFA), if the patient had been discharged from a healthcare facility within the previous 4 weeks; would be classified as having indeterminate disease, if the patient had been discharged from a healthcare facility within the previous 4–12 weeks; or would be classified as having community-associated CDI (CA-CDI), if the patient had not been discharged from a healthcare facility in the previous 12 weeks. HO-HCFA, healthcare facility–onset, healthcare facility–associated CDI.

Classification of Diseases, Clinical Modification, 9th edition, code 008.45).[46] Discharge rates increased most dramatically among persons aged 65 years or more and were more than 5-fold higher in this age group than among individuals aged 45–64 years.

Beginning as early as the second half of 2002 and extending through 2006, hospital outbreaks of unusually severe[25] and recurrent[47] CDI were noted in hospitals throughout much of Quebec, Canada. These outbreaks were, like slightly earlier outbreaks in the United States,[48] associated with the use of fluoroquinolones.[25] An assessment found that the 30-day mortality directly attributable to CDI in Montreal hospitals during this period was 6.9%, but CDI was thought to have contributed indirectly to another 7.5% of deaths.[25] The etiological agents of outbreaks both in Quebec and in at least 8 hospitals in 6 US states were nearly identical strains of *C. difficile.*[24,25] This strain has become known variously by its restriction endonuclease analysis pattern, BI[24]; by its pulsed-field gel electrophoresis (PFGE) pattern, NAP1 (for North American PFGE type 1); or by its PCR ribotype designation, 027; it is now commonly designated "NAP1/BI/027." This strain accounted for 67%–82% of isolates in Quebec,[25] which implies that it might be transmitted more effectively than are other strains. It also possesses, in addition to genes coding for toxins A and B, a gene encoding for the binary toxin. Although the importance of binary toxin as a virulence factor in *C. difficile* has not been established, earlier studies found the toxin was only present in about 6% of isolates.[24] In addition, the epidemic strain has an 18–base pair deletion and an apparently novel single–base pair deletion in *tcdC*,[24,25] a putative negative regulator of expression of toxins A and/or B that is located within the pathogenicity locus downstream from the genes encoding toxins A and B. Consistent with the presence of 1 or more of these molecular markers or other yet undiscovered factors responsible for increased virulence, patients infected with the NAP1/BI/027 epidemic strain in Montreal were shown to have more-severe disease than were patients infected with other strains.[25]

Increased virulence alone may not explain why the NAP1/BI/027 strain has recently become highly prevalent, as it appears this same strain had been an infrequent cause of CDI in North America and Europe dating back to the 1980s.[24] Historic and recent isolates of the NAP1/BI/027 strain differ in their level of resistance to fluoroquinolones; more recent isolates are more highly resistant to these drugs.[24] This, coupled with increasing use of the fluoroquinolones in North American hospitals, likely promoted dissemination of a once-uncommon strain. As of this writing, the NAP1/BI/027 strain has spread to at least 40 US states[24,49] and 7 Canadian provinces,[50] and has caused outbreaks in England,[51,52] parts of continental Europe,[53,54] and Asia.[55]

CDI in populations previously at low risk. In the context of the changing epidemiology of CDI in hospitals, disease is occurring among healthy peripartum women, who have been previously at very low risk for CDI.[56,57] The incidence might also be increasing among persons living in the community, including, but not limited to, healthy persons without recent healthcare contact.[56,58-61] However, there are limited historical data against which to compare the recent incidence.[62-64]

Routes of transmission and the epidemiology of colonization and infection. The primary mode of *C. difficile* transmission resulting in disease is person-to-person spread through the fecal-oral route, principally within inpatient healthcare facilities. Studies have found that the prevalence of asymptomatic colonization with *C. difficile* is 7%–26% among adult inpatients in acute care facilities[1,27] and is 5%–7% among elderly patients in long-term care facilities.[42,65] Other studies, however, indicate that the prevalence of asymptomatic colonization may be more on the order of 20%–50% in facilities where CDI is endemic.[9,66,67] The risk of colonization increases at a steady rate during hospitalization, suggesting a cumulative daily risk of exposure to *C. difficile* spores in the healthcare setting.[1] Other data suggest that the prevalence of *C. difficile* in the stool among asymptomatic adults without recent healthcare facility exposure is less than 2%.[16,17] Newborns and children in the first year of life are known to have some of the highest rates of colonization.[68]

The usual incubation period from exposure to onset of CDI symptoms is not known with certainty; however, in contrast to the situation with other multidrug-resistant pathogens that cause healthcare-associated infections, persons who remain asymptomatically colonized with *C. difficile* over longer periods of time appear to be at decreased, rather than increased, risk for development of CDI.[1,3,5,69] The protection afforded by more long-standing colonization may be mediated in part by the boosting of serum antibody levels against *C. difficile* toxins A and B[5,69]; however, this protection is also observed, both in humans and in animal models, when colonization occurs with nontoxigenic strains, which suggests competition for nutrients or for access to the mucosal surface.[3,70]

The period between exposure to *C. difficile* and the occurrence of CDI has been estimated in 3 studies to be a median of 2–3 days.[1,22,27] This is to be distinguished from the increased risk of CDI that can persist for many weeks after cessation of antimicrobial therapy and which results from prolonged perturbation of the normal intestinal flora.[71] However, recent evidence suggests that CDI resulting from exposure to *C. difficile* in a healthcare facility can have onset after discharge.[72-74] The hands of healthcare workers, transiently contaminated with *C. difficile* spores, are probably the main means by which the organism is spread during non-outbreak periods.[1,66]

Environmental contamination also has an important role in transmission of *C. difficile* in healthcare settings.[75-78] There have also been outbreaks in which particular high-risk fomites, such as electronic rectal thermometers or inadequately cleaned commodes or bedpans, were shared between patients and were found to contribute to transmission.[79]

Risk factors for disease. Advanced age is one of the most

important risk factors for CDI, as evidenced by the several-fold higher age-adjusted rate of CDI among persons more than 64 years of age.[46,80] In addition to advanced age, duration of hospitalization is a risk factor for CDI; the daily increase in the risk of *C. difficile* acquisition during hospitalization suggests that duration of hospitalization is a proxy for the duration, if not the degree, of exposure to the organism from other patients with CDI.[1]

The most important modifiable risk factor for the development of CDI is exposure to antimicrobial agents. Virtually every antimicrobial has been associated with CDI through the years. The relative risk of therapy with a given antimicrobial agent and its association with CDI depends on the local prevalence of strains that are highly resistant to that particular antimicrobial agent.[81]

Receipt of antimicrobials increases the risk of CDI because it suppresses the normal bowel flora, thereby providing a "niche" for *C. difficile* to flourish. Both longer exposure to antimicrobials, as opposed to shorter exposure,[47] and exposure to multiple antimicrobials, as opposed to exposure to a single agent, increase the risk for CDI.[47] Nonetheless, even very limited exposure, such as single-dose surgical antibiotic prophylaxis, increases a patient's risk of both *C. difficile* colonization[82] and symptomatic disease.[83]

Cancer chemotherapy is another risk factor for CDI that is, at least in part, mediated by the antimicrobial activity of several chemotherapeutic agents[84,85] but could also be related to the immunosuppressive effects of neutropenia.[86,87] Recent evidence suggests that *C. difficile* has become the most important pathogen causing bacterial diarrhea in US patients infected with human immunodeficiency virus (HIV), which suggests that these patients are at specific increased risk because of their underlying immunosuppression, exposure to antimicrobials, exposure to healthcare settings, or some combination of those factors.[88] Other risk factors for CDI include gastrointestinal surgery[89] or manipulation of the gastrointestinal tract, including tube feeding.[90] Another potential and somewhat controversial risk factor is related to breaches in the protective effect of stomach acid that result from the use of acid-suppressing medications, such as histamine-2 blockers and proton pump inhibitors. Although a number of recent studies have suggested an epidemiologic association between use of stomach acid–suppressing medications, primarily proton pump inhibitors, and CDI,[48,61,91-93] results of other well controlled studies have suggested this association is the result of confounding with the underlying severity of illness and duration of hospital stay.[25,47,94]

Surveillance. There are few data on which to base a decision about how best to perform surveillance for CDI, either in healthcare or community settings. Nonetheless, interim recommendations have been put forth that, although not evidence-based, could serve to make rates more comparable among different healthcare facilities and systems.[95] There is a current need for all healthcare facilities that provide skilled nursing care to conduct CDI surveillance, and some local or regional systems may be interested in tracking emerging community-associated disease, particularly in view of the changing epidemiology of CDI. A recommended case definition for surveillance requires (1) the presence of diarrhea or evidence of megacolon and (2) either a positive laboratory diagnostic test result or evidence of pseudomembranes demonstrated by endoscopy or histopathology. If a laboratory only performs *C. difficile* diagnostic testing on stool from patients with diarrhea, this case definition should involve tracking of patients with a new primary positive assay result (ie, those with no positive result within the previous 8 weeks) or a recurrent positive assay result (ie, those with a positive result within the previous 2–8 weeks).

It appears that many, if not most, patients who have the onset of CDI symptoms shortly after discharge from a healthcare facility (ie, within 1 month) acquired *C. difficile* while in the facility and that these case patients may have an important impact on overall rates. Nonetheless, it is not known whether tracking of healthcare-acquired, community-onset CDI (ie, postdischarge cases) is necessary to detect healthcare-facility outbreaks or make meaningful comparisons between facilities.[95] What is clear is that tracking CDI cases with symptom onset at least 48 hours after inpatient admission is the minimum surveillance that should be performed by all healthcare facilities. In addition, if interfacility comparisons are to be performed, they should only be performed using similar case definitions. Because the risk of CDI increases with the length of stay, the most appropriate denominator for healthcare facility CDI rates is the number of patient-days. If a facility notes an increase in the incidence of CDI from the baseline rate, or if the incidence is higher than in comparable institutions, surveillance data should be stratified by hospital location to identify particular wards or units where transmission is occurring more frequently, so that intensified control measures may be targeted. In addition, measures should be considered for tracking severe outcomes, such as colectomy, intensive care unit admission, or death, attributable to CDI. Comparison of incidence rates between hospitals in a given state or region could be more meaningful if rates are age-standardized (because the age distribution of inpatients may vary substantially between facilities) or are limited to specific age groups.

A current surveillance definition for community-associated CDI is as follows: disease in persons with no overnight stay in an inpatient healthcare facility in at least the 12 weeks prior to symptom onset.[10,95] A reasonable denominator for community-associated CDI is the number of person-years for the population at risk.

Molecular typing. Molecular typing is an important tool for understanding a variety of aspects of the epidemiology of CDI. The molecular characterization of isolates is essential for understanding the modes of transmission and the settings where transmission occurs. As described above, molecular typing of strains can confirm a shift in the epidemiology of CDI. In addition, tracking certain strains and observing their

clinical behavior has assisted investigators in determining the importance of antimicrobial resistance and virulence factors in outbreaks of epidemic CDI.

Current *C. difficile* typing measures depend on having access to isolates recovered from patient stool specimens. Because of the popularity of using nonculture methods to diagnose *C. difficile* infection, such isolates often are not available, and this may hinder our further understanding of the epidemiology of CDI. It is, therefore, imperative that culture for *C. difficile* be performed for toxin-positive stool samples during outbreaks or in settings where the epidemiology and/or severity of CDI is changing and is unexplained by the results of investigations in similar settings.[96] Outbreaks of CDI in healthcare facilities are most often caused by transmission of a predominant strain; cessation of the outbreak is usually accompanied by a decrease in strain relatedness among *C. difficile* isolates. Because of the clonality of *C. difficile* in outbreaks and in settings with high rates of endemicity, it may be difficult to draw conclusions about some aspects of the epidemiology of *C. difficile.* For example, cases of recurrent disease caused by a strain that is prevalent in a given healthcare facility may just as likely represent reinfection as relapse.

C. difficile may be typed by a variety of methods. Current genetic methods for comparing strains include methods that examine polymorphisms after restriction endonuclease digestion of chromosomal DNA, PCR-based methods, and sequence-based methods. DNA polymorphism–based methods include restriction endonuclease analysis,[97] PFGE,[98] and toxinotyping.[99] PCR-based methods include arbitrarily-primed PCR,[100] repetitive element sequence PCR,[101] and PCR ribotyping.[102] Sequence-based techniques consist presently of multilocus sequence typing[103] and multilocus variable-number tandem-repeat analysis.[104,105] A recent international comparative study of 7 different typing methods (multilocus sequence typing, multilocus variable-number tandem-repeat analysis, PFGE, restriction endonuclease analysis, PCR-ribotyping, amplified fragment-length polymorphism analysis, and surface layer protein A gene sequence typing) assessed the discriminatory ability and typeability of each technique, as well as the agreement among techniques in grouping isolates according to allele profiles defined by toxinotype, the presence of the binary toxin gene, and deletion in the *tcdC* gene.[106] All the techniques were able to distinguish the current epidemic strain of *C. difficile* (NAP1/BI/027) from other strains. Restriction endonuclease analysis, surface layer protein A gene sequence typing, multilocus sequence typing, and PCR ribotyping all included isolates that were toxinotype III, positive for binary toxin, and positive for an 18–base pair deletion in *tcdC* (ie, the current epidemic strain profile) in a single group that excluded other allelic profiles.

II. WHAT IS THE BEST TESTING STRATEGY TO DIAGNOSE CDI IN THE CLINICAL LABORATORY AND WHAT ARE ACCEPTABLE OPTIONS?

Recommendations

5. Testing for *C. difficile* or its toxins should be performed only on diarrheal (unformed) stool, unless ileus due to *C. difficile* is suspected **(B-II).**

6. Testing of stool from asymptomatic patients is not clinically useful, including use as a test of cure. It is not recommended, except for epidemiological studies **(B-III).**

7. Stool culture is the most sensitive test and is essential for epidemiological studies **(A-II).**

8. Although stool culture is not clinically practical because of its slow turnaround time, the sensitivity and specificity of stool culture followed by identification of a toxigenic isolate (ie, toxigenic culture), as performed by an experienced laboratory, provides the standard against which other clinical test results should be compared **(B-III).**

9. Enzyme immunoassay (EIA) testing for *C. difficile* toxin A and B is rapid but is less sensitive than the cell cytotoxin assay, and it is thus a suboptimal alternative approach for diagnosis **(B-II).**

10. Toxin testing is most important clinically, but is hampered by its lack of sensitivity. One potential strategy to overcome this problem is a 2-step method that uses EIA detection of glutamate dehydrogenase (GDH) as initial screening and then uses the cell cytotoxicity assay or toxigenic culture as the confirmatory test for GDH-positive stool specimens only. Results appear to differ based on the GDH kit used; therefore, until more data are available on the sensitivity of GDH testing, this approach remains an interim recommendation. **(B-II)**

11. Polymerase chain reaction (PCR) testing appears to be rapid, sensitive, and specific and may ultimately address testing concerns. More data on utility are necessary before this methodology can be recommended for routine testing. **(B-II)**

12. Repeat testing during the same episode of diarrhea is of limited value and should be discouraged **(B-II).**

Evidence Summary

Accurate diagnosis is crucial to the overall management of this nosocomial infection. Empirical therapy without diagnostic testing is inappropriate if diagnostic tests are available, because even in an epidemic environment, only approximately 30% of hospitalized patients who have antibiotic-associated diarrhea will have CDI.[13] Efficiently and effectively making the diagnosis of CDI remains a challenge to the clinician and the microbiologist.

Since the original observations that *C. difficile* toxins are responsible for antibiotic-associated colitis, most diagnostic

tests that have been developed detect the toxin B and/or toxin A produced by *C. difficile.* Using an animal model and isogenic mutants of *C. difficile,* toxin B was demonstrated to be the primary toxin responsible for CDI.[107] Initial tests were performed using cell culture cytotoxicity assays for toxin B. Subsequent tests have used antigen detection with EIA. Tests detecting *C. difficile* common antigen (ie, GDH) have been improved using EIA, compared with the older latex agglutination assays.[108-110] Because of cost and turnaround time, the focus of diagnostic testing has been on antibody-based tests to identify the toxins. These tests are also easier to perform in the clinical laboratory. The sensitivity of these tests is suboptimal when compared with more time-intensive methodologies. Furthermore, toxin EIAs have suboptimal specificity, which means that, because the great majority of diagnostic samples will not have toxin present, the positive predictive value of the results can be unacceptably low.[111,112] Culture followed by detection of a toxigenic isolate (ie, toxigenic culture) is considered the most sensitive methodology, but it routinely takes 2–3 days and could take up to 9 days to obtain results.[113-115] Thus the optimal strategy to provide timely, cost-effective, and accurate results remains a subject of controversy.

Specimen collection and transport. The proper laboratory specimen for the diagnosis of *C. difficile* infection is a watery, loose, or unformed stool promptly submitted to the laboratory.[116,117] Except in rare instances in which a patient has ileus without diarrhea, swab specimens are unacceptable, because toxin testing cannot be done reliably. Because 10% or more of hospitalized patients may be colonized with *C. difficile,*[1,116] evaluating a formed stool for the presence of the organism or its toxins can decrease the specificity of the diagnosis of CDI. Processing a single specimen from a patient at the onset of a symptomatic episode usually is sufficient. Because of the low increase in yield and the possibility of false-positive results, routine testing of multiple stool specimens is not supported as a cost-effective diagnostic practice.[118]

Detection by cell cytotoxicity assay. Detection of neutralizable toxin activity in stools from patients with antibiotic-associated colitis was the initial observation that led to the discovery that *C. difficile* is the causative agent of this infection.[119] The presence or absence of the pathogenicity locus (PaLoc), a 19-kilobase area of the *C. difficile* genome that includes the genes for toxins A and B and surrounding regulatory genes, accounts for the fact that most strains of *C. difficile* produce either both toxins or neither toxin, although an increasing number of strains are found to lack production of toxin A.[120] Numerous cell lines are satisfactory for detection of cytotoxin, but most laboratories use human foreskin fibroblast cells, on the basis of the fact that it is the most sensitive cell line for detecting toxin at low titer (1 : 160 or less).[121]

Using a combination of clinical and laboratory criteria to establish the diagnosis of CDI, the sensitivity of cytotoxin detection as a single test for the laboratory diagnosis of this illness is reported to range from 67% to 100%.[2,9,122]

Detection by EIA for toxin A or toxins A and B. Commercial EIA tests have been introduced that either detect toxin A only or detect both toxins A and B. Compared with diagnostic criteria that included a clinical definition of diarrhea and laboratory testing that included cytotoxin and culture, the sensitivity of these tests is 63%–94%, with a specificity of 75%–100%. These tests have been adopted by more than 90% of laboratories in the United States because of their ease of use and lower labor costs, compared with the cell cytotoxin assay. The toxin A/B assay is preferred because 1%–2% of strains in the United States are negative for toxin A.[123]

Detection by culture. Along with cytotoxin detection, culture has been a mainstay in the laboratory diagnosis of CDI and is essential for the epidemiologic study of isolates. The description of a medium containing cycloserine, cefoxitin, and fructose (CCFA medium) provided laboratories with a selective culture system for recovery of *C. difficile.*[124] Addition of taurocholate or lysozyme can enhance recovery of *C. difficile,* presumably because of increased germination of spores.[125] Optimal results require that culture plates be reduced in an anaerobic environment prior to use. The strains produce flat, yellow, ground glass–appearing colonies with a surrounding yellow halo in the medium. The colonies have a typical odor and fluoresce with a Wood's lamp.[115] Additionally, Gram stain of these colonies must show typical morphology (gram-positive or gram-variable bacilli) for *C. difficile.* Careful laboratory quality control of selective media for isolation of *C. difficile* is required, as there have been variations in the rates of recovery with media prepared by different manufacturers. With experience, visual inspection of bacterial colonies that demonstrate typical morphology on agar and confirmation by Gram stain usually is sufficient for a presumptive identification of *C. difficile.* Isolates not fitting these criteria can be further identified biochemically or by gas chromatography.

Detection by tests for* C. difficile *common antigen (GDH). The initial test developed to detect GDH was a latex agglutinin assay. It had a sensitivity of only 58%–68% and a specificity of 94%–98%.[2,122] The latex test for *C. difficile*–associated antigen, therefore, is not sufficiently sensitive for the routine laboratory detection of CDI, even though it is rapid, relatively inexpensive, and specific. Use of this test provides no information regarding the toxigenicity of the isolate, nor does it yield the isolate itself, which would be useful for epidemiologic investigations.

Several assays for GDH have been developed using EIA methodology. These newer assays show a sensitivity of 85%–95% and a specificity of 89%–99%. Most importantly, these tests have a high negative predictive value, making them useful for rapid screening, if combined with another method that detects toxin.[126,127] Several 2-step algorithms have been

TABLE 2. Summary of Infection Control Measures for the Prevention of Horizontal Transmission of *Clostridium difficile*

Variable	Strength of recommendation	Reference(s)
Hand hygiene	A-II	
Contact precautions		
Glove use	A-I	Johnson et al[150]
Gowns	B-III	
Use of private rooms or cohorting	C-III	
Environmental cleaning, disinfection, or use of disposables		
Disinfection of patient rooms and environmental surfaces	B-II	
Disinfection of equipment between uses for patients	C-III	Brooks et al[79]
Elimination of use of rectal thermometers	B-II	Mayfield et al,[76] Wilcox et al[78]
Use of hypochlorite (1,000 ppm available chlorine) for disinfection	B-II	

developed that are based on the use of this test.[110,115,126,128,129] They all use the GDH test for screening in which a stool sample with a negative assay result is considered negative for the pathogen but a positive assay result requires further testing to determine whether the *C. difficile* strain is toxigenic. The confirmatory test has primarily been a cell cytotoxin assay.[110,115,129] It is also possible to use a toxin A/B EIA or culture with cytotoxin testing as the confirmatory test, although the limited sensitivity of the toxin EIA is problematic. One of the more recent studies performed 2-step testing of 5,887 specimens at 2 different hospitals. The GDH test result was positive for 16.2% of specimens at one hospital and 24.7% of specimens at the other. Therefore, 75%–85% of the samples did not require that a cell cytotoxin assay be performed, at a cost savings of between $5,700 and $18,100 per month.[110] Another recent study tested 439 specimens using GDH screening with cell cytotoxicity assay for confirmation.[130] The comparator test in this study was culture with cell cytotoxin assay. The GDH test identified all samples that were culture positive. The sensitivity of the 2-step algorithm was 77%, and the sensitivity of culture was 87%. Another recent study comparing GDH EIA with culture, PCR, and toxin EIA found that only 76% of specimens that were culture positive for *C. difficile* and only 32% of culture-positive specimens in which toxin genes were detected tested positive for GDH using an insensitive confirmatory toxin A assay.[130] Although most studies have shown a high negative predictive value for the GDH assay, some studies have questioned its sensitivity. PCR tests for toxigenic *C. difficile* in stool samples are now available commercially from several manufacturers, and this may be a more sensitive and more specific approach, but more data on utility are necessary before this methodology can be recommended for routine testing. Currently there is no testing strategy that is optimally sensitive and specific and, therefore, clinical suspicion and consideration of the patient risk factors are important in making clinical decisions about whom to treat.

Other test methodologies. Pseudomembranous colitis can only be diagnosed by direct visualization of pseudomembranes on lower gastrointestinal endoscopy (either sigmoidoscopy or colonoscopy) or by histopathologic examination. However, direct visualization using any of these techniques will detect pseudomembranes in only 51%–55% of CDI cases that are diagnosed by combined clinical and laboratory criteria that include both a culture positive for *C. difficile* and a positive stool cytotoxin test result.[9] Pseudomembranous colitis has been used as a marker of severe disease, as has CT scanning. Abdominal CT scanning may facilitate the diagnosis of CDI but this methodology is neither sensitive nor specific.[13]

III. WHAT ARE THE MOST IMPORTANT INFECTION CONTROL MEASURES TO IMPLEMENT IN THE HOSPITAL DURING AN OUTBREAK OF CDI?

A. Measures for Healthcare Workers, Patients, and Visitors

Recommendations

13. Healthcare workers and visitors must use gloves (**A-I**) and gowns (**B-III**) on entry to a room of a patient with CDI.
14. Emphasize compliance with the practice of hand hygiene (**A-II**).
15. In a setting in which there is an outbreak or an increased CDI rate, instruct visitors and healthcare workers to wash hands with soap (or antimicrobial soap) and water after caring for or contacting patients with CDI (**B-III**).
16. Accommodate patients with CDI in a private room with contact precautions (**B-III**). If single rooms are not available, cohort patients, providing a dedicated commode for each patient (**C-III**).
17. Maintain contact precautions for the duration of diarrhea (**C-III**).
18. Routine identification of asymptomatic carriers for infection control purposes is not recommended (**A-III**) and treatment of such identified patients is not effective (**B-I**).

Evidence Summary

Prevention of *C. difficile* acquisition can be categorized into 2 strategies: preventing horizontal transmission, to minimize

exposure; and decreasing the risk factors for patients to develop *C. difficile* infection, if exposure has occurred.[131] This section will focus on prevention of horizontal transmission. There are 3 ways in which patients may be exposed to *C. difficile* in the hospital milieu: (1) by contact with a healthcare worker with transient hand colonization, (2) by contact with the contaminated environment, or (3) by direct contact with a patient with CDI. The rate of acquisition during hospitalization increases linearly with time and can be as high as 40% after 4 weeks of hospitalization.[132] There may not be a single method that is effective in minimizing exposure to *C. difficile,* and a multifaceted approach is usually required.[133-136] Different methods may be more or less effective in different institutions, depending on the local epidemiology and the available resources (Table 2).

Hand hygiene. Hand hygiene is considered to be one of the cornerstones of prevention of nosocomial transmission of *C. difficile,* as it is for most nosocomial infections. Several studies have documented the reduction of rates of hospital-acquired infection by improvement in the compliance with hand washing by healthcare workers between episodes of contact with patients.[137] Unfortunately, many studies have also documented low rates of hand washing by healthcare workers.[137,138] The advent of alcohol-based hand antiseptics was greeted with great optimism as a breakthrough for improving compliance with hand hygiene.[139,140] These alcohol-based antiseptics are popular because of their effectiveness in reducing hand carriage of most vegetative bacteria and many viruses, their ease of use at the point of care, and their ability to overcome the relative inaccessibility of hand washing facilities in many institutions.

However, *C. difficile,* in its spore form, is also known to be highly resistant to killing by alcohol.[141] Indeed, exposing stool samples to ethanol in the laboratory facilitates isolation of *C. difficile* from these specimens.[142] Therefore, healthcare workers who decontaminate their hands with alcohol-based products may simply displace spores over the skin surface, as opposed to physically removing *C. difficile* spores by mechanical washing with soap and running water. This could potentially increase the risk of transferring this organism to patients under their care. Several studies have not demonstrated an association between the use of alcohol-based hand hygiene products and increased incidence of CDI. Gordin et al[143] assessed the impact of using an alcohol-based hand rub on rates of infection with methicillin-resistant *Staphylococcus aureus,* vancomycin-resistant *Enterococcus,* and CDI 3 years before and after implementation. After implementation, a 21% reduction was observed in the rate of methicillin-resistant *S. aureus* infection, and a 41% decrease in the rate of vancomycin-resistant *Enterococcus* infection. The incidence of CDI was essentially unchanged and did not increase with the implementation of alcohol-based hand rub.

A recent study compared use of alcohol-based products with other methods of hand hygiene.[144] This study assessed the efficacy of different hand washing methods for removal of a nontoxigenic strain of *C. difficile.* Although there is a theoretical potential for alcohol-based hand hygiene products to increase the incidence of CDI because of their relative ineffectiveness at eliminating spores from the hands, there has not been any clinical evidence to support this thus far.

McFarland et al[1] suggested that chlorhexidine containing antiseptic was more effective than plain soap for removing *C. difficile* from the hands of healthcare workers. They found that *C. difficile* persisted on the hands of 88% of personnel (14 of 16) who had washed with plain soap (as determined by culture). Washing with 4% chlorhexidine gluconate reduced the rate to 14% (1 of 7 personnel). Another study involving experimental hand seeding with *C. difficile* showed no difference between bland soap and chlorhexidine gluconate in removing *C. difficile* from hands.[145]

Contact precautions. The use of additional isolation techniques (contact precautions, private rooms, and cohorting of patients with active CDI) has been employed for control of outbreaks, with varied success.[28,146-148] Contact precautions include the donning of gowns and gloves when caring for patients with CDI.[149] These measures are based on the premise that patients with active CDI are the primary reservoir for spread of disease within the institution. There is ample evidence for the contamination of personnel's hands with *C. difficile* spores.[1,66] Hence, the use of gloves in conjunction with hand hygiene should decrease the concentration of *C. difficile* organisms on the hands of healthcare personnel. A prospective controlled trial of vinyl glove use for handling body substances showed a significant decline in CDI rates, from 7.7 cases per 1,000 discharges before institution of glove use to 1.5 cases per 1,000 discharges after institution of glove use ($P = .015$).[150] In addition, the use of gowns has been promoted because of potential soiling and contamination of the uniforms of healthcare personnel with *C. difficile. C. difficile* has been detected on nursing uniforms, but a study found no evidence of the uniforms being a source of transmission to patients.[151]

Cartmill and colleagues[136] achieved a reduction in the number of new *C. difficile* cases by using an aggressive policy of increasing the number of diarrheal stools cultured for *C. difficile,* instituting contact precautions early, treating CDI patients with vancomycin, and disinfecting environmental surfaces with a hypochlorite solution. Placing the focus for control measures on clinically symptomatic patients with CDI was successful in this institution, which supports the hypothesis that patients with diarrhea, who are known to have the highest number of organisms in their stools and in their immediate hospital environment, are the most likely source of nosocomial transmission.

Facilities. Improving the hospital layout can enhance the effectiveness of infection control measures. In a cohort study of nosocomial acquisition of CDI, there were higher acquisition rates in double rooms than in single rooms (17% vs 7%; $P = .08$) and a significantly higher risk of acquisition after exposure to a roommate with a positive culture result.[1]

The importance of adequate hospital facilities was highlighted in a study comparing CDI rates in 2 Norwegian hospitals.[152] These 2 hospitals were comparable in size and had similar clinical departments. However, the hospitals differed in their physical infrastructure, bed occupancy rate, and antibiotic utilization pattern. The older hospital had fewer single rooms and a higher bed occupancy rate but a lower rate of use of broad-spectrum antibiotics, compared with the modern hospital. The incidence of CDI was lower in the modern hospital than in the older hospital. However, this study was limited by a lack of description of patient demographic characteristics and other risk factors that may impact CDI rates. Furthermore, there may have been a higher rate of case finding in the older institution than in the modern hospital, because the incidence of patient testing was consistently higher in the older hospital during the study period.

In a systematic review of the architecture of hospital facilities and nosocomial infection rates, there was a lack of compelling evidence that a reduction in nosocomial infections could be attributable to improvement in hospital patient rooms.[153] In 8 studies reviewed, 3 studies documented a statistically significant decrease in the incidence of nosocomial infections after the architectural intervention, whereas 5 studies showed no difference.[153] It is difficult to assess the effect of improvements in hospital design and renovation on the incidence of nosocomial infections. These studies are often nonrandomized, historical cohort studies that examine the incidence of specific nosocomial infections before and after the intervention. The American Institute of Architects recommends single-patient rooms in new construction, as well as in renovations.[154]

Healthcare worker carriage. Cases of nosocomial acquisition of *C. difficile* by healthcare workers have been reported.[155,156] Two prospective studies indicate, however, that *C. difficile* poses little risk to the healthcare worker. In a 1-year prospective case-control study in which 149 patients with CDI were identified, rectal swab specimens from 68 personnel (54 nurses and 14 physicians) revealed only 1 employee (1.5%) colonized with *C. difficile*.[9] A colonization rate of 1.7% was found among medical house staff.[157] Therefore, it is rare that healthcare workers acquire *C. difficile*; nevertheless, they can serve as primary transmitters of *C. difficile* by way of transient hand contamination.

Identification and treatment of asymptomatic patient carriers. In institutions with higher rates of CDI (7.8–22.5 cases per 1,000 discharges), the number of asymptomatically colonized patients has been found to be considerably higher than the number with CDI.[1,150,158] The rationale for identifying and treating these asymptomatic patients is that they potentially serve as a reservoir for horizontal spread of *C. difficile* to other patients, either by way of the environment or by way of the hands of medical personnel. Delmee et al[159] demonstrated a significant reduction in new *C. difficile* infections in a leukemia unit after institution of oral vancomycin treatment (500 mg 4 times daily for 7 days) for asymptomatically colonized patients, combined with extensive environmental renovation and cleaning. In contrast, metronidazole therapy was ineffective in reducing the incidence of CDI when administered to all *C. difficile* carriers in a chronic-care facility, even when contact precautions and antibiotic restriction were used concurrently.[160]

One prospective trial showed no significant reduction in the incidence of *C. difficile* carriage after therapy with oral metronidazole, compared with placebo, whereas 9 of 10 patients treated with vancomycin became culture negative for *C. difficile* after treatment.[161] On day 70 of follow-up, however, 4 of 6 patients who had initial clearance with vancomycin treatment were positive for *C. difficile* (including 1 patient who developed CDI), whereas only 1 of 9 placebo-treated patients remained positive for the pathogen ($P < .05$).

Thus, treatment of asymptomatic *C. difficile* carriers is effective when vancomycin is used, but patients treated with vancomycin may be at increased risk for reinfection or prolonged carriage after treatment is stopped. The efficacy of using vancomycin treatment for asymptomatic carriers as a control measure to interrupt hospital transmission has not been established. Similarly, it has been suggested that identification of asymptomatic carriers and institution of more stringent barrier precautions may be useful in interrupting an outbreak, but there are no available data to support such a measure.

B. Environmental Cleaning and Disinfection

Recommendations

19. Identification and removal of environmental sources of *C. difficile*, including replacement of electronic rectal thermometers with disposables, can reduce the incidence of CDI **(B-II)**.

20. Use chlorine-containing cleaning agents or other sporicidal agents to address environmental contamination in areas associated with increased rates of CDI **(B-II)**.

21. Routine environmental screening for *C. difficile* is not recommended **(C-III)**.

Evidence Summary

The true extent of the contribution of the healthcare environment to infection transmission remains controversial. However, for bacteria that resist desiccation, there is much evidence that the environment is an important source of nosocomial infection.[162] *C. difficile* spores can survive in the environment for months or years and can be found on multiple surfaces in the healthcare setting.[1,66,163,164] The rate of recovery of *C. difficile* from the environment is increased if media that encourage spore germination—for example, media containing lysozyme—are used.[125] Interestingly, epidemic strains of *C. difficile* have a greater sporulation capacity in vitro than do nonoutbreak strains.[165] Studies have found that the rate of environmental contamination by *C. difficile* increases according to the carriage and symptom status of the patient(s): it was lowest in

rooms of culture-negative patients (fewer than 8% of rooms), intermediate in rooms of patients with asymptomatic *C. difficile* colonization (8%–30% of rooms), and highest in rooms of patients with CDI (9%–50% of rooms).[1,164] Also, a study found that the incidence of *C. difficile* infection correlated significantly with the environmental prevalence of *C. difficile* on one hospital ward ($r = 0.76$; $P < .05$) but not another ($r = 0.26$; $P > .05$), possibly because of confounding factors.[77] Environmental contamination has been linked to the spread of *C. difficile* by way of contaminated commodes,[1,75,77] blood pressure cuffs,[166] and oral and rectal thermometers.[79,167,168] Replacement of electronic thermometers with single-use disposable thermometers has been associated with significant reductions in CDI incidence.[79,167,168]

There is evidence that the environmental prevalence of *C. difficile* can affect the risk of CDI, and may not simply reflect the prevalence of symptomatic disease. Samore and colleagues[75] showed that the environmental prevalence of *C. difficile* correlated with the extent of contamination of healthcare workers hands by this bacterium. Furthermore, there are several reports that interventions to reduce environmental contamination by *C. difficile* have decreased the incidence of infection.[76,78] Kaatz and colleagues[169] found that phosphate buffered hypochlorite (1,600 ppm available chlorine; pH, 7.6) was more effective than unbuffered hypochlorite (500 ppm available chlorine) at reducing environmental levels of *C. difficile.* Introduction of cleaning with a hypochlorite-based solution (5,000 ppm available chlorine) was also associated with reduced incidence of CDI in a bone marrow transplant unit where there was a relatively high infection rate.[76] The incidence of CDI increased almost to the baseline level after the reintroduction of use of the original quaternary ammonium compound cleaning agent. However, the environmental prevalence of *C. difficile* was not measured in this study, and the results were not reproducible with patients on other units, possibly because of the low prevalence of infection. Wilcox et al[78] used a 2-year crossover study design to demonstrate a significant correlation between the use of a cleaning agent containing chlorine (dichloroisocyanurate; 1,000 ppm available chlorine) and a reduction in the incidence of CDI on 1 of the 2 hospital wards that were examined. Although it is likely that higher concentrations of available chlorine within the range of 1,000–5,000 ppm are more reliably sporicidal than lower concentrations, the potential disadvantages (eg, causticity to surfaces, complaints from personnel about the odor, and possible hypersensitivity) should be balanced against the potential advantages in particular settings (eg, environmental cleaning interventions may have their greatest impact in settings with the highest baseline rates). Therefore, depending on such factors, the concentration of available chlorine should be at least 1,000 ppm and may ideally be 5,000 ppm. A recent report highlighted the use of vaporized hydrogen peroxide to reduce the level of environmental contamination by *C. difficile.* The prevalence of *C. difficile* was significantly reduced (to a recovery level of 0) after hydrogen peroxide use, albeit from a low level (5%), possibly because of former hypochlorite based cleaning; the incidence of CDI decreased, although not significantly.[170] Unfortunately, practical considerations (the need to seal rooms and to have access to specialized equipment) and the cost limit the applicability of this approach to environmental decontamination.

A wide range of disinfectants suitable for decontamination of instruments (eg, endoscopes) or the environment have in vitro activity against *C. difficile* spores.[141,165,171-173] With the exceptions noted above, comparative data on the in situ efficacy of these disinfection options are lacking. The efficacy of cleaning is critical to the success of decontamination in general, and thus user acceptability of disinfection regimens is a key issue. Endoscopes have not been implicated in the transmission of *C. difficile,* but spread by means of this mechanism is preventable by careful cleaning and disinfection with 2% alkaline glutaraldehyde.[171] In vitro data show greater *C. difficile* sporicidal activity as the concentration of free chlorine increases with acidified bleach, but practical issues may limit the use of such products for routine cleaning. A study found that working-strength concentrations of 5 different cleaning agents inhibited growth of *C. difficile* cultures in vitro.[165] However, only chlorine-based cleaning agents used at the recommended working concentrations were able to inactivate *C. difficile* spores. Also, in vitro exposure of epidemic *C. difficile* strains, including NAP1/BI/027, to subinhibitory concentrations of non–chlorine-based cleaning agents (detergent or hydrogen peroxide) significantly increased sporulation capacity; this effect was generally not seen with chlorine-based cleaning agents.[125,167] These observations suggest the possibility that some cleaning agents, if allowed to come into contact with *C. difficile* in low concentrations, could promote sporulation and, therefore, the persistence of the bacterium in the environment.

Use of chlorine-containing cleaning products presents health and safety concerns, as well as compatibility challenges that need to be assessed for risk. However, current evidence supports the use of chlorine-containing cleaning agents (with at least 1,000 ppm available chlorine), particularly to address environmental contamination in areas associated with endemic or epidemic CDI. Routine bacteriological surveillance of the environment is generally unhelpful, largely because it has not been possible to establish threshold levels associated with increased risk of clinical infection, but it may be useful for ascertaining whether cleaning standards are suboptimal, notably in a setting experiencing an outbreak or where *C. difficile* is hyperendemic.

C. Antimicrobial Use Restrictions

Recommendations

22. Minimize the frequency and duration of antimicrobial therapy and the number of antimicrobial agents prescribed, to reduce CDI risk (**A-II**).
23. Implement an antimicrobial stewardship program

(A-II). Antimicrobials to be targeted should be based on the local epidemiology and the *C. difficile* strains present, but restricting the use of cephalosporin and clindamycin (except for surgical antibiotic prophylaxis) may be particularly useful **(C-III)**.

Evidence Summary

Most studies have determined that the great majority of patients with CDI have had prior exposure to antimicrobial agents. In a recent study, 85% of patients with CDI had received antibacterial therapy within the 28 days prior to the onset of symptoms.[174] The widespread use of antimicrobial agents and the propensity for polypharmacy means that the accurate quantification of the CDI risk associated with specific antibiotics is very difficult. An greater number of antimicrobial agents administered, a greater number of doses, and a greater duration of administration have been associated with increased risk of CDI.[9,89,158,175-177] Antibiotic risk studies and prescribing intervention studies frequently do not consider exposure to *C. difficile* when assessing outcomes. Thus, efforts to demonstrate the effects of restriction of antibiotics may be confounded by infection control interventions that affect the risk of acquiring *C. difficile.*

Limitation or restriction of use of antimicrobial agents that are found to be associated with increased CDI rates is an intuitively attractive approach to reducing infection rates. However, there are few sound studies that clearly demonstrate the successful implementation of antibiotic prescribing interventions, notably in terms of their effectiveness at reducing CDI. A recent Cochrane systematic review by Davey and colleagues[178] examined the effectiveness of interventions to improve antibiotic prescribing practices for hospital inpatients. It analyzed relevant randomized and quasi-randomized controlled trials, controlled before-and-after studies, and interrupted time-series studies (with at least 3 data points before and after implementation of the intervention). Of 66 identified intervention studies that contained interpretable data, 5 (all interrupted time-series) reported outcome data regarding occurrence of CDI.[179-183] Three of these found significant reductions in CDI incidence,[179-181] and 2 interrupted time-series showed weak or nonsignificant evidence for a decrease in incidence.[182,183]

Climo et al[180] observed a sustained decrease in the incidence of CDI after the prescribing of clindamycin was restricted (11.5 cases per month prior to restriction, compared with 3.33 cases per month after restriction; $P < .001$). By contrast, the incidence of CDI was increasing by 2.9 cases per quarter before the restriction of clindamycin use. Similarly, Pear and colleagues[179] found that, before clindamycin restriction, the CDI rate was increasing (mean incidence, 7.7 cases per month; $P < .001$), and after restriction the incidence suddenly decreased (mean incidence, 3.68 cases per month ($P = .041$), and there was a sustained reduction averaging 0.32 cases per month ($P = .134$). Furthermore, regression analysis showed a significant relationship between the amount of clindamycin being prescribed per unit time and the incidence of CDI. Carling et al[181] examined the effectiveness of an antimicrobial management team that focused on 3 interventions to alter prescribing patterns: choice, shorter duration of antibiotic therapy (ie, stop therapy after 2–3 days if there was no confirmed infection), and switching from intravenous to oral formulations. Prescribing of third-generation cephalosporins (and aztreonam) was targeted, and over 6 years it decreased from 24.7 to 6.2 defined daily doses per 1,000 patient-days ($P < .0001$). The multidisciplinary antibiotic stewardship program had no impact on the prevalence rates of vancomycin-resistant *Enterococcus* infection or methicillin-resistant *S. aureus* infection but did significantly reduce the rates of CDI ($P = .002$) and antibiotic-resistant gram-negative bacterial infections ($P = .02$).

However, it is important to emphasize that, for a significant decrease in the incidence of CDI to be realized, reducing the use of antimicrobial agents that are associated with a high CDI risk is necessary, as opposed to simply making lower-risk agents available on the formulary. One study found that introduction of piperacillin-tazobactam onto the formulary for a large Elderly Medicine unit was not associated with a significant reduction in the CDI rate.[184] However, once cefotaxime was replaced by piperacillin-tazobactam, CDI rates decreased in 4 of 5 wards and overall by 52% ($P < .008$). Unintentional restriction of piperacillin-tazobactam, consequent to manufacturing difficulties, led to a 5-fold rise in cefotaxime prescribing, and CDI rates increased from 2.2 to 5.1 cases per 100 admissions ($P < .01$). Similar observations that a piperacillin-tazobactam shortage led to increased prescribing of cephalosporins (ceftriaxone and cefotetan) and higher CDI rates have also been reported elsewhere.[185]

As reports of increasing incidence and more-severe CDI associated with the highly fluoroquinolone-resistant NAP1/BI/027 strain continue to mount, several investigators have addressed the issue of antimicrobial restriction as a means of controlling this strain. A reduction in overall antimicrobial use has played a role in controlling at least 2 large institutional outbreaks caused by this strain.[48,186] However, other outbreaks appear to have come under control through the application of infection control measures alone.[25] There are limited data on whether restriction of a specific fluoroquinolone, or restriction of the entire class, can favorably impact increased rates of CDI due to NAP1/BI/027. In an early single-hospital outbreak caused by NAP1/BI/027 and reported by Gaynes et al,[187] it appeared that a switch from levofloxacin to gatifloxacin as the formulary drug of choice precipitated the outbreak; when the formulary drug of choice was switched back to levofloxacin, the outbreak ceased. Moreover, a case-control study showed an association between CDI and gatifloxacin exposure, leading the authors to propose that gatifloxacin is a higher-risk antimicrobial than levofloxacin. However, in a similar scenario in which an outbreak occurred following a formulary switch from levofloxacin to moxifloxacin as the drug of choice, reverting to levofloxacin was not associated

with a decrease in CDI.[188] Given that the NAP1/BI/027 strain has increased resistance to fluoroquinolones as a class, rather than to one specific agent, it is unlikely that restricting the use of a specific fluoroquinolone would reduce CDI rates to the same level that could be achieved if use of all members of the class were restricted. Nonetheless, there is currently insufficient evidence to recommend restriction of use of a specific fluoroquinolone or the fluoroquinolone class for the control of CDI, other than as part of a reduction in overall antimicrobial use.[186]

D. Use of Probiotics

Recommendation

24. Administration of currently available probiotics is not recommended to prevent primary CDI, as there are limited data to support this approach and there is a potential risk of bloodstream infection (**C-III**).

Evidence Summary

For many years, administration of probiotics has been advocated as a preventive measure for patients receiving antibiotics. Until recently, no individual study had shown probiotics to be effective in the prevention of CDI. It is doubtful whether meta-analyses are acceptable, given the diversity of probiotics used in various studies. Additional problems are the lack of standardization of such products, variations in the bacterial counts in such products according to the duration of storage, and the possibility of inducing bacteremia or fungemia. A recent randomized trial showed, for the first time, that ingestion of a specific brand of yogurt drink containing *Lactobacillus casei, Lactobacillus bulgaricus,* and *Streptococcus thermophilus* reduced the risk of CDI in patients more than 50 years of age who were prescribed antibiotics and were able to take food and drink orally.[189] However, this conclusion was based on a small number of patients in a highly selected population that excluded patients receiving high-risk antibiotics. There was also an extraordinarily high rate of CDI among patients in the placebo group, who were given a milkshake in place of the yogurt drink (9 of 53 patients in the placebo group developed CDI, compared with 0 of 56 patients in the intervention group). The Expert Panel believes that larger trials are required before this practice can be recommended.

IV. DOES THE CHOICE OF DRUG FOR TREATMENT OF CDI MATTER AND, IF SO, WHICH PATIENTS SHOULD BE TREATED AND WITH WHICH AGENT?

Recommendations

25. Discontinue therapy with the inciting antimicrobial agent(s) as soon as possible, as this may influence the risk of CDI recurrence (**A-II**).

26. When severe or complicated CDI is suspected, initiate empirical treatment as soon as the diagnosis is suspected (**C-III**).

27. If the stool toxin assay result is negative, the decision to initiate, stop, or continue treatment must be individualized (**C-III**).

28. If possible, avoid use of antiperistaltic agents, as they may obscure symptoms and precipitate toxic megacolon (**C-III**).

29. Metronidazole is the drug of choice for the initial episode of mild-to-moderate CDI. The dosage is 500 mg orally 3 times per day for 10–14 days. (**A-I**)

30. Vancomycin is the drug of choice for an initial episode of severe CDI. The dosage is 125 mg orally 4 times per day for 10–14 days. (**B-I**)

31. Vancomycin administered orally (and per rectum, if ileus is present) with or without intravenously administered metronidazole is the regimen of choice for the treatment of severe, complicated CDI. The vancomycin dosage is 500 mg orally 4 times per day and 500 mg in approximately 100 mL normal saline per rectum every 6 hours as a retention enema, and the metronidazole dosage is 500 mg intravenously every 8 hours. (**C-III**)

32. Consider colectomy for severely ill patients. Monitoring the serum lactate level and the peripheral blood white blood cell count may be helpful in prompting a decision to operate, because a serum lactate level rising to 5 mmol/L and a white blood cell count rising to 50,000 cells per μL have been associated with greatly increased perioperative mortality. If surgical management is necessary, perform subtotal colectomy with preservation of the rectum. (**B-II**)

33. Treatment of the first recurrence of CDI is usually with the same regimen as for the initial episode (**A-II**) but should be stratified by disease severity (mild-to-moderate, severe, or severe complicated), as is recommended for treatment of the initial CDI episode (**C-III**).

34. Do not use metronidazole beyond the first recurrence of CDI or for long-term therapy because of potential for cumulative neurotoxicity (**B-II**).

35. Treatment of the second or later recurrence of CDI with vancomycin therapy using a tapered and/or pulse regimen is the preferred next strategy (**B-III**).

36. No recommendations can be made regarding prevention of recurrent CDI in patients who require continued antimicrobial therapy for the underlying infection (**C-III**).

Evidence Summary

For 25 years, metronidazole and oral vancomycin have been the main antimicrobial agents used in the treatment of CDI. Two randomized controlled trials conducted in the 1980s and 1990s that compared metronidazole therapy and vancomycin therapy found no difference in outcomes but included fewer than 50 patients per study arm.[190,191] Fusidic acid or bacitracin have not been widely adopted for treatment, partially because comparative studies showed a trend toward higher frequency

of recurrence of CDI or lower efficacy.[191,192] Treatment with teicoplanin is probably not inferior to treatment with metronidazole or vancomycin, but this drug remains unavailable in the United States.[193] Vancomycin is the only agent with an indication for CDI from the US Food and Drug Administration. The use of vancomycin for initial treatment of CDI markedly decreased following the 1995 Centers for Disease Control and Prevention's recommendation that the use of vancomycin in hospitals be reduced, to decrease the selection pressure for the emergence of vancomycin-resistant enterococci.[194] Since then, metronidazole has generally been recommended for first-line treatment of CDI, with oral vancomycin being used mainly after metronidazole is found to be ineffective or if it is contraindicated or not well tolerated.[13,14,195] Prospective trials of metronidazole (and vancomycin) therapy have not compared regimens with durations longer than 10 days. However, it is recognized that some patients may respond slowly to treatment and may require a longer course (eg, 14 days). The oral formulation of vancomycin is much more expensive than metronidazole, and to reduce costs, some hospitals use the generic intravenous formulation of vancomycin for oral administration. Some patients report a bad taste after taking this intravenous formulation by mouth.

Recent reports from Canada and the United States, in the context of the emergence of a hypervirulent strain of *C. difficile,* have prompted a reassessment of the comparative efficacy of metronidazole and vancomycin, especially when used to treat patients with severe CDI, primarily on the basis of studies done prior to the emergence of the epidemic strain. When administered orally, metronidazole is absorbed rapidly and almost completely, with only 6%–15% of the drug excreted in stool. Fecal concentrations of metronidazole likely reflect its secretion in the colon, and concentrations decrease rapidly after treatment of CDI is initiated: the mean concentration is 9.3 μg/g in watery stools but only 1.2 μg/g in formed stools.[196] Metronidazole is undetectable in the stool of asymptomatic carriers of *C. difficile.*[161] Consequently, there is little rationale for administration of courses of metronidazole longer than 14 days, particularly if diarrhea has resolved. In contrast, vancomycin is poorly absorbed, and fecal concentrations following oral administration (at a dosage of 125 mg 4 times per day) reach very high levels: 64–760 μg/g on day 2 and 152–880 μg/g on day 4.[197] Doubling the dosage (250 mg 4 times per day) may result in higher fecal concentrations on day 2.[198] Fecal levels of vancomycin are maintained throughout the duration of treatment. Given its poor absorption, orally administered vancomycin is relatively free of systemic toxicity.

Historically, metronidazole resistance in *C. difficile* has been rare; minimal inhibitory concentrations (MICs) of nearly all strains have been less than or equal to 2.0 mg/L.[199-203] In a recent report from Spain, the MIC_{90} of 415 isolates was 4.0 mg/L, and 6.3% of isolates had metronidazole MICs of 32 mg/L or higher.[204] These levels of resistance have not been reported elsewhere. In the United Kingdom, recently recovered isolates belonging to ribotype 001 had geometric mean MICs of 5.94 μg/mL, compared with 1.03 μg/mL for historic isolates (recovered before 2005) of the same ribotype.[205] There is no evidence that the epidemic NAP1/BI/027 strain is more resistant to metronidazole than are nonepidemic strains or historic isolates.[25,206] However, given the relatively low fecal concentrations achieved with metronidazole, even a modest decrease in susceptibility might be clinically relevant, and continued surveillance for metronidazole resistance will be important. The MIC_{90} of vancomycin against *C. difficile* is 1.0–2.0 μg/mL, and the highest MIC ever reported is 16 μg/mL,[200-203,207] but considering the high fecal concentrations achieved with oral vancomycin, emergence of resistance is likely not a concern.

Three main outcomes should be considered when evaluating drugs used in the treatment of CDI: time to symptom resolution (or the proportion of patients who respond within 7–10 days); recurrences after initial symptom resolution; and the frequency of major complications, such as death within 30 days of diagnosis, hypovolemic or septic shock, megacolon, colonic perforation, emergency colectomy, or intensive care unit admission.

Treatment of a first episode of CDI. Three factors may indicate a severe or complicated course and should be considered when initiating treatment: age, peak white blood cell count (leukocytosis), and peak serum creatinine level.[25,80] The influence of greater age probably reflects a senescence of the immune response against *C. difficile* and its toxins, and greater age has been consistently related to all adverse outcomes. Leukocytosis likely reflects the severity of colonic inflammation; complications are more common among patients who had leukocytosis with a white blood cell count of 15,000 cells/μL or higher than among patients with a normal white blood cell count, and the course of the disease is truly catastrophic in patients with a white blood cell count of 50,000 cells/μL or higher.[208] An elevated serum creatinine level may indicate severe diarrhea with subsequent dehydration or inadequate renal perfusion.

The time to resolution of diarrhea might be shorter with vancomycin than with metronidazole therapy.[209] A recent observational study showed that patients treated with vancomycin in the years 1991–2003 were less likely to develop complications or die within 30 days after diagnosis than were patients treated with metronidazole.[80] However, extension of this case series up through 2006 showed that for the years 2003–2006, when infection with the NAP1/BI/027 strain predominated, vancomycin no longer was superior to metronidazole therapy.[210] Thus, the potential superiority of vancomycin therapy in avoiding complications of CDI, especially among patients infected with the NAP1/BI/027 strain, requires further study.

A recent randomized controlled trial showed, for the first time, that vancomycin at a dosage of 125 mg 4 times per day was superior to metronidazole at a dosage of 250 mg 4 times per day in a subgroup of patients with severe disease, as

assessed by a severity score incorporating 6 clinical variables.[211] The patients were recruited in the years 1994–2002, probably before the emergence of the NAP1/BI/027 strain in the United States. A more recent study conducted since the emergence of the NAP1/BI/027 strain, reported in abstract form, confirms the superiority of vancomycin over metronidazole for treatment of severe CDI.[212] There is no evidence to support administration of combination therapy to patients with uncomplicated CDI. Although hampered by its low statistical power, a recent trial did not show any trend toward better results when rifampin was added to a metronidazole regimen. There is no evidence to support use of a combination of oral metronidazole and oral vancomycin.

The criteria proposed in Table 3 for defining severe or complicated CDI are based on expert opinion. These criteria may need to be reviewed in the future, on publication of prospectively validated severity scores for patients with CDI.

Treatment of severe, complicated CDI. Ileus may impair the delivery of orally administered vancomycin to the colon, but intravenously administered metronidazole is likely to result in detectable concentrations in feces and an inflamed colon. Even though it is unclear whether a sufficient quantity of the drug reaches the right and the transverse colon, intracolonic administration of vancomycin seems useful in some cases.[28,213] If colonic perforation is demonstrated or colectomy is imminent, it may be prudent to stop oral or rectal therapy with any antimicrobial agent, but, short of these complications, the emphasis should be on delivery of effective therapy to the colon. Despite the lack of data, it seems prudent to administer vancomycin by oral and rectal routes at higher dosages (eg, 500 mg) for patients with complicated CDI with ileus. Use of high doses of vancomycin is safe, but high serum concentrations have been noted with long courses of 2 g per day, with renal failure. It would be appropriate to obtain trough serum concentrations in this circumstance. Passive immunotherapy with intravenous immunoglobulins (150–400 mg/kg) has been used for some patients not responding to other therapies,[214] but no controlled trials have been performed.

Colectomy can be life-saving for selected patients.[208] Colectomy has usually been performed for patients with megacolon, colonic perforation, or an acute abdomen, but the procedure is now also performed for patients with septic shock.[208,215] Among patients with a lactate level of 5 mmol/L or greater, postoperative mortality is 75% or higher, when possible colectomy should be performed earlier.[208]

Treatment of recurrent CDI. The frequency of further episodes of CDI necessitating re-treatment remains a major concern. Historically, 6%–25% of patients treated for CDI have experienced at least 1 additional episode.[28,216,217] Recurrences correspond to either relapse of infection the original strain or re-infection of patients who remained susceptible and are exposed to new strains.[218,219] In clinical practice, it is impossible to distinguish these 2 mechanisms. Recent reports documented an increase in the frequency of recurrences after metronidazole therapy, especially in patients aged 65 years or more. More than half of patients aged 65 years or more in a Canadian center experienced at least 1 recurrence,[220] while in Texas, half of patients treated with metronidazole either did not respond to the drug or experienced a recurrence.[206] Other risk factors for a recurrence are the administration of other antimicrobials during or after initial treatment of CDI, and a defective immune response against toxin A.[69,221]

Using either metronidazole or vancomycin treatment of a first recurrence does not alter the probability of a second recurrence,[222] but use of vancomycin is recommended for the first recurrence in patients with a white blood cell count of

TABLE 3. Recommendations for the Treatment of *Clostridium difficile* Infection (CDI)

Clinical definition	Supportive clinical data	Recommended treatment	Strength of recommendation
Initial episode, mild or moderate	Leukocytosis with a white blood cell count of 15,000 cells/μL or lower and a serum creatinine level less than 1.5 times the premorbid level	Metronidazole, 500 mg 3 times per day by mouth for 10–14 days	A-I
Initial episode, severe[a]	Leukocytosis with a white blood cell count of 15,000 cells/μL or higher or a serum creatinine level greater than or equal to 1.5 times the premorbid level	Vancomycin, 125 mg 4 times per day by mouth for 10–14 days	B-I
Initial episode, severe, complicated	Hypotension or shock, ileus, megacolon	Vancomycin, 500 mg 4 times per day by mouth or by nasogastric tube, plus metronidazole, 500 mg every 8 hours intravenously. If complete ileus, consider adding rectal instillation of vancomycin	C-III
First recurrence	...	Same as for initial episode	A-II
Second recurrence	...	Vancomycin in a tapered and/or pulsed regimen	B-III

[a] The criteria proposed for defining severe or complicated CDI are based on expert opinion. These may need to be reviewed in the future upon publication of prospectively validated severity scores for patients with CDI.

15,000 cells/μL or higher (or a rising serum creatinine level), since they are at higher risk of developing complications.

A substantial proportion of patients with a second recurrence will be cured with a tapering and/or pulsed regimen of oral vancomycin. Metronidazole should not be used beyond the first recurrence or for long-term therapy because of the potential for cumulative neurotoxicity.[223] Various regimens have been used and are similar to this one: after the usual dosage of 125 mg 4 times per day for 10–14 days, vancomycin is administered at 125 mg 2 times per day for a week, 125 mg once per day for a week, and then 125 mg every 2 or 3 days for 2–8 weeks, in the hope that *C. difficile* vegetative forms will be kept in check while allowing restoration of the normal flora. Management of patients who do not respond to this course of treatment or experience a further relapse is challenging. There is no evidence that adding cholestyramine or rifampin to the treatment regimen decreases the risk of a further recurrence.[224] It should be noted that cholestyramine, colestipol, and other anion-exchange resins bind vancomycin, which make these a specific contraindication. A recent uncontrolled case series of patients with multiple recurrences of CDI documented that oral rifaximin therapy (400 mg 2 times per day for 2 weeks) cured 7 of 8 patients when it was started immediately following the last course of vancomycin and before symptom recurrence.[225] Caution is recommended with use of rifaximin because of the potential for isolates to develop an increased MIC during treatment.[225,226]

Studies of the probiotic *Saccharomyces boulardii* have been inconclusive, but in a subset analysis of a randomized controlled trial, administration of *S. boulardii* in combination with a high dosage of vancomycin appeared to decrease the number of recurrences. Administration of *S. boulardii* has, however, been associated with fungemia in immunocompromised patients and in patients with central venous lines, and it should be avoided in critically ill patients.[227] There is no compelling evidence that other probiotics are useful in the prevention or treatment of recurrent CDI.[228]

Considering that disruption of the indigenous fecal flora is likely a major risk for infection with *C. difficile* and, particularly, for recurrent infection, instillation of stool from a healthy donor has been used with a high degree of success in several uncontrolled case series.[229,230] The availability of this treatment is limited, however. If "fecal transplant" is considered, the donor should be screened for transmissible agents, and logistic issues need to be considered, including the timing, the collection and processing of the specimen from the donor, the preparation of the recipient, and the route and means of administration (ie, by nasogastric tube or by enema).

Other potential options for treatment include alternative antimicrobial agents, such as nitazoxanide,[7] intravenous immunoglobulins (150–400 mg/kg).[230-233]

Prevention of recurrent CDI in patients requiring antimicrobial therapy. Some patients need to receive other antimicrobials during or shortly after the end of CDI therapy, either to complete the treatment of the infection for which they had received the inciting antibiotics or to treat a new incidental infection. These patients are at high risk of a recurrence and its attendant complications.[69,221] Many clinicians prolong the duration of treatment of CDI in such cases, until after the other antimicrobial regimens have been stopped. Whether this reduces the risk of CDI recurrence is unknown, and the Expert Panel offers no specific recommendation, but if the duration of CDI treatment is prolonged, oral vancomycin is the preferred agent, given the absence of therapeutic levels of metronidazole in the feces of patients who no longer have active colitis.

RESEARCH GAPS

The initial step in developing a rational clinical research agenda is the identification of gaps in information. The process of guideline development, as practiced by SHEA and the IDSA, serves as a natural means by which such gaps are identified. Thus, these guidelines identify important clinical questions and identify the quality of evidence supporting those recommendations. Clinical questions identified by the SHEA-IDSA Expert Panel and by members of the IDSA Research Committee that could inform a *C. difficile* research agenda are listed below.

Epidemiology

What is the epidemiology of CDI? What is the incubation period of *C. difficile*? What is the infectious dose of *C. difficile*? How should hospital rates be risk-adjusted for appropriate interhospital comparisons? Does administration of proton pump inhibitors increase the risk of CDI and, if so, what is the magnitude of risk? What are the sources for *C. difficile* transmission in the community? Is exposure to antimicrobials (or equivalent agents, such as chemotherapy drugs) required for susceptibility to CDI? What is the role of asymptomatic carriers in transmission of *C. difficile* in the healthcare setting? What are the validated clinical predictors of severe CDI? At what age and to what degree is *C. difficile* pathogenic among infants?

Diagnostics

Is GDH detection in stool sufficiently sensitive as a screening test for C. difficile *colitis?* How well does this method correlate with culture for toxigenic *C. difficile* and cell culture cytotoxicity assay? Which of these "gold standard" assays (culture for toxigenic *C. difficile* or cell culture cytotoxicity assay) is optimal as a reference test for diagnosis of CDI? Is screening by GDH test, coupled with confirmatory testing for toxigenic *C. difficile* by cell culture cytotoxicity assay or real time PCR for toxin B, as sensitive as primary testing of stool using real-time PCR? What is the best diagnostic method for hospital laboratories that do not have PCR technology available?

Which commercial PCR assay for toxin B performs best, compared with culture for toxigenic C. difficile*?* Is PCR testing for toxin B too sensitive for clinical utility? How do individual laboratory-derived PCR assays for *C. difficile* compare with commercial PCR assays?

Is there any role for repeated C. difficile *stool testing during the same episode of illness?*

After initial diagnosis of CDI, should testing be repeated for any reason other than recurrence of symptoms following successful treatment?

Management

If a validated severity-of-illness tool for CDI is developed, how will treatment recommendations for primary CDI be modified?

What is the best treatment for recurrent CDI? What is the best way to restore colonization protection of intestinal microbiota? What is the role of fecal transplant? What is the role of administration of passive antibodies (immunoglobulins or monoclonal antibodies) or active immunization (with vaccines)?

What is the best approach to treatment of fulminant CDI? What are the criteria for colectomy in a patient with fulminant CDI? What is the role of treatment with vancomycin or other antibiotics alone or in combination in fulminant infection? What is the role of treatment with passive antibodies (immunoglobulin or monoclonal antibody therapy) in fulminant infection?

Prevention

What preventive measures can be taken to reduce the incidence of CDI? Can administration of probiotics or biotherapeutic agents effectively prevent CDI? What are the most effective antimicrobial stewardship strategies to prevent CDI? What are the most effective transmission prevention strategies (ie, environmental management and isolation) to prevent CDI in inpatient settings? What is the incremental impact of each? Can vaccination effectively prevent CDI, and what would be the composition of the vaccine and the route of administration? What are systemic or mucosal serologic markers that predict protection against CDI?

Basic Research

What is the biology of C. difficile *spores that leads to clinical infection?* What induces spore germination and where does it occur in the human gastrointestinal tract? How do spores interact with the human gastrointestinal immune system? What are the triggers for sporulation and germination of *C. difficile* in the human gastrointestinal tract? What is the role of sporulation in recurrent *C. difficile* disease?

What is the basic relationship of C. difficile *to the human gut mucosa and immune system?* Where in the gut do *C. difficile* organisms reside? What enables *C. difficile* to colonize patients? Is there a *C. difficile* biofilm in the gastrointestinal tract? Is mucosal adherence necessary for development of CDI? Is there a nutritional niche that allows *C. difficile* to establish colonization? What is the role of mucosal and systemic immunity in preventing clinical CDI? What causes *C. difficile* colonization to end? Do *C. difficile* toxins enter the circulation during infection?

PERFORMANCE MEASURES

Performance measures are tools to help guideline users measure both the extent and the effects of implementation of guidelines. Such tools or measures can be indicators of the process itself, outcomes, or both. Deviations from the recommendations are expected in a proportion of cases, and compliance in 80%–95% of cases is generally appropriate, depending on the measure.

- Infection control practices should be consistent with guideline recommendations, including compliance with recommended isolation precautions and adequacy of environmental cleaning. Data exist supporting the conclusion that use of these measures has led to control of outbreaks of CDI.
- Treatment of the initial episode of CDI should be consistent with the guidelines. In particular, patients with severe CDI (provisionally identified as leukocytosis with a white blood cell count greater than 15,000 cells/μL or an increase in the serum creatinine level to 1.5 times the premorbid level) should be treated with vancomycin. Evidence suggests treatment with this agent has significantly better outcomes than does treatment with metronidazole.
- Appropriate testing for the diagnosis of CDI includes submitting samples only of unformed stool. Additionally, no more than 1 stool sample should be obtained for routine testing during a diarrheal episode. Stool should not be submitted for test of cure.

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Potential conflicts of interest. S.H.C. reports that he has served as a speaker for Viropharma and Wyeth Pharmaceuticals and has served as a consultant to Genzyme, Salix and Romark Laboratories. D.N.G. reports that he has served as a consultant for ViroPharma, Optimer, Genzyme, Cepheid, BD GeneOhm, Salix, Romark, Merck, Schering-Plough, Gojo, and TheraDoc; has received research support from ViroPharma, Massachusetts Biological Laboratories, Optimer, Cepheid, Gojo, Merck, and Genzyme; and holds patents for the prevention and treatment of CDI licensed to ViroPharma. S.J. reports that he has served as an advisor to Genzyme, Viropharma, Salix

Pharmaceutical, Romark Laboratories, and Acambis. V.G.L. reports that she has served as a consultant for Genzyme. J.P. reports that he has served on advisory boards for Pfizer and Novartis; as an advisor for Viropharma, Acambis, Wyeth Pharmaceuticals, and Bayer; and as speaker for Wyeth Pharmaceuticals. C.P.K. reports that he has served as scientific advisor and consultant to Actelion, Cubist Pharm, MicroBiotix, Salix Pharm, Sanofi-Pasteur, ViroPharma, and Wyeth Pharm and has received research support from Actelion and MicroBiotix. M.H.W. and L.C.M. report no conflicts relevant to this guideline.

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It is important to realize that guidelines cannot always account for individual variation among patients. They are not intended to supplant physician judgment with respect to particular patients or special clinical situations. SHEA and the IDSA consider adherence to these guidelines to be voluntary, with the ultimate determination regarding their application to be made by the physician in the light of each patient's individual circumstances.

The findings and conclusions in this report are those of the author(s), writing on behalf of SHEA and the IDSA, and do not necessarily represent the views of the Centers for Disease Control and Prevention, or the United States Department of Veterans Affairs.

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High Touch Surface Areas

Subject:	**Cleaning High Touch Surface Areas (HTSA)**
Distribution:	Patient Care Manual
Originator:	Director of Environmental Services, Infection Preventionist
Reviewer(s):	Director of Quality & Patient Safety, Infection Control Committee, Quality/Safety Committee
Reviewed:	12/10
Revised:	
Approved By:	Diane Hopkins RN MS CNO

Purpose
To prevent the spread of Healthcare Acquired Infections

Policy
A. Housekeeping staff to obtain a list in the morning of all occupied rooms from department manager.
B. Staff cleans each room following cleaning guidelines set by each department.
C. Housekeeping staff will use daily worksheets to determine what items need to be cleaned each day.
    1. Staff will turn in completed forms to Director of Environmental Services daily.
    2. See Attachment A for sample worksheet.

Procedure
A. List of High Touch Surface areas that are to be disinfected daily:
    1. Inpatient and outpatient areas
        - Door handle
        - Light switches
        - Nurse's call buttons
        - TV remotes
        - Telephones
        - Bed rails
        - Tray table
        - Bedside tables
        - Chair (arm-seats)
        - Curtains (check if soiled)
        - Soap dispensers and foam
        - Faucets by sinks
        - Paper towel dispensers
        - Needle boxes exteriors
        - Laundry hamper covers
        - Glove box holders
        - Waste container lids
        - Exam tables
        - IV poles
    2. Bathrooms/Restrooms
        - Door handles
        - Light switches
        - Nurses call cords or button
        - Toilet flush handle
        - Handicap rails
        - Soap dispensers
        - Paper towel dispensers
        - Shower door handles
        - Shower faucet handles
        - Waste container lids
        - Toilet brush in room
        - Toilet seats

CCU areas (floors in all areas dry and wet mop both unless stated different)
Waiting Rm. hokey/baskets/dust (D) _____Vacuum (1x week)_____Furniture vac (1x week)_____
Storage closet (Wet Tuesday) _____Water fountain (D) _____
Nurses Station: Baskets/sink/dust/hokey (D) _____Vacuum (1 x week)_____
Supply area (D) _____Tub room (D) _____Nurses Lav (D) _____
Doors/windows in halls (D) _____Walls spot check _____Blinds (Dust weekly) _____
Patient rooms: 254_____ 255_____ 256_____ 257_____ 258_____
Hall areas: Hokey (D)_____Vacuum (1 x week)_____
Time spent cleaning ICU and CCU_____

Med surg areas (floors in all areas dry and wet mop both unless stated different)
Nurse's station:
Floor dry mop (M + W + F) _____wet mop (T + Th) _____
Baskets_____dust desk and counters (D) _____Med carts (D) _____
Storage room across nurses station: baskets/hokey/dust (D) _____Vacuum (1 X week)_____
Linen cabinet space across 247_____
Sink areas in hallway BY: 244_____251_____
Carpet hall ways:
- Hokey (D)_____vacuum (2 x Week)_____remove stains (D)_____

Patient rooms:
- 253_____252_____251_____250_____249_____
- 248_____247_____246_____245_____244_____

Also rooms:
- 201_____202_____

Time spent in med surg_____

O.B. areas floors in all areas dry and wet mop both unless stated different)
North elevator: Floor, doors, walls, frame_____Janitor closet _____
Stairway (2nd floor to basement) Dry (D) _____Wet (Tues & Thurs)_____Railings/doors wipe (D)_____
Nurse's dress room and lav. (D) _____
Lavatory 1 (D) _____Doctor's bathroom (D)_____Bathtub room (D)_____
Nurse's station areas:
- O.B. desk_____ OB. med cart_____O.B. supervisor's office (D)_____
- Freezer_____(3rd wk. of month)

Nursery areas: Work room (D)_____Nursery (D)_____
Mother rooms:
- 231_____232_____233_____234_____235_____

Dirty Utility room (D)_____ OB supply Storage room (D)_____
Hospitality break room (D) _____ OB Waiting area (D) _____
Hall floors: Dry mop (D) _____Wet mop (Mon. &Thurs.)_____ (more as needed)
Doors & windows in halls (D) _____Spot check walls (D) _____
Time spent in OB areas:_____

RM/AREA	DATE CLEAND	Time you started to cleaned room	Time room was ready for a new admit	EMPLOYEE INITIALS who cleaned	Time the patient went home PLUS who told you room was ready to clean	BED ALARM CHECKED	CHECKED THERMAST SET TO 72
O.B.	*****	**********	********	*******	********	*******	********
231							
232							
233							
234							
235							
	****	****	****	****	****	****	****
7-SIDE							
241							
242							

243	****	****	****	****	****	****	****
6-SIDE							
244							
245							
246							
247							
248							
249							
250							
251							
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253							
201	****	****	****	****	****	****	****
202							
CCU-ICU							
254							
255							
256							
257							
258							

Record when you do these (Place initials in boxes) this will also show how me how many were done for this date

Surgical carts (2nd floor)							
Visitor beds							
wheelchairs							
Carts in PAR							
BP machines							
Blinds							
Curtains							
commodes							
Computer stands							
Ivacs							
Weigh scale							

Mattress numbers listed on beds

- **check for cracks/tears**
- **Report if an issue found**

502	516	535
503	517	536
504	518	538
505	519	539
506	520	541
507	521	543
508	522	
509	523	
510	524	
511	525	
512	526	
513	527	
514	528	
515	533	

SAFE from CDI

E – Educate Staff and Patients

Staff Education

Clostridium difficile Infection Prevention in Acute Care Settings Presentation
Minnesota Department of Health, HAI Prevention Unit

Improving Hand Hygiene Practices in Healthcare Settings
Hand Hygiene Resource Center (http://www.handhygiene.org/educational_tools.asp)

FAQ: *Clostridium difficile* Information for Healthcare Providers
Centers for Disease Control and Prevention

FAQ: Information About the Current Epidemic Strain of *Clostridium difficile*
Centers for Disease Control and Prevention

Mercy Hospital Patient Safety and Care Committee: 5 Minute Huddle
Allina Hospitals and Clinics, Mercy Hospital

Clostridium difficile Infection Education Pre/Post Test
LifeCare Medical Center

Environmental Services Education

Example Environmental Services Education Presentation
University of Minnesota Medical Center, Fairview

Contact Isolation Cleaning and Disinfecting Protocol: Compliance Review
Clorox Infection Prevention Program: Clostridium difficile Prevention Tool Kit
(www.cloroxprofessional.com)

Provider Education

Minnesota Antimicrobial Resistance Collaborative (http://www.minnesotaarc.org/)

Laboratory Education

Clostridium difficile Diagnostic Methods
Minnesota Department of Health, HAI Prevention Unit

Patient and Family Education

FAQ about *Clostridium difficile*
Centers for Disease Control and Prevention

Patient and Family Education Regarding *Clostridium difficile* Infection
Association for Professionals in Infection Control and Epidemiology Guide to the Elimination of Clostridium difficile in Healthcare Settings, 2008

Understanding Clostridium difficile: A Patient's Guide
Robert Michael Educational Institute LLC

SAFE from CDI

Staff Education

Patient Safety

Clostridium difficile Infection Prevention in Acute Care Settings

October 2011

Minnesota Department of Health
HAI Prevention Unit

Objectives

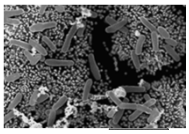
- Describe *Clostridium difficile*
- Describe the consequences of antibiotic overuse as they relate to *C. difficile* infection (CDI)
- Describe infection prevention and control measures to prevent the development and transmission of *C. difficile* in acute care settings

C. difficile Bacteria

- Anaerobic gram-positive, spore-forming rod
- Major cause of antibiotic-associated diarrhea
- Considered "normal" bacteria in the healthy gut of people of all ages

Forms of *C. difficile* Bacteria

- Vegetative (active) form
  - Cannot survive in the environment for prolonged periods of time but can cause infection
- Dormant spore form
  - Can survive in the environment for long periods of time

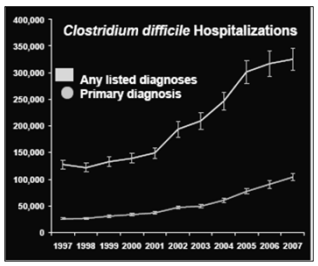


Epidemiology of *C. difficile*

- Hospital-acquired, hospital-onset:
  - 165,000 cases
  - $1.3 billion in excess costs
  - 9,000 deaths annually
- Hospital-acquired, post-discharge (up to 4 weeks):
  - 50,000 cases
  - $0.3 billion in excess costs
  - 3,000 deaths annually

Campbell et al. Infect Control Hosp Epidemiol. 2009:30:523-33.
Dubberke et al. Emerg Infect Dis. 2008;14:1031-8.
Dubberke et al. Clin Infect Dis. 2008;46:497-504.
Elixhauser et al. HCUP Statistical Brief #50. 2008.
CDC. www.cdc.gov/HAI/pdfs/toolkits/CDItoolkitwhite_clearance_edits.pdf

CDI as Discharge Diagnosis, 1997-2007



Incidence of *C. difficile* infection is increasing

CDC. www.cdc.gov/HAI/pdfs/toolkits/CDItoolkitwhite_clearance_edits.pdf

Clinical Manifestations of CDI

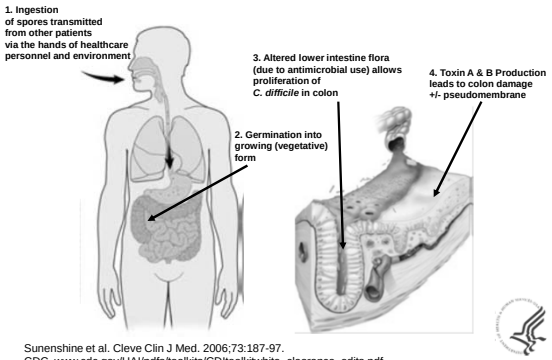
Asymptomatic colonization | **Diarrheal illness** | **Pseudomembranous colitis** | **Toxic megacolon**

Asymptomatic colonization may be protective against CDI

- Fever
- Cramping, abdominal pain
- Frequent loose, watery, unformed bowel movements not due to another cause
- Recent history of antibiotic exposure

SHEA and IDSA Guidelines, 2007

Pathogenesis of CDI



Sunenshine et al. Cleve Clin J Med. 2006;73:187-97.
CDC. www.cdc.gov/HAI/pdfs/toolkits/CDItoolkitwhite_clearance_edits.pdf

Risk Factors for CDI

Antibiotic exposure is a major risk factor for *C. difficile* infection

- More than 90% of all cases occur during or after antibiotic therapy
- All antibiotics implicated, but broad spectrum agents are more likely to cause disease
- Increasing role of fluoroquinolones

Other Risk Factors

- Advanced age
- Immunosuppression
- Use of nasogastric or gastrostomy feeding tubes
- Underlying medical issues or prolonged hospital stays
- Gastric acid suppression such as proton-pump inhibitors

Antimicrobials in hospitals

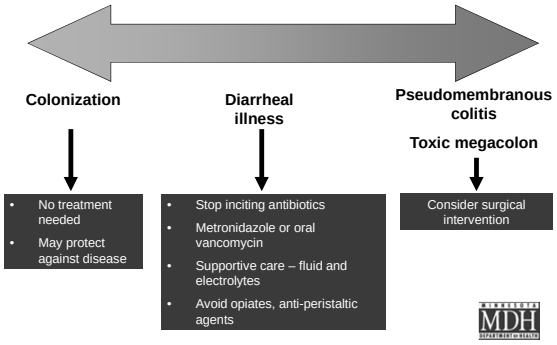
- Up to 50% of antimicrobial use is considered to be inappropriate
- Antimicrobials account for 30% of all hospital pharmacy budgets
- Inappropriate and unnecessary antimicrobial use leads to increased selection of resistant pathogens

Dellit TH, et al. Clin Inf Dis. 2007

Consequences of Antibiotic Resistance

- Worse clinical outcomes
- Need for treatment with more toxic, expensive antibiotics
- Limited treatment options for many infections
- Clinical complications
- Potential for transmission between patients and healthcare workers and the environment

CDI Treatment

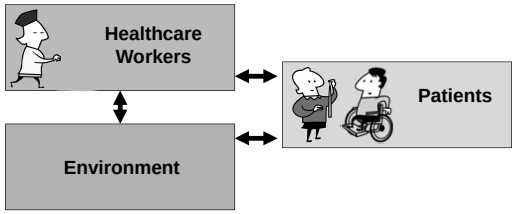


Transmission of *C. difficile*

- *C. difficile* is transmitted through:
  - Fecal-oral route and
  - Direct contact
- Transmission most commonly occurs through:
  - Environment: contaminated objects (e.g., commodes, bathing tubs, etc.)
  - Hands of healthcare personnel
- Spores can survive for months on environmental surfaces

Transmission

- Transmission can occur from:



Infection Prevention Strategies for CDI Patients

CDI Prevention

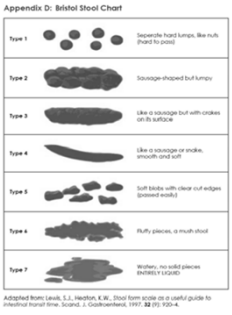
Keys to success!

1. **Prevent Acquisition of Organism:**
   ⇨ **Adhere to infection prevention practices**
2. **Prevent Development of Disease:**
   ⇨ **Antimicrobial stewardship**

Early Identification of CDI Patients

- Nurses trained to recognize signs/symptoms of CDI (use Bristol Stool Chart)
- Appropriate staff trained to obtain specimens for lab testing
- Timely communication of test results to providers

CDI Diagnosis (cont.)



Test only diarrheal (unformed) stool

Lab Testing for *C. difficile*

- Develop a standardized lab testing policy that includes:
  - Reject formed stools
  - Avoid serial stool testing of patients
- Develop communication process to communicate results in a timely manner to:
  - Patient care unit/facility
  - Provider
  - Infection Prevention
- Consider use of PCR
  - Rapid test results
  - Switching from EIA to PCR may increase CDI rates
  - More expensive than EIA

CDI Diagnosis

- Develop a standardized diagnostic protocol that includes:
  - Test unformed stools only (Bristol stool chart types 5 – 7)
  - Submit <u>one</u> stool specimen for initial CDI testing

  Also:
  - Avoid serial stool testing when initial test is negative
  - Do not test asymptomatic patients
  - Do not conduct repeat testing during the same episode of diarrhea for confirmed CDI patients (e.g. electronic flag)
  - Retest only if CDI symptoms continue or recur after 10 days of treatment
  - Do not perform post treatment "tests of cure"

CDI Isolation Precautions

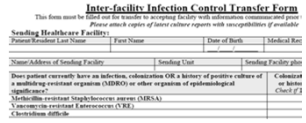
- Place CDI patients in Isolation Precautions
  - Private room / cohort
    - If cohort: dedicate bedside commode for each patient
  - Consider preemptive isolation for patient suspected of having CDI
- Dedicate patient care equipment
  - Clean/disinfect reusable equipment after every use
- Remove patients from Isolation Precautions when CDI symptoms resolve
  - <3 unformed stools in 24-hour period
- Core/Enhanced

Core CDI Isolation Precautions

- Personal protective equipment (PPE) and hand hygiene
  - Don gloves and gown for contact with patient/environment
  - Perform hand hygiene, don gloves and gown before entering room
  - Change gloves immediately:
    - If visibly soiled
    - After touching or handling surfaces/materials contaminated with feces
  - Remove gloves and gown before exiting room
  - Perform hand hygiene before exiting room
    - Soap and water preferred
    - Use alcohol-based hand rub if soap and water not available

Core CDI Isolation Precautions (cont.)

- Communicate Isolation Precautions status
  - Signage icons/symbols include:
    - Hand hygiene for entry and exit
    - Gown and gloves for room entry
    - Process for environmental cleaning/disinfection
  - When CDI patients are transferred, communicate Isolation Precautions status to receiving facility


Inter-facility Infection Control Transfer Form

This form must be filled out for transfer to accepting facility with information communicated prior

Please attach copies of latest culture reports with susceptibilities if available

Sending Healthcare Facility:

Patient/Resident Last Name	First Name	Date of Birth	Medical Rec

Name/Address of Sending Facility	Sending Unit	Sending Facility pho

Does patient currently have an infection, colonization OR a history of positive culture of a multidrug-resistant organism (MDRO) or other organism of epidemiological significance?	Colonizat or histo Check if
Methicillin-resistant Staphylococcus aureus (MRSA)	
Vancomycin-resistant Enterococcus (VRE)	
Clostridium difficile	

Enhance CDI Isolation Precautions

- Preemptively place patients with loose stools in Isolation Precautions
- Implement universal glove use on floors/units with endemic rates or ongoing transmission of CDI
- Increase monitoring of compliance with Isolation Precautions

CDI Environmental Cleaning/ Disinfection

- Clean and disinfect environmental surfaces and reusable devices/equipment after each use
  - EPA-registered disinfectant
    - http://epa.gov/oppad001/list_i_clostridium.pdf
    - Follow manufacturer instructions for application contact time, dilution
  - 1:10 bleach solution (mixed daily)
- Alcohol-based disinfectants are not effective against *C. difficile* spores
- Routine environmental testing is not recommended

Guideline for Environmental Infection Control in Health-Care Facilities, 2003
http://www.cdc.gov/ncidod/hip/enviro/guide.htm

CDI Environmental Cleaning/Disinfection (cont.)

- Assign responsibility for:
  - monitoring and restocking of cleaning/disinfection supplies
  - monitoring and restocking of PPE supplies
  - cleaning/disinfection responsibility for patient care equipment
  - cleaning/disinfection responsibility for high touch surfaces
- Implement cleaning/disinfection schedule for:
  - Patient care equipment
  - Patient environment

Antimicrobial Stewardship

- More than 90% of CDI cases occur during or after antibiotic therapy
- All antibiotics are implicated but broad-spectrum agents are more likely to cause disease.
- Individuals on antibiotics remain susceptible to CDI for as long as 4-6 weeks after the antibiotic is stopped

Antimicrobial stewardship is essential for CDI prevention!

Antimicrobial Stewardship Program (ASP) Components

- Multidisciplinary antimicrobial stewardship team includes a physician with infectious diseases interest and representation from:
  - Clinical pharmacy
  - Infection prevention
  - Microbiology
  - Information technology and/or
  - Hospitalist/intensivist
- Surveillance for antimicrobial prescribing practices
  - Frequency, duration, number of agents prescribed per patient

ASP Components (cont.)

- Feed back data to prescribers including:
  - Antimicrobial prescribing practices
  - Antimicrobial use data (volume and classes)
- Antimicrobial formularies and preauthorization requirements for non-formulary antimicrobial use

ASP Components (cont.)

- Adjust empirically prescribed antibiotics in a timely manner based on lab results
- Regularly review treatment pathways and order sets that include antimicrobial prescribing
- Base guidelines or clinical treatment pathways on local/regional/state antibiotic resistance data

Measurement: CDI Surveillance

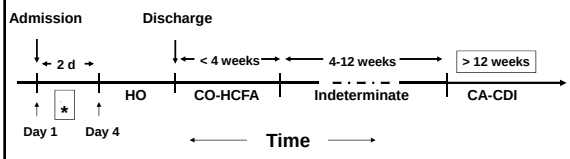
- Use National Healthcare Safety Network (NHSN) surveillance definitions

  http://www.cdc.gov/nhsn/mdro_cdad.html

- Categorize CDI cases by:
  - Location (e.g. patient care unit)
  - Date of specimen collection in relation to admission date

Measurement: CDI Surveillance (cont.)

Categorize Cases by location and time of onset†



HO: Hospital (Healthcare)-Onset ("nosocomial")
CO-HCFA: Community-Onset , Healthcare Facility-Associated
CA: Community -Associated

*** Depending upon whether patient was discharged within previous 4 weeks, CO-HCFA vs. CA**
† Onset defined in NHSN LabID Event by specimen collection date

CDC. www.cdc.gov/HAI/pdfs/toolkits/CDItoolkitwhite_clearance_edits.pdf

Measurement: CDI Process Measures

- Measure compliance with protocols for:
  - Hand hygiene
  - Contact Precautions
  - Environmental cleaning/disinfection
- Audit tools available from APIC, CDC, IHI

Summary

- Major cause of antibiotic-associated and healthcare-associated diarrhea
- Increasing incidence and disease severity
- Wide range of clinical symptoms
- Prevention:
  - Hand hygiene
  - Environmental cleaning/disinfection
  - Antimicrobial stewardship

Resources

- MDH CDI roadmap and toolkit
  www.health.state.mn.us/divs/idepc/dtopics/hai/index.html
- CDI infection prevention guidelines
  - SHEA/IDSA Compendium – Strategies to Prevent *Clostridium difficile* Infections in Acute Care Hospitals
  - APIC Guide to the Elimination of *Clostridium difficile* Infections in Healthcare Settings, 2008
- CDI clinical management guidelines
  - Clinical practice guidelines for *Clostridium difficile* infection in adults: 2010 update by SHEA/IDSA
- CDC CDI Toolkit
  www.cdc.gov/HAI/recoveryact/stateResources/toolkits.html

APIC: Association for Professionals in Infection Control and Epidemiology
IDSA: Infectious Diseases Society of America
SHEA : Society of Healthcare Epidemiology of America

IMPROVING

HAND HYGIENE PRACTICES

IN HEALTHCARE SETTINGS

Improving Your Hand Hygiene Practices

- Important topics covered in this review
  - **Why should we clean our hands?**
  - **Barriers to frequent handwashing**
  - **How do hands become contaminated?**
  - **Advantages of alcohol-based hand rubs**
  - **New Hand Hygiene Recommendations**

Why Is Cleaning Your Hands between Patients Important?

- **Healthcare-associated pathogens are most often transmitted from patient to patient on the hands of healthcare workers**
- **Cleaning your hands before and after patient contact is one of the most important measures for preventing the spread of microorganisms in healthcare settings**

Does Hand Hygiene Reduce the Spread of Microorganisms in Healthcare Settings?

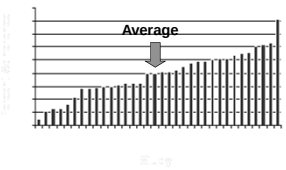
- **In a scientific study performed in a hospital nursery,**
  - **1/2 of the nurses did <u>not</u> wash their hands between patient contacts**
  - **1/2 of the nurses washed their hands with an antimicrobial soap between patient contacts**
- **Babies cared for by nurses who did not wash their hands acquired S. aureus significantly more often than babies cared for by nurses who washed their hands with an antimicrobial soap**
- **The study proved that cleaning hands with an antiseptic agent reduces spread of pathogens in hospitals**

Mortimer EA et al. Am J Dis Child 1962;104:289

How Is Our Track Record on Handwashing in Healthcare Facilities?

- **A review of 34 published studies of handwashing adherence among healthcare workers found that adherence rates varied from 5% to 81%**
- **The average adherence rate was only 40%**

Average Handwashing Adherence of Personnel in 34 Studies



Why Is Adherence of Personnel to Recommended Handwashing So Poor?

- **Factors responsible for poor handwashing adherence rates include:**
  - **heavy workloads (too busy)**
  - **sinks are poorly located**
  - **skin irritation caused by frequent exposure to soap and water**
  - **hands don't look dirty**
  - **handwashing takes too long**

Hand Hygiene Resource Center (http://www.handhygiene.org/educational_tools.asp)

Personnel with Heavy Workloads Have Little Time to Wash Their Hands

- The busier healthcare workers are, the less likely they are to wash their hands when recommended
- Nursing shortages have caused nurses to be busier than ever before

Pittet D et al. Ann Intern Med 1999;130:126

Inconveniently Located Sinks May Discourage Frequent Handwashing

- Sinks used for handwashing are often installed in inconvenient locations
- Personnel may fail to wash their hands when indicated because it is too much trouble to get to the sinks provided

Skin Irritation and Dryness of Hands Is Another Deterrent to Frequent Handwashing

- Frequent handwashing with soap and water often causes skin irritation and dryness
- In winter months, the skin on the hands of some personnel may become so dry and cracked that bleeding occurs
- When this occurs, personnel avoid washing their hands because it is painful to do so

Larson E et al. Heart Lung 1997;26:404
Pittet D et al. Lancet Infectious Dis April 2001:9

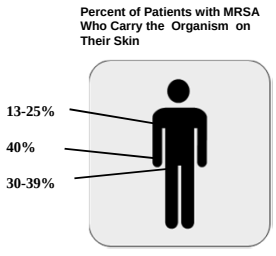
Many Personnel Don't Realize When They Have Germs on Their Hands

- Healthcare workers can get 100s to 1000s of bacteria on their hands by doing simple tasks like:
  - pulling patients up in bed
  - taking a blood pressure or pulse
  - touching a patient's hand
  - rolling patients over in bed
  - touching the patient's gown or bed sheets
  - touching equipment like bedside rails, overbed tables, IV pumps

Casewell MW et al. Br Med J 1977;2:1315
Ojajarvi J J Hyg 1980;85:193

Patients Often Carry Resistant Bacteria on Their Skin

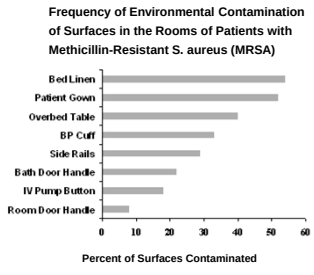
- Patients often carry resistant bacteria on many areas of their skin, even when they have no wounds or broken skin
- The Figure shows the percent of patients with methicillin-resistant S. aureus (MRSA) who carry the organism on the skin under their arms, on their hands or wrists, or in the groin area.



Other Activities Leading to Hand Contamination Among Healthcare Workers

Resistant bacteria on the skin or in the gastrointestinal tract of patients often contaminate items in the immediate vicinity of the patient

Healthcare workers can contaminate their hands by touching environmental surfaces near affected patients.



Hand Hygiene Resource Center (http://www.handhygiene.org/educational_tools.asp)

How Can We Overcome Problems Associated with Handwashing?

- Washing hands frequently with soap and water is
  - inconvenient
  - time-consuming
  - often causes skin irritation and dryness
- We need to make cleaning your hands faster, more convenient and less irritating
- Experts now recommend that healthcare workers routinely clean their hands with an alcohol-based hand rub (a gel, rinse or foam)

Using an Alcohol-Based Hand Rub Takes Less Time than Handwashing

- Time required for ICU nurses to go to a sink, wash and dry their hands, and return to patient care activities: average = 62 seconds
- Estimated time required to clean hands with an alcohol-based hand rub available at patient's bedside: average = 15 seconds
- One advantage of using alcohol-based hand rubs is that they require much less time to use.

Voss A & Widmer A Infect Control Hosp Epidemiol 1997;18:205

Are Alcohol-Based Hand Rubs Really Effective?

- Numerous published studies have shown that alcohol-based hand rubs remove bacteria from hands more effectively than washing hands with plain soap and water
- In most studies, alcohol-based hand rubs removed bacteria from the hands to a greater degree than did washing hands with an antimicrobial soap and water

Boyce JM, Pittet D et al. MMWR 2002;51 (RR-16):1-45

Won't Frequent Use of Alcohol Dry Out My Skin?

- Several studies have proven that nurses who routinely cleaned their hands between patients by using an alcohol-based hand rub had less skin irritation and dryness than nurses who washed their hands with soap and water
- Alcohol-based hand rubs contain skin conditioners (emollients) that help prevent the drying effects of alcohol

Boyce JM et al. Infect Control Hosp Epidemiol 2000;21:442
Winnefeld M et al. Br J Dermatol 2000;143:546

Promoting Alcohol-Based Hand Rubs May Improve Hand Hygiene Habits

- When hospitals place alcohol-based hand rub dispensers near each patient's bed, healthcare workers clean their hands significantly more often than they do when only sinks are available for handwashing

Hand Hygiene Compliance by ICU Personnel Before & After Alcohol Dispensers Were Installed Next to Every 4th Bed And Next to Every Bed

Bischoff WE et al. Arch Intern Med 2000;160:1017

Advantages of Cleaning Hands with Alcohol-Based Hand Rubs

- When compared to soap and water handwashing, alcohol-based hand rubs have the following advantages:
  - take less time to use
  - can be made more accessible than sinks
  - cause less skin irritation and dryness
  - are more effective in reducing the number of bacteria on hands
  - making alcohol-based handrubs readily available to personnel has led to improved hand hygiene practices

Hand Hygiene Resource Center (http://www.handhygiene.org/educational_tools.asp)

New CDC Hand Hygiene Guideline

- A new Hand Hygiene Guideline for Healthcare Settings was published by the CDC in October 2002
- The Guideline is designed to:
  - make cleaning your hands faster, more convenient and easier on your hands
  - increase adherence of healthcare workers to recommended hand hygiene procedures
  - reduce the spread of microorganisms in healthcare settings

Boyce JM, Pittet D et al. MMWR 2002;51 (RR-16):1-45

When Should You Wash Your Hands with Soap and Water?

- Wash your hands with plain soap and water, or with antimicrobial soap and water if:
  - your hands are visibly soiled (dirty)
  - hands are visibly contaminated with blood or body fluids
  - before eating
  - after using the restroom

Here Are Some Tips on How to Wash Your Hands Effectively

- When washing hands with plain or antimicrobial soap,
  - wet hands first with water (avoid HOT water)
  - apply 3 to 5 ml of soap to hands
  - rub hands together for at least 15 seconds
  - cover all surfaces of the hands and fingers
  - rinse hands with water and dry thoroughly
  - use paper towel to turn off water faucet

When Should You Use an Alcohol-Based Hand Rub?

- If hands are not visibly soiled or contaminated with blood or body fluids, use an alcohol-based hand rub for routinely cleaning your hands
  - before having direct contact with patients
  - after having direct contact with a patient's skin
  - after having contact with body fluids, wounds or broken skin
  - after touching equipment or furniture near the patient
  - after removing gloves

Here Are Some Tips on How to Use an Alcohol-Based Hand Rub

- apply 1.5 to 3 ml of an alcohol gel or rinse to the palm of one hand, and rub hands together
- cover all surfaces of your hands and fingers, including areas around/under fingernails
- continue rubbing hands together until alcohol dries
- if you applied a sufficient amount of alcohol hand rub, it should take at least 10 -15 seconds of rubbing before your hands feel dry

More Tips on How to Use an Alcohol-Based Hand Rub

- If you feel a "build-up" of emollients on your hands after cleaning your hands 5 to 10 times with an alcohol-based hand rub, wash your hands with soap and water
- If you clean your hands with an alcohol-based hand rub before putting on gloves, make sure the alcohol has dried completely before putting on gloves

Hand Hygiene Resource Center (http://www.handhygiene.org/educational_tools.asp)

END

For further information on hand hygiene, visit:

Hand Hygiene Resource Center
Hospital of Saint Raphael
New Haven, CT

www.handhygiene.org

Department of Health and Human Services
Centers for Disease Control and Prevention

Frequently Asked Questions

Information for Healthcare Providers

Released August 2004; Updated 07/22/2005

Questions addressed on this page

Questions and Answers

What is *Clostridium difficile (C. difficile)*?

C. difficile is a spore-forming, gram-positive anaerobic bacillus that produces two exotoxins: toxin A and toxin B. It is a common cause of antibiotic-associated diarrhea (AAD). It accounts for 15-25% of all episodes of AAD.

What are *C. difficile*-associated diseases?

They are diseases that result from C. difficile infections including:

- pseudomembranous colitis (PMC)
- toxic megacolon
- perforations of the colon
- sepsis
- death (rarely)

What are the main clinical symptoms of *C. difficile*-associated disease?

Clinical symptoms include:

- watery diarrhea
- fever
- loss of appetite
- nausea
- abdominal pain/tendernes

Which patients are at increased risk for *C. difficile*-associated disease?

The risk for disease increases in patients with:

- antibiotic exposure
- gastrointestinal surgery/manipulation
- long length of stay in healthcare settings
- a serious underlying illness
- immunocompromising conditions

- advanced age

What is the difference between *C. difficile* colonization and *C. difficile*-associated disease?

***C. difficile* colonization**

- patient exhibits NO clinical symptoms
- patient tests positive for *C. difficile* organism and/or its toxin
- more common than *C. difficile*-associated disease

***C. difficile*-associated disease**

- patient exhibits clinical symptoms
- patient tests positive for the *C. difficile* organism and/or its toxin

Which laboratory tests are commonly used to diagnose *C. difficile*-associated disease?

- Stool culture for *C. difficile*: This is the most sensitive test available, but the one most often associated with false-positive results due to presence of non-toxigenic strains. Stool cultures for *C. difficile* also are labor intensive and require the appropriate culture environment to grow anaerobic microorganisms. Results are available within 48-96 hours of the test.
- Antigen detection for *C. difficile*: These are rapid tests (<1 hr) that detect the presence of *C. difficile* antigen by latex agglutination or immunochromatographicassays. They must be combined with toxin testing to verify diagnosis.
- Toxin testing for *C. difficile**:
  - Enzyme immunoassay detects toxin A, toxin B, or both A and B. It is a same-day assay but less sensitive than the tissue culture cytotoxicity assay.
  - Tissue culture cytotoxicity assay detects toxin B only. This assay requires technical expertise to perform, is costly, and requires 24-48 hr for a final result. It does provide specific and sensitive results for *C. difficile*-associated disease.
- *C. difficile* toxin is very unstable. The toxin degrades at room temperature and may be undetectable within 2 hours after collection of a stool specimen. False-negative results occur when specimens are not promptly tested or kept refrigerated until testing can be done.

How is C. difficile transmitted?

C. difficile is shed in feces. Any surface, device, or material (e.g., commodes, bathing tubs, and electronic rectal thermometers) that becomes contaminated with feces may serve as a reservoir for the *C. difficile* spores. *C. difficile* spores are transferred to patients mainly via the hands of healthcare personnel who have touched a contaminated surface or item.

How is *C. difficile*-associated disease usually treated?

In 23% of patients, *C. difficile*-associated disease will resolve within 2-3 days of discontinuing the antibiotic to which the patient was previously exposed. The infection can usually be treated with an appropriate course (about 10 days) of antibiotics including metronidazole or vancomycin (administered orally). After treatment, repeat *C. difficile* testing is not recommended if the patients' symptoms have resolved, as patients may remain colonized.

How can *C. difficile*-associated disease be prevented in hospitals and other healthcare settings?

- Use antibiotics judiciously
- Use Contact Precautions: for patients with known or suspected C. difficile-associated disease:
  - Place these patients in private rooms.If private rooms are not available, these patients can be placed in rooms (cohorted) with other patients with C. difficile-associated disease.
  - Perform Hand Hygiene using either an alcohol-based hand rub or soap and water.
    - If your institution experiences an outbreak, consider using only soap and water for hand hygiene when caring for patients with C. difficile-associated disease; alcohol-based hand rubs may not be as effective against spore-forming bacteria.
  - Use gloves when entering patients' rooms and during patient care.
  - Use gowns if soiling of clothes is likely.
  - Dedicate equipment whenever possible.

    - CONTINUE THESE PRECAUTIONS UNTIL DIARRHEA CEASES
- Implement an environmental cleaning and disinfection strategy:
    - Ensure adequate cleaning and disinfection of environmental surfaces and reusable devices, especially items likely to be contaminated with feces and surfaces that are touched frequently.
    - Use an Environmental Protection Agency (EPA)-registered hypochlorite-based disinfectant for environmental surface disinfection after cleaning in accordance with label instructions; generic sources of hypochlorite (e.g., household chlorine bleach) also may be appropriately diluted and used. (Note: alcohol-based disinfectants are not effective against C. difficile and should not be used to disinfect environmental surfaces.)
    - Follow the manufacturer's instructions for disinfection of endoscopes and other devices
    - Infection control practices in long term care and home health settings are similar to those practices taken in traditional health-care settings.

What can I use to clean and disinfect surfaces and devices to help control *C. difficile*?

Surfaces should be kept clean, and body substance spills should be managed promptly as outlined in CDC's "Guidelines for Environmental Infection Control in Health-Care Facilities." Hospital cleaning products can be used for routine cleaning. Hypochlorite-based disinfectants have been used with some success for environmental surface disinfection in those patient-care areas where surveillance and epidemiology indicate ongoing transmission of *C. difficile*. Consult the aforementioned guidelines for use conditions for generic sources of hypochlorite-based products (e.g., household chlorine bleach) for disinfection of environmental surfaces.

Note: EPA-registered hospital disinfectants are recommended for general use whenever possible in patient-care areas. At present there are no EPA-registered products with specific claims for inactivating *C. difficile* spores, but there are a number of registered products that contain hypochlorite. If an EPA-registered proprietary hypochlorite product is used, consult the label instructions for proper and safe use conditions.

Where can I get more information?

The Centers for Disease Control and Prevention also has **General Information about *C. difficile*** and more information about **Gastrointestinal Infections in Heathcare Settings.**

Additional Scientific References:

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- CDC. Guidelines for environmental infection control in health-care facilities. MMWR 2003;52 (RR10):1–42. Also available at: http://www.cdc.gov/ncidod/hip/enviro/guide.htm
- CDC. Guidelines for hand hygiene in health-care settings. MMWR 2002;51 (RR16):1–45.
- Johnson S, Gerding DN. *Clostridium difficile*-associated diarrhea. Clin Infect Dis 1998;26:1027–36.
- Simor AE, Bradley SF, Strausbaugh LJ, Crossley K, Nicolle LE. SHEA Position Paper: *Clostridium difficile* in long-term-care facilities for the elderly. Infect Control Hosp Epidemiol 2002;23:696–703.
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CDC Frequently Asked Questions
Information About The Current Epidemic Strain Of *Clostridium difficile*

Updated March 2010

Questions addressed on this page

Questions and Answers

How has the epidemiology of *Clostridium difficile (C. difficile)* infections (CDI) changed?

Over the past several years nationwide, states have reported increased rates of *C. difficile* infection, noting more severe disease and an associated increase in mortality. CDI remains a disease mostly associated with healthcare (at least 80%) Patients most at risk remain the elderly, especially those using antibiotics. Although the elderly are still most affected, more disease has been reported in traditionally 'low risk' persons such as healthy person in the community and peripartum women.

What are the possible reasons for this change in the disease?

The increased rates and/or severity of disease may be caused by changes in antibiotic use, changes in infection control practices, or the emergence of an epidemic strain of CDI with increased virulence and/or antimicrobial resistance.

Has a new strain of *C. difficile* been identified?

Yes, in 2004 the emergence of a new epidemic strain of *C. difficile*-associated disease causing hospital outbreaks in several states was reported by the Centers for Disease Control and Prevention (CDC) at scientific meetings.

What is unique about this epidemic strain?

The epidemic strain identified in 2004 appears to be more virulent, with ability to produce greater quantities of toxins A and B. In addition, it is more resistant to the antibiotic group known as fluoroquinolones.

How is the epidemic strain detected?

Like other strains of *C. difficile*, this new strain can be detected in the stool of infected patients by using laboratory tests that are commonly available in most hospitals. However, none of the FDA-approved tests differentiate between the various strains of *C. difficile*. Fortunately, because the control measures for outbreaks of any strain of C. difficile are similar, identification of the specific strain is not imperative for controlling outbreaks.

Is treatment of this epidemic strain different

The usual treatment for *C. difficile* infection includes, if possible, stopping antibiotics being given for other purposes and/or treatment with metronidazole or vancomycin. In order to reduce selective pressure for vancomycin resistance in enterococci, current guidelines recommend the first-line use of metronidazole over

vancomycin . However, recent reports suggest that the new strain may not respond as well to treatment with metronidazole despite the absence of laboratory evidence of metronidazole resistance. This may be due to increased virulence in the new strain. Depending upon the severity of the CDI, metronidazole is likely to be the appropriate first-line therapy for most cases. Regardless of what therapy is used, patients should be carefully monitored to be sure they are responding to therapy and that there is no deterioration in their condition. For more information see IDSA Guidelines.

How does fluoroquinolone resistance affect management of this epidemic strain?

Increased fluoroquinolone resistance does not affect the management of infections caused by this strain. Fluoroquinolones have never been recommended for treatment of *C. difficile* infection and susceptibility testing is performed only as a part of an epidemiological investigation. However, resistance to fluoroquinolones may provide the epidemic strain with an advantage over susceptible strains to spread within healthcare facilities where these antibiotics are commonly used.

What should healthcare facilities do in response to the emergence of the epidemic strain?

Healthcare facilities should monitor the number of C. difficile infections and, especially if rates at the facility increase, the severity of disease and patient outcomes.

If an increase in rates or severity is observed, healthcare facilities should reassess compliance with the recommended infection control measures for known cases of CDI including the following:

- Use antibiotics judiciously
- Use Contact Precautions: for patients with known or suspected *C. difficile*-infection:
    - Place these patients in private rooms.If private rooms are not available, these patients can be placed in rooms (cohorted) with other patients with *C. difficile*-infection.
    - Use gloves when entering patients' rooms and during patient care.
    - Perform Hand Hygiene after removing gloves.
        - Because alcohol does not kill *C. difficile* spores, use of soap and water is more efficacious than alcohol-based hand rubs. However, early experimental data suggest that, even using soap and water, the removal of *C. diffile* spores is more challenging than the removal or inactivation of other common pathogens.
        - Preventing contamination of the hands via glove use remains the cornerstone for preventing *C. difficile* transmission via the hands of healthcare workers; any theoretical benefit from instituting soap and water must be balanced against the potential for decreased compliance resulting from a more complex hand hygiene message.
        - If your institution experiences an outbreak, consider using only soap and water for hand hygiene when caring for patients with *C. difficile*-infection.
    - Use gowns when entering patients' rooms and during patient care.
    - Dedicate or perform cleaning of any shared medical equipment.
    - CONTINUE THESE PRECAUTIONS UNTIL DIARRHEA CEASES
        - Because *C. difficile* -infected patients continue to shed organism for a number of days following cessation of diarrhea, some institutions routinely continue isolation for either several days beyond symptom resolution or until discharge, depending upon the type of setting and average length of stay.
- Implement an environmental cleaning and disinfection strategy:
    - Ensure adequate cleaning and disinfection of environmental surfaces and reusable devices, especially items likely to be contaminated with feces and surfaces that are touched frequently.
    - Use an Environmental Protection Agency (EPA)-registered hypochlorite-based disinfectant for environmental surface disinfection after cleaning in accordance with label instructions; generic sources of hypochlorite (e.g., household chlorine bleach) also may be appropriately diluted and used.
    - Follow the manufacturer's instructions for disinfection of endoscopes and other devices.
- Recommended infection control practices in long term care and home health settings are similar to those practices taken in traditional health-care settings.

If assistance is needed with these measures, additional help should be sought from local or state health departments and/or local infection control experts.

Website: http://www.cdc.gov/ncidod/dhqp/id_CdiffFAQ_newstrain.html

Mercy Hospital Patient Safety and Care Committee

5 Minute Huddle Focus: July 26-30

Reducing Hospital-acquired *Clostridium difficile* infections (HA CDI) is a Mercy priority and requires a multi-pronged approach. To reduce CDI and improve patient safety:

1. Promptly isolate symptomatic patients

2. Use effective hand hygiene practices
    - Soap and water handwash preferred after caring for confirmed CDI patients. If there is no handwashing sink in patient room, use Quik-Care foam on room exit then wash hands using sinks or Resurgent Hand Hygiene stations.

3. Assure compliance with Contact Precautions
    - Gown and gloves are required for caregivers entering Contact or Enteric Precautions rooms.

4. Respectfully coach one another when non-compliance with hand hygiene or contact precautions is observed

5. Environmental cleanliness
    - Use bleach for room and equipment cleaning and disinfection for confirmed CDI patients on units in Enteric Precautions
    - Limit number of supplies stored in all patient rooms and avoid contamination (perform hand hygiene before accessing)

Watch for new Allina Policy changes to be communicated soon.

Thank you!

Patient Safety and Care Committee

SAVE That Line!

Follow these important principles when inserting or maintaining any vascular access device:

S CRUPULOUS HAND HYGIENE

Before and after contact with vascular access device and prior to insertion

A SEPTIC TECHNIQUE

During catheter insertion and care

V IGOROUS FRICTION TO HUBS

Vigorous friction with alcohol wherever you "make or break a connection" to give medications, flush, or change tubing and injection port or add on device

E NSURE PATENCY

Flush all lumens with adequate amount of saline or heparinized saline to maintain patency, per institution policy. If lack of blood return or sluggish flow is encountered, initiate thrombolytic protocol per institution policy.

For more information, contact the Association for Vascular Access (AVA) at **www.avainfo.org** or call **1-801-792-9079** or **1-877-924-AVA1(2821)**

LifeCare Medical Center

Clostridium Difficile Infection (CDI)

Name_____ Date _____

	Education Questions	true or false (circle one)	
1.	Symptoms of CDI are passage of 3 or more unformed stools within a 24-hr period due to- unknown causation or having been on long term antibiotic use or recent chemotherapy.	TRUE	FALSE
2.	Since CDI can be spread easily by an infected patients & their contaminated environment patients with symptoms should be tested for CDI.	TRUE	FALSE
3.	If any patient develops symptoms of CDI the physician on call needs to be notified for lab to be ordered.	TRUE	FALSE
4.	Even though other rooms may be used, rooms 4 & 5 are ideal for CDI patients needing Enteric Precautions because there is a sink in the ante room to wash hands with soap and water.	TRUE	FALSE
5.	Transport of CDI patients outside the room is avoided unless medically necessary.	TRUE	FALSE
6.	Patients and families need CDI education and documentation of this is also needed.	TRUE	FALSE
7.	Isolation Precaution status of CDI patients is communicated to transfer facilities.	TRUE	FALSE
8.	Only unformed stools are acceptable for CDI testing.	TRUE	FALSE
9.	Isolation – Enteric Precautions may be discontinued if the patient is no longer having loose stools or no stools for > 48 hours.	TRUE	FALSE
10.	If you are discontinuing Enteric Precautions the patient must be transferred to a new room and Environmental Services need to be notified to do terminal cleaning in the original room.	TRUE	FALSE
11.	Frequently touched items such as the IV tubing, foley bags and tubing, telemetry, etc. are cleaned daily with sporacidal, by the evening nurse assigned to the CDI patient.	TRUE	FALSE

w/infection control/CDI initial education 6-11

SAFE from CDI

Environmental Services

Patient Safety

Preventing The Spread of Infections: Includes Clostridium *difficile*

Infection Prevention

UMMC/UMACH

How to prevent the spread of germs

- Hand hygiene
- Cover your cough
- Flu vaccine
- Isolation precautions
- Worksite cleanliness

Hand Hygiene

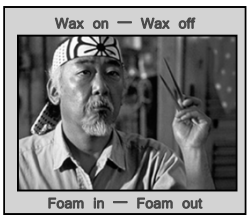
- The **MOST** important thing you can do to prevent the spread of germs
  - From patient to you
  - From you to patient
  - From patient to patient

Wash hands *or* use a waterless antiseptic hand rub

- **Before & after contact with**
  - **all patients**
  - **blood or body fluids**
  - **mucous membranes**
  - **non-intact skin and rashes**
- **Before & after eating**
- **After using the bathroom**
- **After taking off gloves !**

Waterless Alcohol Products

- How to use
  - About walnut size amount (enough to take 15 seconds to rub until dry)
  - Rub all hand surfaces, even under fingernails

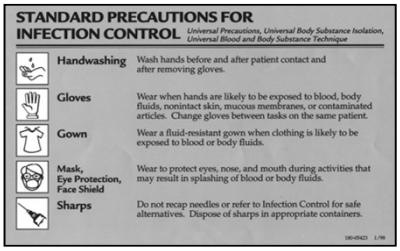


How to Wash Hands

1. **Moisten hands**
2. **One pump of product onto hands**
3. **Wash all surfaces including under nails for 15 seconds**
4. **Thoroughly rinse**
5. **Pat hands dry**
6. **Use paper towel to turn off faucet**
7. **Apply lotion to hands 3 times a day; hospital provided lotion.**

Standard Precautions

- **Precautions to use for <u>all</u> patients**
- **Use for <u>all</u> contact with blood and body fluids, mucous membranes and non-intact skin**



Standard Precautions

- **For all patients -wear gloves to touch**
  - **Wounds**
  - **Body fluids**
  - **Rashes**
  - **Broken skin**
  - **Mucous membranes**
  - **IV lines, drains, catheters**
- **Wear a gown if blood, body fluid may soil clothing**
- **Wear a mask and eye protection if any risk of splash or spray to face**

Contact Precautions

Isolation Precautions used for preventing the spread of:

- **MRSA, VRE, ESBL &**
- **other drug resistant organisms**
- **Uncontained drainage**
- **RSV, conjunctivitis, scabies, lice**

Contact Isolation

Staff entering this room <u>MUST</u> do the following if entering beyond the swing of the door:

Clean Hands

Gloves

Gown

<u>Everyone leaving the patient</u> room must remove PPE and Clean Hands

Visitors do not need to wear gloves and a gown, unless in contact with patient body fluids but must clean hands upon entering and leaving this room

Questions? Contact staff or see hospital policy.

UMMC/UMACH

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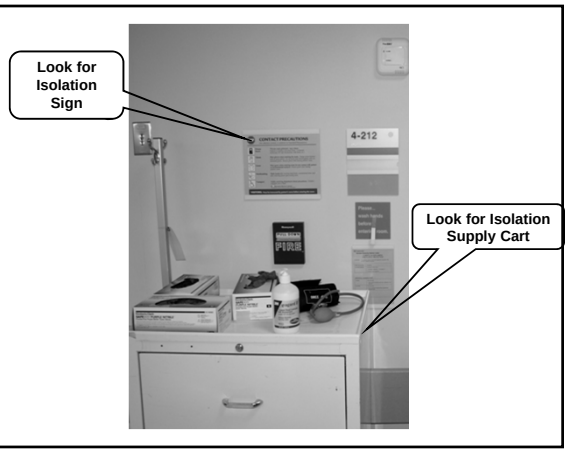
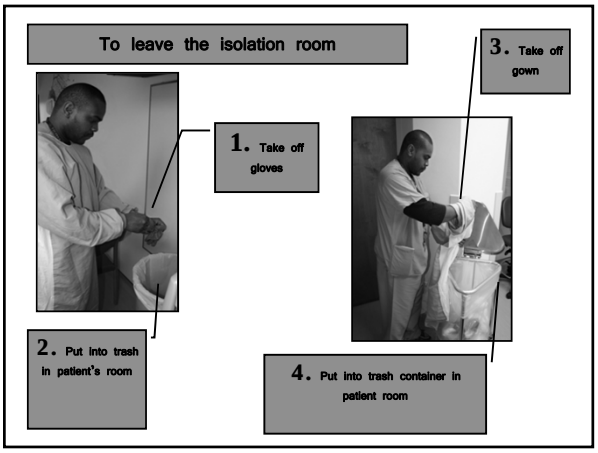
Visitors: *must be instructed by patient's nurse before entering room*





5. Hand Hygiene

Clostridium *difficile* Infection (CDI) Caused by Clostridium difficile

CDI is the most frequent cause of health care- associated diarrhea

C - difficile

- A spore forming bacteria
- Transient GI colonization normal in all populations.
- Toxins, produced when C. diff is exposed to antibiotics, are the cause of GI symptoms.
- Disease ranges from mild diarrhea to colitis and death.
- Higher rates of CDAD may also be related to trends in antibiotic use.

How hard is it to kill germs?

Hard to kill ***C. Difficile -spore***
TB -spore
Norovirus
Athletes foot
Pseudomonas
Vegetative state- C. difficle
Staphylococcus
HIV/AIDS
Easy to kill ***Hepatitis***

Enteric Isolation

Staff entering this room <u>MUST</u> do the following if entering beyond the swing of the door:

Clean Hands

Gloves

Gown

<u>Everyone leaving the patient</u> room must remove PPE then Clean Hands with Soap and water

**** Do not use waterless based hand sanitizer****

Visitors do not need to wear gloves and a gown, unless in contact with patient body fluids but must clean hands upon entering and leaving this room

Questions? Contact staff or see hospital policy.

UMMC/UMACH

508051

Visitors: *must be instructed by patient's nurse before entering room*

Control of *C. difficile* Requires a Multifaceted Approached Enteric *P*recautions

- **Hand hygiene: soap & water**
- **Gloves & gown**
- **Good surface cleaning (elbow grease)**
- **Collaboration between nursing and environmental service staff**

Hand Hygiene

For C diff: Use Soap & Water

Worksite Cleanliness

- **Common hospital disinfectants**
  - **Quaternary Ammonium**
  - **Bleach**
  - **Alcohol**
- **Disinfect work surfaces and equipment**
  - **When soiled**
  - **At regular intervals**
  - **Patient care equipment disinfected between each patient use**

Cleaning & Disinfection

- Routinely wear gloves – to protect from chemicals & bacteria, etc.
- Follow chemical use instructions.
- Never mix any chemicals.
- Bleach requires special precautions and careful labeling and storage (check with your supervisor).

Cleaning and Disinfection

- Most important to remember:
- Good surface cleaning removes organic matter (e.g., food, urine, sputum etc.) is critical.
- Pay attention to: high touch surfaces (e.g., bed rail, bathroom fixtures, doorknobs)
- Only use your hospital's approved product.
- Ask about any special circumstances.

Preventing the Spread of Infections

- Follow hand hygiene requirements
- Use standard precautions for all patients
- Follow the hospital's isolation precautions
- For C-diff – wash hands with soap and water
- Cleaning is critical
- Disinfection- follow your hospital's recommendations and product use.

It Takes Team Work To Make It Happen!

Thank You.

Contact Isolation Cleaning and Disinfecting Protocol: Compliance Review

Name: _____ Date: _____

1. In the United States hospital-acquired infections afflict over 2 million patients and kill approximately 100,000 people annually.

   A. True
   B. False

2. EVS staff should perform hand hygiene before putting on gloves and entering a patient room.

   A. True
   B. False

3. EVS staff should remove gloves just prior to exiting the patient room and perform hand hygiene immediately after exiting patient room. Never wear gloves from room to room.

   A. True
   B. False

4. Patients are put in isolation to prevent the spread of disease.

   A. True
   B. False

5. EVS staff should prepare EPA-registered disinfecting solutions fresh daily for the open bucket method and open bucket disinfecting solutions should be changed frequently.

   A. True
   B. False

6. Disinfecting wipes should not be presoaked or re-dipped in the open bucket method. Avoid application methods that produce mist or vapor.

   A. True
   B. False

7. EVS staff should change flat mop heads after mopping every patient room.

   A. True
   B. False

8. How often should EVS staff change the disinfecting wipe?

   A. When unable to achieve appropriate wet contact time
   B. When visibly soiled
   C. Both of the above

9. How often should housekeeping equipment that is used to clean and disinfect a contact isolation room be cleaned?

   A. Weekly
   B. Daily
   C. After every contact isolation room

10. The disinfecting protocols for a *C. difficile* room call for usage of 1:10 dilution of bleach, which signifies:

    A. Each surface must be wiped 10 times
    B. A Mix of 1 part bleach and 9 parts water
    C. A Mix of 1 part bleach and 10 parts water

11. The residue sometimes seen on surfaces disinfected with bleach is:

    A. Gross filth
    B. Salt. It can be simply wiped away with a clean damp cloth
    C. Part of the surface that has been scraped off

12. The EPA-registered contact time for Clorox® Germicidal Wipes against *C. difficile* spores is _____ minutes:

A. 5 minutes
B. 6 minutes
C. 10 minutes

13. To achieve maximum wetness — and potency — with a wipe:

A. Wipe the surface until it has a deep, wet glare
B. Wipe each surface one time
C. Wipe each surface until the wipe is crumpled in your hand

14. The appropriate cleaning pattern is dirtiest to cleanest and lowest to highest.

A. True
B. False

15. Where do you park your cleaning cart if a room is occupied?

A. Next to the patient's bed
B. Outside the room
C. In the bathroom

16. When cleaning a contact isolation *C. difficile* room, full personal protective equipment, including protective gown, eyewear and gloves, is required:

A. True
B. False

17. Prior to entering an occupied contact isolation room:

A. Knock and announce myself
B. Don PPE
C. Wash hands
D. All of the above

18. The first step after entering a contact isolation room is to:

A. Begin disinfecting with a wipe
B. Collect soiled linens and remove trash
C. High dust

19. In discharge cleaning of a contact isolation *C. difficile* room, high dusting includes the following items: lights, vents, clock, pictures, curtain tracks, TV, etc.:

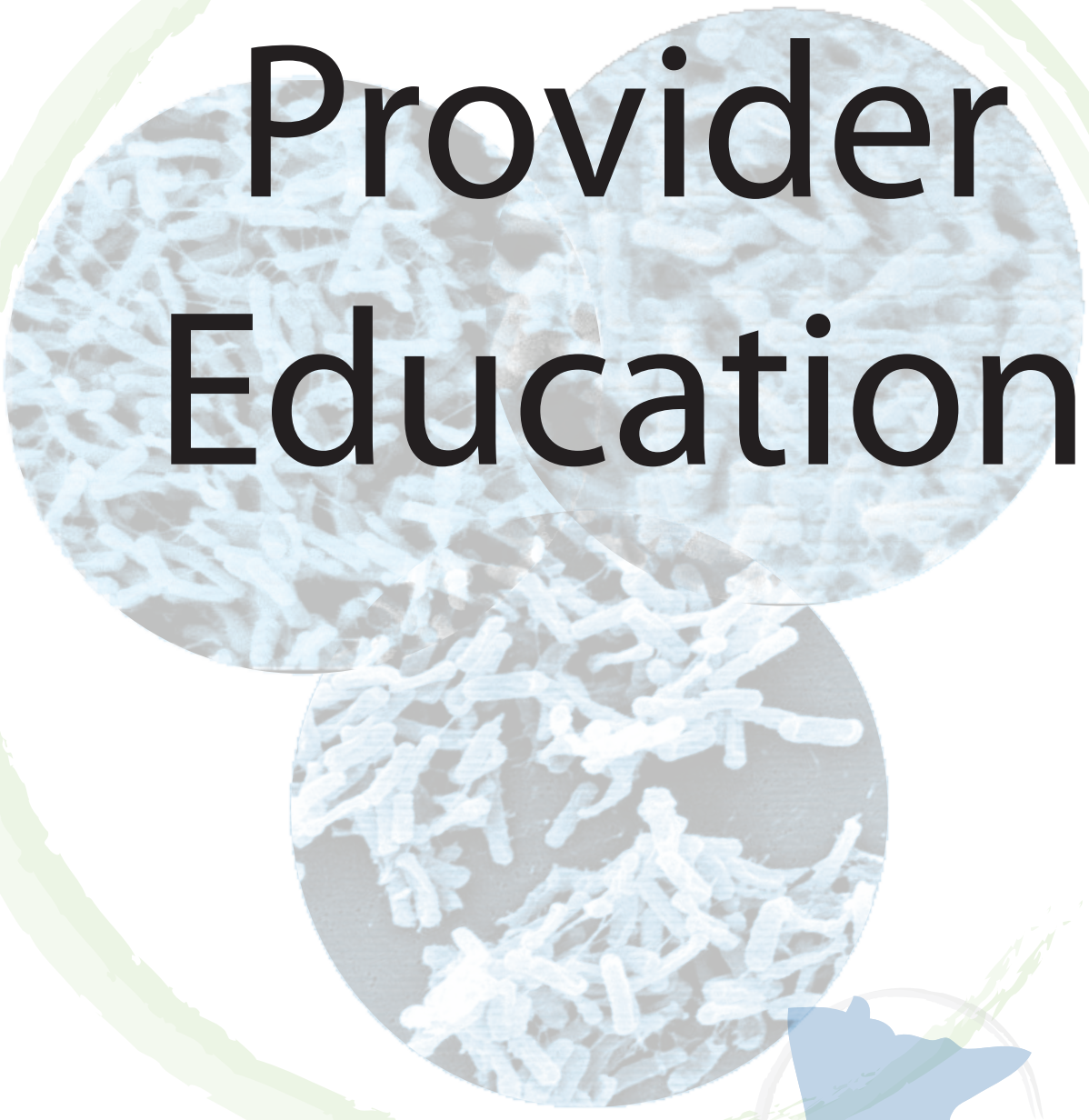
A. True
B. False

20. Cite two differences between occupied and discharge contact isolation room cleaning:

1. _____
2. _____

SAFE from CDI

Provider Education



Patient Safety

Stop Antibiotic Misuse in Minnesota

Minnesota Antibiotic Resistance Collaborative (MARC)

Antibiotic Facts

- Learn about antibiotics, preventing antibiotic-resistant infections, and appropriate use of antibiotics.
  What Are Antibiotics? | Prevent Antibiotic-Resistant Infections | Appropriate Use of Antibiotics

Illnesses and Antibiotic Resistance

- Find out about viruses and bacteria, specific illnesses, and antibiotic-resistant diseases.
  Virus vs Bacteria | Will Antibiotics Help? | Staph Infections and MRSA

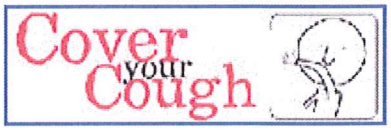
Prevent Illness

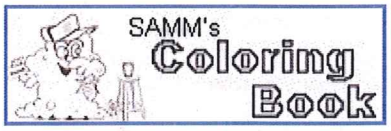
- Stop the spread of germs if you are sick and how you can stay healthy.
  Stay Healthy | Cover Your Cough | Handwashing | Get Vaccinated

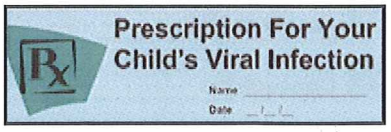
Print Materials

- View, download, or order educational print materials.
  Posters | Flyers and brochures | Prescription pads | Other items | Cover Your Cough | Educational resource order form

Featured Materials:







Antibiotic IQ Test

Cough and Cold Care Kit

FAQ

Criteria for Initiation of Antibiotics in LTC

Protect Your Long Term Care Residents

Protect Your Loved Ones

Learning about MRSA: A guide for Patients

Changing Bandages: MRSA

Prescription Pads

SAMM Sticker

SAMM Button

Coloring Book

Self Study Childcare Curriculum

Cover Your Cough

Resource Order Form

For Fun!

I.Q. Quiz

Science Museum

For Health Care

For Child Care

For Long Term Care

About MARC

Contact Us

For Fun!

- Online IQ Quiz |Science Museum Exhibit

More information for...

- Health Care Professionals
- Child Care Professionals
- Long Term Care Professionals

About MARC

- Information about the Minnesota Antibiotic Resistance Collaborative, and it's member organizations.

Antibiotics are powerful medicines for fighting infections, but they don't cure every illness. Taking antibiotics when they are not needed - or not completing the prescription given by your child's health care provider - can even be harmful.

Antibiotics don't work for viruses that often cause colds and flu.

Overuse of antibiotics can cause some bacteria to become resistant - bacteria can then survive the antibiotics that are meant to kill them.

Infections caused by antibiotic resistant bacteria are hard to treat and can be serious.

SAFE from CDI

Laboratory Education

Patient Safety

Clostridium difficile Diagnostic Methods

Clostridium difficile infection (CDI) may be suspected in patients with diarrhea who have a history of antibiotic use, are of advanced age, who reside in a long-term care facility. To determine if a patient has CDI, consider both clinical symptoms and lab test results. The following tests can be used to confirm or to assist in confirming CDI in symptomatic patients:

Laboratory Tests

Stool Samples

- Culture
  - Most sensitive test available, but often associated with false-positive results due to presence of non-toxigenic strains
  - Labor intensive and requires careful laboratory quality control
  - Results are available within 48-96 hours
- Antigen detection
  - Detects the presence of *C. difficile* antigen (GDH) by latex agglutination or immunochromatographicassays
  - Rapid test results (<1 hr)
  - Should be combined with toxin testing to verify diagnosis
- Toxin testing
  - Enzyme immunoassay (EIA) detects toxin A, toxin B, or both A and B
  - Same-day results
  - Easy to use
  - Low labor costs
- Polymerase chain reaction (PCR)
  - Detects toxigenic C. difficile in stool
  - A potential advantage is ability to determine strains, for instance, whether they make toxin and to which toxin type they belong
  - May be a more sensitive and more specific approach, but more research is necessary

Obtaining stool specimens

- Only unformed should be tested.
- Testing asymptomatic patients (those with formed stools) is not recommended.
- Fresh stool is required.
- *C. difficile* toxin is very unstable and degrades at room temperature in as short as two hours.
  - False-negative results occur when specimens are not kept refrigerated until testing can be done.
- Collect specimen in clean, watertight container
  - Transport media is not necessary and may increase false positive results
  - Transport specimens as soon as possible and store at 2 - 8 °C until tested.
  - Storage at room temperature may decrease the sensitivity of some tests, possibly due to toxin inactivation

Tissue Samples

- Cell cytotoxicity assay
  - Detects toxin B only
  - Results within 24-48 hrs
  - Requires technical expertise and is costly

NOTE: Post-treatment testing in the absence of clinical symptoms is also not recommended, as people may remain colonized with *C. difficile* indefinitely.

Colon examination

In some cases, examination of the colon can be used to help confirm a diagnosis of CDI. If *C. difficile* colitis is not accompanied by pseudomembrane formation, endoscopic findings are relatively nonspecific, but a biopsy specimen may reveal changes typical of pseudomembranous colitis.

- Endoscopy
  - Pseudomembranous colitis can only be diagnosed by direct visualization of pseudomembranes on lower gastrointestinal endoscopy
  - At least 90% of patients with pseudomembranous colitis demonstrate either *C. difficile* or its toxin in stool samples
  - Because of its cost, risk to the patient, and the availability of other diagnostic tests, endoscopy is usually reserved for special situations
  - The American College of Gastroenterology Guidelines recommend endoscopy for situations such as the following: (1) a rapid diagnosis is needed and test results are delayed or insensitive tests are used, (2) the patient has an ileus and stool is not available, and (3) other colonic diseases that can be diagnosed with endoscopy are being considered.

Imaging tests

- Computerized tomography (CT) scan
  - Provides detailed images of the colon
  - This scan can show a thickening of the wall of the colon, which is common in pseudomembranous colitis

Sensitivity and Specificity of diagnostic laboratory tests for CDI

***C. difficile* Laboratory Tests**[1]	**Substance detected**	**Time required**	**Sensitivity %**	**Specificity %**
Cytotoxin	Toxin B	1-3 days	95	90-95
Toxin Culture (gold standard)	Toxigenic *C. difficile*	3-5 days	>95	80-90
EIA toxin A or A/B	Toxin A or A/B	Hours	75-80	97-98
EIA GDH	*C. difficile*	Hours	95-100	70-80
EIA GDH and toxin A/B	*C. difficile* and *C. difficile* toxin	Hours	95-100	97-98
RT-PCR	Toxigenic *C. difficile*	Hours	>98	80-99
Other *C. difficile* Tests[2]			**Sensitivity**	**Specificity**
Endoscopy for PMC			51 - 55	100
Latex test for *C. difficile* antigen			58 - 92	80 - 96

1. Bartlet JG. Detection of *Clostridium difficile* Infection. ICHE. 2010; 31(S1):S35-S37.
2. Gerding DN, Johnson S, Peterson LR, et al. *Clostridium difficile*-associated diarrhea and colitis. ICHE. 1995;16:459-477.

Sensitivity of a test indicates the probability that if the person has the disease, the test will be positive.

Specificity is the probability that if a person does not have the disease, the test will be negative.

References

Cohen SH, Gerding DN, Johnson S, et al. Clinical Practice Guidelines for Clostridium difficile Infection in Adults: 2010 Update by the Society for Healthcare Epidemiology of America (SHEA) and the Infectious Diseases Society of America (IDSA). Infect Control Hosp Epidemiol. 2010 May;31(5):431-55.

Mandell GL, Bennet JE, Dolin R. Mandell, Douglas, and Bennett's Principles and Practice of Infectious Diseases Seventh Edition. Philadelphia: Churchill Livingstone Elsevier, 2010.

SAFE from CDI

Patient Education

Patient Safety

FAQs
(frequently asked questions)

about
"Clostridium Difficile"

What is Clostridium difficile infection?

Clostridium difficile [pronounced Klo-STRID-ee-um dif-uh-SEEL], also known as "*C. diff*" [See-dif], is a germ that can cause diarrhea. Most cases of *C. diff* infection occur in patients taking antibiotics. The most common symptoms of a *C. diff* infection include:

- Watery diarrhea
- Fever
- Loss of appetite
- Nausea
- Belly pain and tenderness

Who is most likely to get C. diff infection?

The elderly and people with certain medical problems have the greatest chance of getting *C. diff. C. diff* spores can live outside the human body for a very long time and may be found on things in the environment such as bed linens, bed rails, bathroom fixtures, and medical equipment. *C. diff* infection can spread from person-to-person on contaminated equipment and on the hands of doctors, nurses, other healthcare providers and visitors.

Can C. diff infection be treated?

Yes, there are antibiotics that can be used to treat *C. diff.* In some severe cases, a person might have to have surgery to remove the infected part of the intestines. This surgery is needed in only 1 or 2 out of every 100 persons with *C. diff.*

What are some of the things that hospitals are doing to prevent C. diff infections?

To prevent *C. diff.* infections, doctors, nurses, and other healthcare providers:

- Clean their hands with soap and water or an alcohol-based hand rub before and after caring for every patient. This can prevent *C. diff* and other germs from being passed from one patient to another on their hands.
- Carefully clean hospital rooms and medical equipment that have been used for patients with *C. diff*.
- Use Contact Precautions to prevent *C. diff* from spreading to other patients. Contact Precautions mean:
  - Whenever possible, patients with *C. diff* will have a single room or share a room only with someone else who also has *C. diff*.
  - Healthcare providers will put on gloves and wear a gown over their clothing while taking care of patients with *C. diff*.
  - Visitors may also be asked to wear a gown and gloves.
  - When leaving the room, hospital providers and visitors remove their gown and gloves and clean their hands.
  - Patients on Contact Precautions are asked to stay in their hospital rooms as much as possible. They should not go to common areas, such as the gift shop or cafeteria. They can go to other areas of the hospital for treatments and tests.
- Only give patients antibiotics when it is necessary.

What can I do to help prevent C. diff infections?

- Make sure that all doctors, nurses, and other healthcare providers clean their hands with soap and water or an alcohol-based hand rub before and after caring for you.

If you do not see your providers clean their hands, please ask them to do so.

- Only take antibiotics as prescribed by your doctor.
- Be sure to clean your own hands often, especially after using the bathroom and before eating.

Can my friends and family get C. diff when they visit me?

C. diff infection usually does not occur in persons who are not taking antibiotics. Visitors are not likely to get *C. diff*. Still, to make it safer for visitors, they should:

- Clean their hands before they enter your room and as they leave your room
- Ask the nurse if they need to wear protective gowns and gloves when they visit you.

What do I need to do when I go home from the hospital?

Once you are back at home, you can return to your normal routine. Often, the diarrhea will be better or completely gone before you go home. This makes giving *C. diff* to other people much less likely. There are a few things you should do, however, to lower the chances of developing *C. diff* infection again or of spreading it to others.

- If you are given a prescription to treat *C. diff,* take the medicine exactly as prescribed by your doctor and pharmacist. Do not take half-doses or stop before you run out.
- Wash your hands often, especially after going to the bathroom and before preparing food.
- People who live with you should wash their hands often as well.
- If you develop more diarrhea after you get home, tell your doctor immediately.
- Your doctor may give you additional instructions.

If you have questions, please ask your doctor or nurse.

Co-sponsored by:

SHEA The Society for Healthcare Epidemiology of America
IDSA
American Hospital Association
APIC Spreading knowledge. Preventing infection.
CDC Centers for Disease Control and Prevention
The Joint Commission

Patient and Family Education Regarding *Clostridium difficile* Infection (CDI)

What is *Clostridium difficile*?
Clostridium difficile is a bacterium that causes diarrhea as well as more serious intestinal conditions such as colitis, an inflammation of the bowel.

What is *Clostridium difficile* infection?
Clostridium difficile is the most common cause of infectious diarrhea in healthcare facilities. The main symptoms include watery diarrhea, fever, and abdominal pain or tenderness. *Clostridium difficile* infection may occur as an undesirable consequence when antibiotics are taken to treat an infection. When treating that infection, some of your good bowel bacteria are also killed thereby allowing the bacteria that are not killed by the antibiotics to grow. One of these bacteria that are resistant to many antibiotics is *Clostridium difficile*. When *Clostridium difficile* multiplies, it produces toxins or substances that can damage the bowel and cause diarrhea. *Clostridium difficile* infection results in diarrhea requiring specific treatment and it can sometimes be quite severe. In severe cases, surgery resulting in removal of a portion of the intestines may be needed.

Who can develop *Clostridium difficile* infection?
Clostridium difficile infection, also known as CDI, usually occurs during or after the use of antibiotics. Those individuals having serious illness, the elderly, or those in poor general health are at increased risk of developing CDI.

How is *Clostridium difficile* infection diagnosed?
If you are on antibiotics, or have recently taken antibiotics, and you develop watery diarrhea and fever, your doctor may suspect *Clostridium difficile* as a cause of those symptoms. A sample of your stool (feces) will be collected and sent to the laboratory for analysis. The laboratory will test the stool to see if *Clostridium difficile* toxins are present. One or more stool samples may be collected.

How is *Clostridium difficile* infection treated?
Your doctor may prescribe a specific type of antibiotic that targets and kills *Clostridium difficile*. Treatment usually consists of antibiotics taken for about 10 days.

How do people get *Clostridium difficile* infection?
People in good health usually don't get *C. difficile* infection. People who have other illnesses or conditions requiring prolonged use of antibiotics and the elderly are at greater risk of acquiring this disease. When a person has *Clostridium difficile* infection, the germs in the stool can soil surfaces such as toilets, handles, bedpans, or commode chairs. When touching these items, the hands of the patient as well as the hands of healthcare workers and family members can become soiled with *Clostridium difficile*. These soiled items and hands can be involved in moving the organism to other surfaces and other people.

This is why an individual with *Clostridium difficile* infection is placed in isolation when in a healthcare setting.

What type of isolation is used for *Clostridium difficile* infection?
If you have *Clostridium difficile* diarrhea, you will be moved to a private room until you are free from diarrhea. Your activities outside the room will be restricted. Everyone who enters your room must wear gown and gloves. Everyone **MUST** clean their hands after providing care to you or touching your environment. You should also pay attention to cleaning your hands regularly and showering or bathing to reduce the amount of bacteria on your skin. Your room will also be cleaned regularly and all equipment disinfected before it is removed from your room.

What should I do to prevent the spread of *C. difficile* to others?

If you are infected you can spread the disease to others. However, only people that are hospitalized or on antibiotics are likely to become ill. For safety precautions you may do the following to reduce the chance of spread to others:

- wash hands with soap and water, especially after using the restroom and before eating;
- clean surfaces in bathrooms, kitchens and other areas on a regular basis with household detergent/disinfectants

Should special practices be done when I go home?
Healthy people like your family and friends who are not taking antibiotics are at very low risk of developing *Clostridium difficile infection*. However, it is prudent for everyone to clean their hands regularly and maintain a hygienic environment, especially the bathroom area. Cleaning of the environment can be done using your regular germicide or you can use a solution of chlorine bleach and water. If you use this solution, mix 1 part chlorine bleach (unscented) with 9 parts tap water. Change the solution daily and be sure to protect yourself from splashes or sprays of the solution into your face and eyes. You might want to wear protective gloves so the bleach solution does not come into contact with your skin.

What else should I know about cleaning the house environment?
Use a clean cloth and saturate it with the germicide or bleach solution. Use friction when cleaning surfaces then allow the surface to air dry. If there is soil on the surface, remove it then use a new cloth saturated with the germicide in order to disinfect the surface. Pay special attention to areas that may have some into contact with feces such as the commode and sink. When laundering items, rinse clothing or fabric that has been soiled with stool, then use your regular laundry processes. Use the hot water cycle and detergent. If you want to add some chlorine bleach, that will assist with killing of the germs. Dry the items in the dryer. There is no need to initiate special precautions with dishes and eating utensils.

What about cleaning of hands?
Having clean hands is the most important thing any of us can do to prevent illness. When performing hand hygiene (another term for cleaning hands), it can be done using traditional soap and water hand washing or using an alcohol-based solution. Since *Clostridium difficile* is an organism found in feces, use of traditional hand washing is preferred.

When washing your hands, first wet your hands with water than apply soap in the palm. Rub hands together taking care to cover all surfaces of the hands as well as between the fingers. Rub for at least 15 seconds, then rinse with water. Pat hands dry instead of rubbing as this may prevent damage to the skin of the hands and chapping. If alcohol-based hand rubs are used, put a small amount of the solution (about the size of a nickel) in the palm of one hand then rub the solution over both hands and between fingers until the solution dries. There is no need to rinse hands afterward.

Perform hand hygiene after using the toilet, after touching dirty surfaces or items, before eating, before preparing meals, and any time your hands are visibly soiled or "feel" dirty. Teach this important practice to others including children.

What other information is important for me to know?
It is very important that you take all your medication as prescribed by your doctor. You should not use any drugs from the drugstore that will stop your diarrhea (e.g., Imodium) as this may result in the *Clostridium difficile* toxins staying inside your colon and causing more severe illness. **If your diarrhea persists or comes back, contact your doctor.**

For more information on *Clostridium difficile* infection, go to the Centers for Disease Control and Prevention website http://www.cdc.gov/ncidod/dhqp/id_CdiffFAQ_general.

FOR MORE INFORMATION about *Clostridium difficile*, visit www.cdc.gov.

A Patient's Guide

UNDERSTANDING *Clostridium difficile*

Developed by

Robert Michael Educational Institute LLC

Supported by an educational grant from

ViroPharma Incorporated

The content of this educational brochure on Clostridium difficile *has been reviewed for technical accuracy by the Centers for Disease Control and Prevention.*

UNDERSTANDING

Clostridium difficile

1. What is *Clostridium difficile (C. difficile)*?

C. difficile is a bacterium that is found in the intestines. It most commonly causes mild to moderate diarrhea. Sometimes it can cause more serious infection of the intestines, called colitis. In rare cases, infection with *C. difficile* can lead to death.

2. How does *C. difficile* cause disease?

C. difficile bacteria can be found in the intestines of healthy people. It is usually kept in check by other normal bacteria. When a person takes an antibiotic, some of the normal bacteria die and *C. difficile* bacteria can multiply. When *C. difficile* bacteria multiply, some are capable of producing toxins that cause diarrhea or inflammation of the colon.

3. What are the symptoms of *C. difficile* disease?

The most common symptom of *C. difficile* disease is watery diarrhea, consisting of 3 or more bowel movements per day for 2 or more days. Other common symptoms include fever, loss of appetite, nausea, and abdominal cramping or tenderness.

4. Who is at risk for developing *C. difficile* disease?

Antibiotic use is the most important risk factor for developing *C. difficile* disease. Other important risk factors include hospitalization, a stay in a nursing home, advanced age, a serious underlying illness, a weakened immune system, or gastrointestinal surgery.

5. How is *C. difficile* disease treated?

If you develop *C. difficile* disease as a result of antibiotic use, your doctor may instruct you to stop taking that antibiotic if possible. In addition, your doctor may prescribe oral metronidazole or oral vancomycin capsules to treat your *C. difficile* disease. In very severe cases, intravenous medications or surgery may be required.

To learn more about *Clostridium difficile*, contact your healthcare provider or visit www.cdc.gov.

6. How is *C. difficile* spread?

C. difficile is found in feces and has the ability to form spores. People can become infected when they touch items that are contaminated with feces and then touch their mouth. In the hospital, *C. difficile* can be spread between patients on the hands of healthcare workers.

It is important to note that *C. difficile* bacteria produce spores that can live on surfaces for months. In the hospital, spores can be transferred to anyone who comes into contact with contaminated items (such as bedrails and commodes) or medical devices (such as blood pressure cuffs and thermometers). If the spores are ingested, *C. difficile* disease may occur.

7. How can I prevent spreading *C. difficile* to my family members and friends?

It is rare for healthy people who are not taking antibiotics to get *C. difficile* disease. However, you can still spread the bacteria to others – particularly if you have diarrhea.

Especially after using the bathroom and before eating, wash your hands with soap and water. It may help to prevent the spread of *C. difficile* if you clean your kitchen and bathrooms daily with a mixture of bleach and water. The mixture should include 1 part bleach to every 10 parts water; so, for example, if you are using a cup, mix 1 cup of bleach with 10 cups of water. This mixture can be used to clean the surfaces in your kitchen (for example, countertops and cutting boards) and bathrooms (for example, toilet seats, toilet bowl, flush handle and sink faucet handles). Mix only the amount of bleach and water that you will need to clean your kitchen and bathrooms once, and pour the rest down the drain. If you have diarrhea, try to avoid using the same toilet that your family members use unless the toilet can be cleaned with the bleach and water mixture after each use.

8. What symptoms should I be concerned about during or after treatment for *C. difficile* disease?

You should seek medical advice immediately if you develop a fever, chills, vomiting, abdominal pain, diarrhea, or any other concerning symptoms.

SAFE from CDI

Prevention Strategies

Clostridium difficile Infections Toolkit
Centers for Disease Control and Prevention

Strategies to Prevent *Clostridium difficile* Infections in Acute Care Hospitals
Infection Control and Hospital Epidemiology: SHEA/IDSA Practice Recommendation, 2008

Early Recognition

- Bristol Stool Chart
  National Health Services
  (http://www.documents.hps.scot.nhs.uk/abouthps/hpn/clostridium-difficile-infection-guidelines.pdf)

- *Clostridium difficile* Infection Testing Guidance
  Minnesota Department of Health, HAI Prevention Unit

- Identification of *Clostridium difficile* patients: Nursing Protocol
  Park Nicollet Health Services, Methodist Hospital

- Early Recognition Nursing Presentation
  LifeCare Medical Center

- Laboratory Policy and Procedure: Specimen collection (non-blood)
  LifeCare Medical Center

- CDI Recognition & Environmental Management
  LifeCare Medical Center

Isolation Precautions

- Clorox *Clostridium difficile* Infection Prevention Guide
  Clorox Infection Prevention Program (www.cloroxprofessional.com)

- Contact and Enteric Precautions Signage
  University of Minnesota Medical Center, Fairview

- Contact and Enteric Precautions Signage and Education Sheets
  Washington State Hospital Association

- Contact Precautions Signage
  Sanford Medical Center Canby

- Enteric Precautions Signage
  Allina Hospitals and Clinics, Mercy Hospital

Environmental Cleaning and Disinfection

- Isolation Room Cleaning Protocol
  Clorox (www.cloroxprofessional.com)

Sample Hospital Environmental Cleaning Audit Tool
Allina Hospitals and Clinics

Environmental Checklist for Daily Cleaning
Association for Professionals in Infection Control and Epidemiology Guide to the Elimination of Clostridium difficile in Healthcare Settings, 2008

CDC Environmental Checklist for Monitoring Terminal Cleaning
Centers for Disease Control and Prevention

CDC Environmental Cleaning Evaluation Worksheet
Centers for Disease Control and Prevention

Environmental Checklist for Daily Cleaning
Sanford Medical Center Canby

Housekeeping Cleaning Cheat Sheet
Sanford Medical Center Canby

Environmental Services: The Front Line of Infection Prevention
Mayo Clinic, Rochester

Options for Evaluating Environmental Cleaning, December 2010
Centers for Disease Control and Prevention and Carney Hospital: Environmental Evaluation Workgroup

Antimicrobial Stewardship

Antimicrobial Practice Improvement in Hospitals: Implementing Antimicrobial Stewardship
American Society of Health-System Pharmacists

Infectious Diseases Society of America and the Society for Healthcare Epidemiology of America Guidelines for Developing an Institutional Program to Enhance Antimicrobial Stewardship
Infection Control and Hospital Epidemiology: SHEA Position Paper, 2007

Antimicrobial Stewardship Introduction Presentation
Minnesota Department of Health

Antibiotic Overview
Minnesota Department of Health

Antimicrobial Stewardship Tool Kit for targeting CDI prevention
Minnesota Department of Health, HAI Prevention Unit

Table of Antibiotics Closely Associated with CDI
Minnesota Department of Health, HAI Prevention Unit

Get Smart about Antibiotics
Park Nicollet Health Services
Adapted from the CDC "Gest Smart: Know When Antibiotics Work"
(www.cdc.gov/getsmart)

Minnesota Department of Health Antibiogram, 2010
Minnesota Department of Health

Healthcare-associated Infections

HAI Elimination

Clostridium difficile (CDI) Infections Toolkit

Activity C: ELC Prevention Collaboratives

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Cliff McDonald, MD, FACP

Division of Healthcare Quality Promotion

Centers for Disease Control and Prevention

Draft - 12/23/09 --- Disclaimer: The findings and conclusions in this presentation are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

Outline

- **Background**
  - Impact
  - HHS Prevention Targets
  - Pathogenesis
  - Epidemiology
- **Prevention Strategies**
  - Core
  - Supplemental
- **Measurement**
  - Process
  - Outcome
- **Tools for Implementation/Resources/References**

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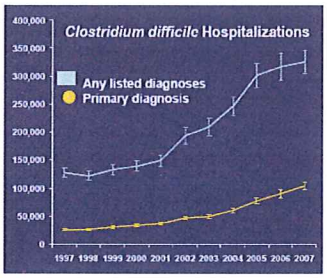
Background: Impact



- Hospital-acquired, hospital-onset: 165,000 cases, $1.3 billion in excess costs, and 9,000 deaths annually
- Hospital-acquired, post-discharge (up to 4 weeks): 50,000 cases, $0.3 billion in excess costs, and 3,000 deaths annually
- Nursing home-onset: 263,000 cases, $2.2 billion in excess costs, and 16,500 deaths annually

Campbell et al. Infect Control Hosp Epidemiol. 2009:30:523-33.

Dubberke et al. Clin Infect Dis. 2008;46:497-504.

Dubberke et al. Emerg Infect Dis. 2008;14:1031-8.

Elixhauser et al. HCUP Statistical Brief #50. 2008.

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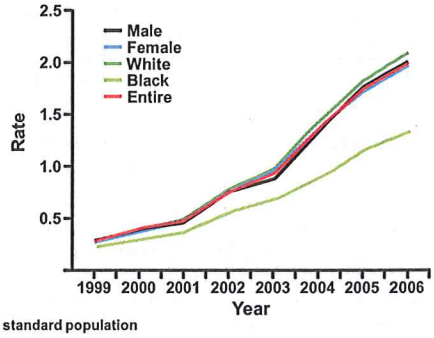
Background: Impact

Age-Adjusted Death Rate* for Enterocolitis Due to *C. difficile*, 1999–2006



*Per 100,000 US standard population

Heron et al. Natl Vital Stat Rep 2009;57(14).
Available at http://www.cdc.gov/nchs/data/nvsr/nvsr57/nvsr57_14.pdf

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Background: HHS Prevention Targets

- **Case rate per 10,000 patient-days as measured in NHSN**
  - National 5-Year Prevention Target: 30% reduction
- **Because little baseline infection data exists, administrative data for ICD-9-CM coded *C. difficile* hospital discharges is also tracked**
  - National 5-Year Prevention Target: 30% reduction

http://www.hhs.gov/ophs/initiatives/hai/prevtargets.html

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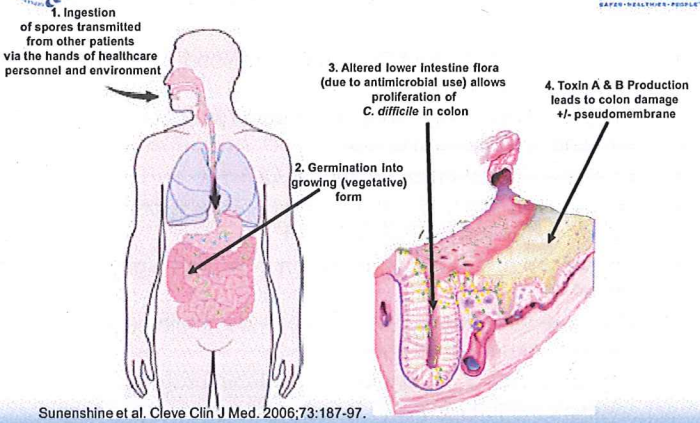
Background: Pathogenesis of CDI



Sunenshine et al. Cleve Clin J Med. 2006;73:187-97.

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Background: Epidemiology

Current epidemic strain of *C. difficile*

- BI/NAP1/027, toxinotype III
- Historically uncommon – epidemic since 2000
- More resistant to fluoroquinolones
  - Higher MICs compared to historic strains and current non-BI/NAP1 strains
- More virulent
  - Increased toxin A and B production
  - Polymorphisms in binding domain of toxin B
  - Increased sporulation

McDonald et al. N Engl J Med. 2005;353:2433-41.
Warny et al. Lancet. 2005;366:1079-84.
Stabler et al. J Med Micro. 2008;57:771–5.
Akerlund et al. J Clin Microbiol. 2008;46:1530–3.

Background: Epidemiology

Risk Factors

- Antimicrobial exposure
- Acquisition of *C. difficile*

Main modifiable risk factors

- Advanced age
- Underlying illness
- Immunosuppression
- Tube feeds
- ? Gastric acid suppression

Prevention Strategies

- **Core Strategies**
  - High levels of scientific evidence
  - Demonstrated feasibility
- **Supplemental Strategies**
  - Some scientific evidence
  - Variable levels of feasibility

*The Collaborative should at a minimum include core prevention strategies. Supplemental prevention strategies also may be used. Most core and supplemental strategies are based on HICPAC guidelines. Strategies that are not included in HICPAC guidelines will be noted by an asterisk (*) after the strategy. HICPAC guidelines may be found at www.cdc.gov/hicpac

Prevention Strategies: Core

- Contact Precautions for duration of diarrhea
- Hand hygiene in compliance with CDC/WHO
- Cleaning and disinfection of equipment and environment
- Laboratory-based alert system for immediate notification of positive test results
- Educate about CDI: HCP, housekeeping, administration, patients, families

http://www.cdc.gov/ncidod/dhqp/id_CdiffFAQ_HCP.html
Dubberke et al. Infect Control Hosp Epidemiol 2008;29:S81-92.

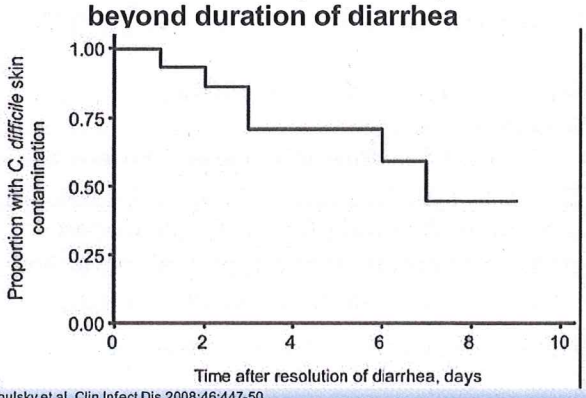
Prevention Strategies: Supplemental

- Extend use of Contact Precautions beyond duration of diarrhea (e.g., 48 hours)*
- Presumptive isolation for symptomatic patients pending confirmation of CDI
- Evaluate and optimize testing for CDI
- Implement soap and water for hand hygiene before exiting room of a patient with CDI
- Implement universal glove use on units with high CDI rates*
- Use sodium hypochlorite (bleach) – containing agents for environmental cleaning
- Implement an antimicrobial stewardship program

* Not included in CDC/HICPAC 2007 Guideline for Isolation Precautions

Supplemental Prevention Strategies:

Rationale for considering extending isolation beyond duration of diarrhea



Bobulsky et al. Clin Infect Dis 2008;46:447-50.

Supplemental Prevention Strategies:
Consider presumptive isolation for patients with ≥3 unformed stools within 24 hours

- Patients with CDI may contaminate environment and hands of healthcare personnel pending results of diagnostic testing
- CDI responsible for only ~30-40% of hospital-onset diarrhea
- However, CDI more likely among patients with ≥3 unformed (i.e. taking the shape of a container) stools within 24 hours
  - Send specimen for testing and presumptively isolate patient pending results
  - Positive predictive value of testing will also be optimized if focused on patients with ≥3 unformed stools within 24 hours
  - Exception: patient with possible recurrent CDI (isolate and test following first unformed stool)

Supplemental Prevention Strategies:
Evaluate and optimize test-ordering practices and diagnostic methods

- Most laboratories have relied on Toxin A/B enzyme immunoassays
  - Low sensitivities (70-80%) lead to low negative predictive value
- Despite high specificity, poor test ordering practices (i.e. testing formed stool or repeat testing in negative patients) may lead to many false positives
- Consider more sensitive diagnostic paradigms but apply these more judiciously across the patient population
  - Employ a highly sensitive screen with confirmatory test or a PCR-based molecular assay
  - Restrict testing to unformed stool only
  - Focus testing on patients with ≥ 3 unformed stools within 24 hours
  - Require expert consultation for repeat testing within 5 days

Peterson et al. Ann Intern Med 2009;15:176-9.

Supplemental Prevention Strategies:
Hand Hygiene – Soap vs. Alcohol gel

- Alcohol not effective in eradicating *C. difficile* spores
- However, one hospital study found that from 2000-2003, despite increasing use of alcohol hand rub, there was no concomitant increase in CDI rates
- Discouraging alcohol gel use may undermine overall hand hygiene program with untoward consequences for HAIs in general

Boyce et al. Infect Control Hosp Epidemiol 2006;27:479-83.

Supplemental Prevention Strategies:
Hand Washing: Product Comparison

Product	Log10 Reduction
Tap Water	0.76
4% CHG antimicrobial hand wash	0.77
Non-antimicrobial hand wash	0.78
Non-antimicrobial body wash	0.86
0.3% triclosan antimicrobial hand wash	0.99
Heavy duty hand cleaner used in manufacturing environments	1.21*

* Only value that was statistically better than others

Conclusion: Spores may be difficult to eradicate even with hand washing.

Edmonds, et al. Presented at: SHEA 2009; Abstract 43.

Supplemental Prevention Strategies:
Hand Hygiene Methods

Since spores may be difficult to remove from hands even with hand washing, adherence to glove use, and Contact Precautions in general, should be emphasized for preventing *C. difficile* transmission via the hands of healthcare personnel

Johnson et al. Am J Med 1990;88:137-40.

Supplemental Prevention Strategies:
Glove Use

Rationale for considering universal glove use (in addition to Contact Precautions for patients with known CDI) on units with high CDI rates

- Although the magnitude of their contribution is uncertain, asymptomatic carriers have a role in transmission
- Practical screening tests are not available
- There may be a role for universal glove use as a special approach to reducing transmission on units with longer lengths of stay and high endemic CDI rates
- Focus enhanced environmental cleaning strategies and avoid shared medical equipment on such units as well

Supplemental Prevention Strategies: Environmental Cleaning

- Bleach can kill spores, whereas other standard disinfectants cannot
- Limited data suggest cleaning with bleach (1:10 dilution prepared fresh daily) reduces *C. difficile* transmission
- Two before-after intervention studies demonstrated benefit of bleach cleaning in units with high endemic CDI rates
- Therefore, bleach may be most effective in reducing burden where CDI is highly endemic

Mayfield et al. Clin Infect Dis 2000;31:995-1000.

Wilcox et al. J Hosp Infect 2003;54:109-14.

Supplemental Prevention Strategies: Environmental Cleaning

Assess adequacy of cleaning before changing to new cleaning product such as bleach

- Ensure that environmental cleaning is adequate and high-touch surfaces are not being overlooked
- One study using a fluorescent environmental marker to asses cleaning showed:
  - only 47% of high-touch surfaces in 3 hospitals were cleaned
  - sustained improvement in cleaning of all objects, especially in previously poorly cleaned objects, following educational interventions with the environmental services staff
- The use of environmental markers is a promising method to improve cleaning in hospitals.

Carling et al. Clin Infect Dis 2006;42:385-8.

Supplemental Prevention Strategies: Audit and feedback targeting broad-spectrum antibiotics

- A prospective, controlled interrupted time-series analysis in 3 acute medical wards for the elderly in the UK demonstrated the impact of antimicrobial management on reducing CDI.
  - Introduced a narrow-spectrum antibiotic policy
  - Reinforced using feedback
  - Associated with significant changes in targeted antibiotics and a significant reduction in CDI

Fowler et al. J Antimicrob Chemother 2007;59:990-5.

Summary of Prevention Measures

Core Measures

- Contact Precautions for duration of illness
- Hand hygiene in compliance with CDC/WHO
- Cleaning and disinfection of equipment and environment
- Laboratory-based alert system
- CDI surveillance
- Education

Supplemental Measures

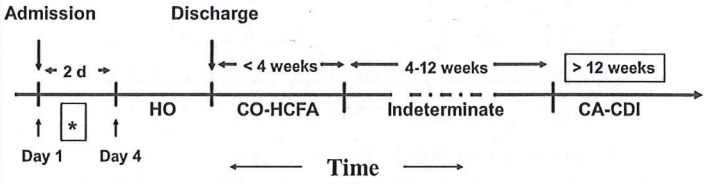
- Prolonged duration of Contact Precautions*
- Presumptive isolation
- Evaluate and optimize testing
- Soap and water for HH upon exiting CDI room
- Universal glove use on units with high CDI rates*
- Bleach for environmental disinfection
- Antimicrobial stewardship program

* Not included in CDC/HICPAC 2007 Guideline for Isolation Precautions

Measurement: Process Measures

- **Core Measures:**
  - Measure compliance with CDC/WHO recommendations for hand hygiene and Contact Precautions
  - Assess adherence to protocols and adequacy of environmental cleaning
- **Supplemental Measures**:
  - Intensify assessment of compliance with process measures
  - Track use of antibiotics associated with CDI in a facility

Measurement: Outcome Categorize Cases by location and time of onset†



HO: Hospital (Healthcare)-Onset
CO-HCFA: Community-Onset , Healthcare Facility-Associated
CA: Community -Associated

* Depending upon whether patient was discharged within previous 4 weeks, CO-HCFA vs. CA

† Onset defined in NHSN LabID Event by specimen collection date

Modified from CDAD Surveillance Working Group. Infect Control Hosp Epidemiol 2007;28:140-5.

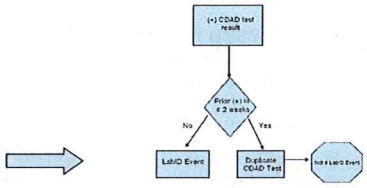
Measurement: Outcome
Use NHSN CDAD Module

NHSN Laboratory-identified MDRO or CDAD Event

*required for saving		
Facility ID:	Event #:	
*Patient ID:	Social Security #:	
Secondary ID:		
Patient Name, Last:	First:	Middle:
*Gender: M F	*Date of Birth:	
Ethnicity (Specify):	Race (Specify):	
Event Details		
*Event Type: LabID	*Date Specimen Collected:	
*Specific Organism Type: (Check one) ☐MRSA ☐MSSA ☐VRE ☐MDR-*Klebsiella* ☐MDR-*Acinetobacter* ☐*C. difficile*		
*Outpatient: Yes No	*Specimen Source:	
*Date Admitted	*Location:	*Date Admitted

Measurement: Outcome
Focus on Laboratory Identified (LabID) Events in NHSN

Figure 2. CDAD Test Result Algorithm for Laboratory-Identified (LabID) Events



Measurement: Outcome
NHSN Reporting: Definitions

Based on data submitted to NHSN, CDI LabID Events are categorized as:

- **Incident:** specimen obtained >8 weeks after the most recent LabID Event
- **Recurrent:** specimen obtained >2 weeks and ≤ 8 weeks after most recent LabID Event

Measurement: Outcome
NHSN Reporting: Definitions

Incident cases further characterized based on date of admission and date of specimen collection:

- **Healthcare Facility-Onset (HO):** LabID Event collected >3 days after admission to facility (i.e., on or after day 4)
- **Community-Onset (CO):** LabID Event collected as an outpatient or an inpatient ≤3 days after admission to the facility (i.e., days 1, 2, or 3 of admission)
- **Community-Onset Healthcare Facility-Associated (CO-HCFA):** CO LabID Event collected from a patient who was discharged from the facility ≤4 weeks prior to date stool specimen collected

Measurement: Outcome
Calculating CDI Incidence Rates*

- **Healthcare Facility-Onset Incidence Rate** = Number of all Incident HO CDI LabID Events per patient per month / Number of patient days for the facility x 10,000
- **Combined Incidence Rate** = Number of all Incident HO and CO-HCFA CDI LabID Events per patient per month / Number of patient days for the facility x 10,000

*For a given healthcare facility

Evaluation Considerations

- **Assess baseline policies and procedures**
- **Areas to consider**
  - **Surveillance**
  - **Prevention strategies**
  - **Measurement of effect of strategies**
- **Coordinator should track new policies/practices implemented during collaboration**

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- Peterson LR, Robicsek A. Does my patient have *Clostridium difficile* infection? Ann Intern Med 2009;15:176-9
- Riggs MM, Sethi AK, Zabarsky TF, et al. Asymptomatic carriers are a potential source for transmission of epidemic and nonepidemic *Clostridium difficile* strains among long-term care facility residents. Clin Infect Dis 2007; 45:992–8.

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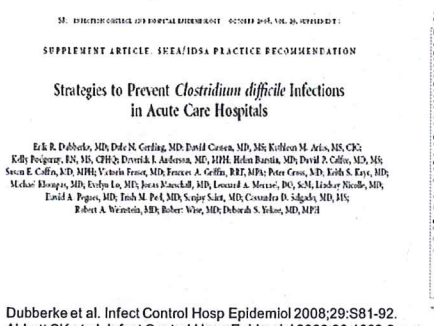
- Wilcox MF, Fawley WN, Wigglesworth N, et al. Comparison of the effect of detergent versus hypochlorite cleaning on environmental contamination and incidence of *Clostridium difficile* infection. J Hosp Infect 2003:54:109-14.

Additional resources

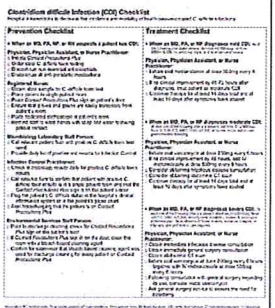
SHEA/IDSA Compendium of Recommendations



SUPPLEMENT ARTICLE: SHEA/IDSA PRACTICE RECOMMENDATION

Strategies to Prevent *Clostridium difficile* Infections in Acute Care Hospitals

CDI Checklist Example



Dubberke et al. Infect Control Hosp Epidemiol 2008;29:S81-92.
Abbett SK et al. Infect Control Hosp Epidemiol 2009;30:1062-9.

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Additional Reference Slides

- The following slides may be used for presentations regarding CDI.
- Explanations are available in the notes section of the slides.

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Supplemental Prevention Strategies:
Rationale for Soap and Water: Lack of efficacy of alcohol-based handrub against *C. difficile*

Interventions compared		Mean log reduction (95% CI), log_{10} CFU/mL
Intervention 1	Intervention 2	
Warm water and plain soap	No hand hygiene	2.14 (1.74–2.54)
Warm water and plain soap	Alcohol-based handrub	2.08 (1.69–2.47)
Cold water and plain soap	No hand hygiene	1.88 (1.48–2.28)
Cold water and plain soap	Alcohol-based handrub	1.82 (1.43–2.22)
Warm water and plain soap	Antiseptic hand wipe	1.57 (1.18–1.96)
Warm water and antibacterial soap	No hand hygiene	1.51 (1.12–1.91)
Warm water and antibacterial soap	Alcohol-based handrub	1.46 (1.06–1.85)
Cold water and plain soap	Antiseptic hand wipe	1.31 (0.92–1.71)
Warm water and antibacterial soap	Antiseptic hand wipe	0.94 (0.55–1.34)
Warm water and plain soap	Warm water and antibacterial soap	0.63 (0.23–1.02)
Antiseptic hand wipe	No hand hygiene	0.57 (0.17–0.96)
Antiseptic hand wipe	Alcohol-based handrub	0.51 (0.12–0.91)
Cold water and plain soap	Warm water and antibacterial soap	0.37 (−0.03 to 0.76)
Warm water and plain soap	Cold water and plain soap	0.26 (−0.14 to 0.66)
Alcohol-based handrub	No hand hygiene	0.06 (−0.34 to 0.45)

Oughton et al. Infect Control Hosp Epidemiol 2009;30:939-44.

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Supplemental Prevention Strategies:
Hand Hygiene – Alcohol Hand Rub Use 2000-2003

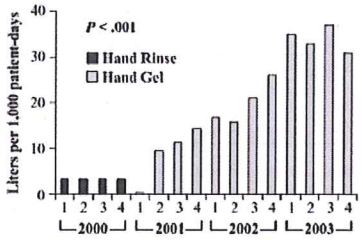

FIGURE 1. Use of alcohol hand rub by healthcare workers, in liters per 1,000 patient-days, per quarter, 2000-2003.

Boyce et al. Infect Control Hosp Epidemiol 2006; 27:479-83.

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Supplemental Prevention Strategies:
Hand Hygiene – CDI Rates 2000-2003

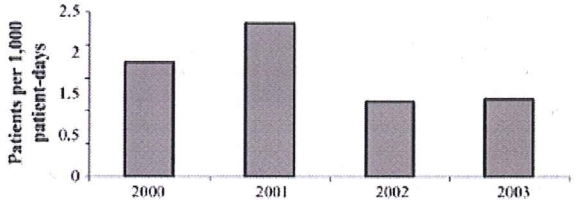

FIGURE 2. Number of patients with 1 or more tests positive for *Clostridium difficile* toxin per 1,000 patient-days, 2000-2003.

Boyce JM et al. Infect Control Hosp Epidemiol 2006; 27:479-83.

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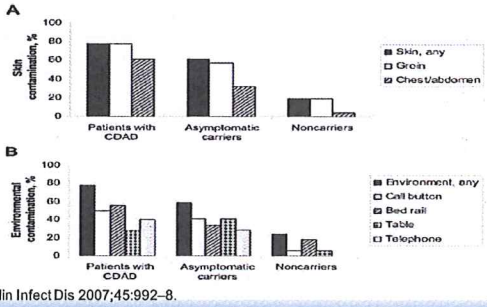
Supplemental Prevention Strategies:
Universal Glove Use

Role of asymptomatic carriers?
Rationale for universal glove use on units with high CDI rates



Riggs et al. Clin Infect Dis 2007;45:992–8.

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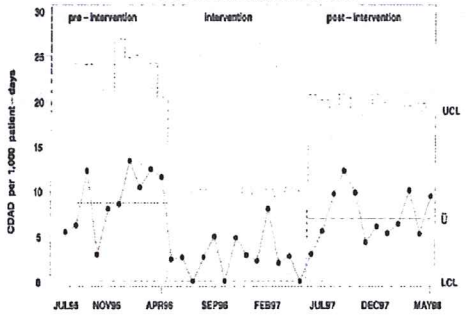
Supplemental Prevention Strategies: Environmental Cleaning

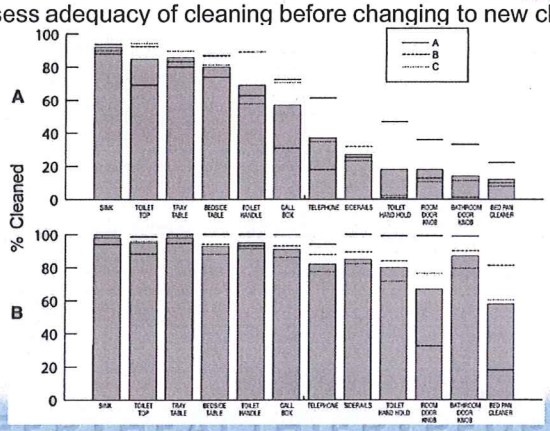
How Much Can be Achieved via Environmental Decontamination?



Mayfield et al. Clin Infect Dis 2000;31:995–1000.

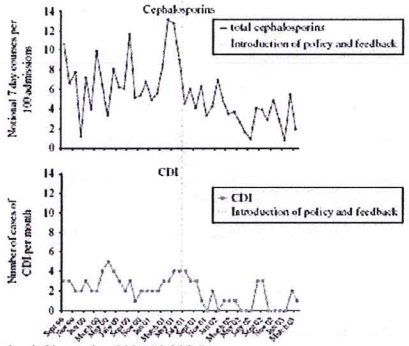
Supplemental Prevention Strategies: Environmental Cleaning

Assess adequacy of cleaning before changing to new cleaning



Carling et al. Clin Infect Dis 2006;42:385-8.

Supplemental Prevention Strategies: Audit and feedback targeting broad-spectrum antibiotics



Fowler et al. J Antimicrob Chemother 2007;59:990-5.

SUPPLEMENT ARTICLE: SHEA/IDSA PRACTICE RECOMMENDATION

Strategies to Prevent *Clostridium difficile* Infections in Acute Care Hospitals

Erik R. Dubberke, MD; Dale N. Gerding, MD; David Classen, MD, MS; Kathleen M. Arias, MS, CIC; Kelly Podgorny, RN, MS, CPHQ; Deverick J. Anderson, MD, MPH; Helen Burstin, MD; David P. Calfee, MD, MS; Susan E. Coffin, MD, MPH; Victoria Fraser, MD; Frances A. Griffin, RRT, MPA; Peter Gross, MD; Keith S. Kaye, MD; Michael Klompas, MD; Evelyn Lo, MD; Jonas Marschall, MD; Leonard A. Mermel, DO, ScM; Lindsay Nicolle, MD; David A. Pegues, MD; Trish M. Perl, MD; Sanjay Saint, MD; Cassandra D. Salgado, MD, MS; Robert A. Weinstein, MD; Robert Wise, MD; Deborah S. Yokoe, MD, MPH

PURPOSE

Previously published guidelines are available that provide comprehensive recommendations for detecting and preventing healthcare-associated infections. The intent of this document is to highlight practical recommendations in a concise format designed to assist acute care hospitals in implementing and prioritizing their *Clostridium difficile* infection (CDI) prevention efforts. Refer to the Society for Healthcare Epidemiology of America/Infectious Diseases Society of America "Compendium of Strategies to Prevent Healthcare-Associated Infections" Executive Summary and Introduction and accompanying editorial for additional discussion.

SECTION 1: RATIONALE AND STATEMENTS OF CONCERN

1. Increasing rates of CDI

C. difficile now rivals methicillin-resistant *Staphylococcus aureus* (MRSA) as the most common organism to cause healthcare-associated infections in the United States.[1]

a. In the United States, the proportion of hospital discharges in which the patient received the *International Classification of Diseases, Ninth Revision* discharge diagnosis code for CDI more than doubled between 2000 and 2003,[1] and CDI rates continued to increase in 2004 and 2005 (L. C. McDonald, MD, personal communication, July 2007). These increases have been seen in pediatric and adult populations, but elderly individuals have been disproportionately affected.[1] CDI incidence has also increased in Canada and Europe.[2-4]

b. There have been numerous reports of an increase in CDI severity.[2-6]

c. Most reports of increases in the incidence and severity of CDI have been associated with the BI/NAP1/027 strain of *C. difficile*.[2-6] This strain produces more toxins A and B in vitro than do many other strains of *C. difficile*, produces a third toxin (binary toxin), and is highly resistant to fluoroquinolones.

2. Outcomes associated with CDI

CDI is associated with increased lengths of hospital stay, costs, morbidity, and mortality among adult patients. Data on the changing epidemiology of CDI in pediatric patients are limited and are confounded by the prevalence of asymptomatic carriage of *C. difficile* among children younger than 12 months of age.[7,8]

a. CDI increases mean length of hospital stay from 2.6 days to 4.5 days.[9,10]

From the Washington University School of Medicine, St. Louis, Missouri (E.R.D., V.F., J.M.); the Loyola University Chicago Stritch School of Medicine (D.N.G.), the Stroger (Cook County) Hospital and the Rush University Medical Center (R.A.W.), Chicago, the Joint Commission, Oakbrook Terrace (K.P., R.W.), and the Hines Veterans Affairs Medical Center, Hines (D.N.G.), Illinois; the University of Utah, Salt Lake City (D.C.); the Association for Professionals in Infection Control and Epidemiology (K.M.A.) and the National Quality Forum (H.B.), Washington, D.C.; the Duke University Medical Center, Durham, North Carolina (D.J.A., K.S.K.); the Mount Sinai School of Medicine, New York, New York (D.P.C.); the Children's Hospital of Philadelphia and University of Pennsylvania School of Medicine, Philadelphia, Pennsylvania (S.E.C.); the Institute for Healthcare Improvement, Cambridge (F.A.G.), and the Brigham and Women's Hospital and Harvard Medical School, Boston (M.K., D.S.Y.), Massachusetts; the Hackensack University Medical Center, Hackensack (P.G.), and the University of Medicine and Dentistry–New Jersey Medical School, Newark (P.G.), New Jersey; the Warren Alpert Medical School of Brown University and Rhode Island Hospital, Providence, Rhode Island (L.A.M.); the David Geffen School of Medicine at the University of California, Los Angeles (D.A.P.); the Johns Hopkins Medical Institutions and University, Baltimore, Maryland (T.M.P.); the Ann Arbor Veterans Affairs Medical Center and the University of Michigan Medical School, Ann Arbor, Michigan (S.S.); the Medical University of South Carolina, Charleston (C.D.S.); and the University of Manitoba, Winnipeg, Canada (E.L., L.N.).

Accepted May 27, 2008; electronically published September 16, 2008.

Infect Control Hosp Epidemiol 2008; 29:S81–S92

 0899-823X/2008/2910S1-0009$15.00. DOI: 10.1086/591065

b. Attributable costs of inpatient CDI have been estimated to be $2,470-$3,669 per episode. Attributable inpatient costs during the 6 months after CDI diagnosis are $5,042-$7,179.[10,11] US hospital costs for CDI management have been estimated to be $3.2 billion per year.[12]

c. Patients with CDI were almost twice as likely to be discharged to a long-term care facility than were propensity score–matched control individuals.[9]

d. CDI has recently been associated with an attributable mortality rate of 6.9% at 30 days after diagnosis and 16.7% at 1 year.[3,4,9]

3. Changing risk factors and possible decrease in CDI treatment response rates

a. Fluoroquinolones, previously infrequently associated with CDI, have been found to be one of the primary predisposing antimicrobials in recent studies.[3,6,13,14]

i. Virtually every antibiotic has been associated with CDI. Cephalosporins, ampicillin, and clindamycin remain important predisposing antibiotics.

b. Gastric acid suppression has been recognized as a risk factor for CDI in some studies.[14,15]

i. Some studies suggest that the association between gastric acid suppression and CDI are related to other important risk factors, such as severity of illness and age.[14,16]

ii. Gastric acid suppression may be an important risk factor for CDI outside of healthcare facilities.[15]

c. Several studies suggest that rates of response to treatment of CDI with metronidazole are declining; these studies include a randomized, prospective, blinded, and severity-stratified study that demonstrated statistically superior rates of response to vancomycin treatment for severe disease but not for mild disease, compared with metronidazole treatment.[17-19]

SECTION 2: STRATEGIES TO DETECT CDI

1. Surveillance definitions

Definitions for CDI surveillance in the United States and Europe have recently been published.[20,21]

a. In the United Kingdom, all cases of CDI in patients older than 65 years of age have been reported to the healthcare-associated infection surveillance system for National Health Service Acute Trusts in England since January 2004.[22] Reporting for all CDI cases in patients older than 2 years of age started in April 2007.[23]

b. The Canadian Hospital Epidemiology Committee, a joint initiative of the Canadian Infectious Diseases Society and the Canadian Nosocomial Infection Surveillance Program, used a standard definition for CDI surveillance to track nosocomial CDI over a 4-month period in 1997 and after 2005 in healthcare facilities across Canada[24] (M. Miller, MD, personal communication, December 2007).

c. Data are lacking to determine the ideal definition for healthcare-associated CDI. However, this is a minor limitation in light of the need for a standardized surveillance definition for CDI. The following information focuses on the definitions for CDI surveillance in the United States and Europe.[20,21]

i. A CDI case is defined as a case of diarrhea or toxic megacolon without other known etiology that meets 1 or more of the following criteria: (1) the stool sample yields a positive result of a laboratory assay for *C. difficile* toxin A and/or B, or a toxin-producing *C. difficile* organism is detected in the stool sample by culture or other means; (2) pseudomembranous colitis is seen on endoscopic examination or surgery; and (3) pseudomembranous colitis is seen on histopathological examination.

ii. Several CDI definitions are proposed, including community-associated CDI; community-onset, healthcare facility–associated CDI; and recurrent CDI. Healthcare facilities should track at least healthcare facility–onset, healthcare facility–associated CDI (Table 1).[20,21]

iii. Surveillance for CDI is limited by the use of non–culture-based methods to diagnose CDI, such as stool toxin assays, which have lower sensitivity than does *C. difficile* stool culture.[20-22,24-27]

2. Identifying patients with CDI

Positive results of diarrheal stool tests for toxigenic *C. difficile* or its toxins are the most common methods used to identify patients with CDI.[20-22,24]

a. Positive results of diarrheal stool tests should automatically be sent to infection prevention and control professionals and to clinicians caring for the patient.

b. Only diarrheal stools should be tested for *C. difficile* or its toxins. A positive result of a test for toxigenic *C. difficile* and/or its toxins in a patient with diarrhea is considered to be diagnostic for CDI. However, some centers permit *C. difficile* testing of nondiarrheal stools. In such cases, review of patient records is required to ensure that the patient has symptoms consistent with CDI.

i. Because of the high prevalence of asymptomatic carriage of toxigenic *C. difficile* among infants younger than 1 year of age, testing should be conducted only for infants with diarrhea along with investigation of alternative causes of diarrhea.[7,8] Detection of *C. difficile* toxin should not be assumed to be causative of diarrhea in these infants, although infants older than 6 months of age who are colonized have been shown to have a higher frequency of all-cause diarrhea than do noncolonized infants.[28,29]

c. A minority of patients have CDI diagnosed by visualization of pseudomembranes by endoscopy and/or histopathologic analysis, without positive stool test results.

3. Methods for surveillance of CDI

a. Conducting CDI surveillance to determine CDI rates provides a measure to determine the burden of CDI at a

TABLE 1. *Clostridium difficile* Infection (CDI) Surveillance Definitions

CDI case type	Definition
Healthcare facility onset, healthcare facility associated	Symptom onset >48 h after admission to a healthcare facility
Community onset, healthcare facility associated	Symptom onset in the community or ⩽48 h after admission, provided that symptom onset was <4 weeks after the last discharge from a healthcare facility
Community associated	Symptom onset in the community or ⩽48 h after admission to a healthcare facility, provided that symptom onset was >12 weeks after the last discharge from a healthcare facility
Indeterminate onset	Case does not fit any of the above criteria for an exposure setting (eg, onset in the community >4 weeks but <12 weeks after the last discharge from a healthcare facility)
Unknown	Exposure setting cannot be determined, because of a lack of available data
Recurrent	Episode occurred ⩽8 weeks after the onset of a previous episode, provided that CDI symptoms from the earlier episode resolved

NOTE. Definitions are from McDonald et al.[20] and Kuijper et al.[21] When laboratory-based reporting of symptoms is used, the date and time of stool specimen collection can be used as a surrogate for symptom onset. If data on the time a patient was admitted (in addition to date) and/or the time stool was collected for testing are not available, CDI can be considered to be healthcare facility onset if stool is positive for toxigenic *C. difficile* or a *C. difficile* toxin after the third calendar day after hospital admission, where the first day is the day of admission (ie, a patient admitted on Monday with stool first positive for *C. difficile* toxin on Thursday or later is considered to have healthcare facility–onset CDI).

healthcare facility. These data are also used to assess the efficacy of interventions to prevent CDI. When they are reported back to healthcare providers and hospital administrators, CDI rates can be applied as a tool to improve adherence to CDI preventive measures.

b. Surveillance can be performed on specific wards or units and/or at the level of the entire healthcare facility.

c. Laboratories performing *C. difficile* testing should report results to infection prevention and control professionals daily. The CDI rate can be expressed as the number of CDI case patients per 10,000 patient-days.

i. This rate is calculated as follows: (number of case patients/number of patient-days per reporting period) × 10,000 = rate per 10,000 patient-days.[19]

ii. To convert the rate per 10,000 patient-days to the rate per 1,000 patient-days, divide the rate by 10 (conversely, to convert a rate from 1,000 patient-days to 10,000 patient-days, multiply the rate by 10).

d. Because of a lack of published data on CDI surveillance using similar case-finding methods and surveillance definitions, specific definitions for what constitutes an "outbreak" or "hyperendemic" rate cannot be provided at this time.

i. An outbreak can be defined as an increase in CDI rate in time and/or space believed to be greater than that expected by chance alone.

ii. A hyperendemic rate can be defined as a persistently elevated CDI rate compared with past rates or compared with rates in other, similar healthcare facilities.

SECTION 3: STRATEGIES TO PREVENT CDI

1. Existing guidelines and recommendations

a. Published guidelines for the management of CDI are few, and only some address CDI prevention.[22,25-27]

i. Most data published on CDI prevention are from before-after studies conducted in response to outbreaks. Often, several concomitant interventions are performed, making it difficult to determine the relative importance of one intervention compared with another. Before-after studies are also limited by time-related biases that are difficult to adjust for in the absence of a control group or properly conducted analyses, such as interrupted time series analysis.[30,31] However, 2 recent studies have used these techniques, demonstrating the importance of antimicrobial stewardship and its role in preventing CDI.[31,32]

b. Less is known about the mechanisms and prevention of *C. difficile* transmission, compared with other antimicrobial-resistant gram-positive organisms, such as MRSA and vancomycin-resistant enterococcus (VRE). Although these 3 organisms have many common epidemiologic characteristics, *C. difficile* and VRE, in particular, share risk factors for transmission.[33] The major difference among these 3 organisms is that *C. difficile* forms spores, whereas the other 2 do not. The formation of spores has novel (as yet unknown) implications for methods of hand hygiene and environmental disinfection, because *C. difficile* spores are resistant to the bactericidal effects of alcohol and most hospital disinfectants.

c. General strategies to prevent CDI, per previously published guidelines,[22,24-27] include the following:

i. Methods of reducing the risk of CDI if the organism is encountered by the patient

(a) Follow antimicrobial usage restriction and stewardship guidelines.

ii. Methods of preventing the patient from being exposed to *C. difficile* (disinfection and barrier methods)

(a) Avoid the use of electronic thermometers; the handles become contaminated with *C. difficile.*

(b) Use dedicated patient care items and equipment; if items must be shared, clean and disinfect the equipment between patients.

(c) Use full barrier precautions (gowns and gloves) for contact with patients with CDI and for contact with their body substances and environment (contact precautions).

(d) Place patients with CDI in private rooms, if available; give isolation preference to patients with fecal incontinence if room availability is limited.

(e) Perform meticulous hand hygiene based on Centers for Disease Control and Prevention or World Health Organization guidelines before and after entering the room of a patient with CDI, with soap and water or an alcohol-based hand-hygiene product (in routine settings or settings of endemicity). Perform hand hygiene with soap and water preferentially, instead of alcohol hand hygiene products, after caring for a patient with CDI in outbreak settings or settings of hyperendemicity. Ensure that proper hand-hygiene techniques are used when hand washing with soap and water is employed.[34]

(f) Perform environmental decontamination of rooms housing patients with CDI, using sodium hypochlorite (household bleach) diluted 1 : 10 with water, in an outbreak setting or setting of hyperendemicity.

(g) Educate healthcare personnel and hospital administration about the clinical features, transmission, and epidemiology of CDI.

d. Other important principles to be aware of when caring for patients with CDI include the following:[22,25-27]

i. Perform testing for *C. difficile* only on unformed diarrheal stools (toxin testing of formed stool is strongly discouraged).

ii. Do not give prophylactic antimicrobial CDI therapy (eg, with metronidazole or vancomycin) to patients at high risk for CDI.

iii. Do not treat or attempt to decolonize asymptomatic *C. difficile* carriers. Antimicrobial therapy is not effective for decolonization.

iv. Do not conduct repeated testing for *C. difficile* if a patient has had a stool sample positive for *C. difficile,* unless symptoms resolved with treatment and then returned after treatment (ie, do not perform test of cure in patients successfully treated for CDI).

2. Infrastructure requirements

a. Trained infection prevention and control personnel

i. Infection prevention and control personnel must have knowledge about risk factors for and methods to prevent CDI. They must also be trained in how to determine when a case of CDI is healthcare associated and how to calculate CDI rates.[20,21]

b. Method to identify patients with CDI

i. Infection prevention and control personnel must be able to identify patients with CDI as soon as possible after their condition is diagnosed. This is necessary to ensure that patients are placed under contact precautions in a timely fashion. These data can also be used to calculate CDI rates.

c. Ability to place patients with CDI under contact precautions

i. Contact precautions require the ability to place patients in a private room (preferably) or to cohort patients with CDI, as well as to place materials necessary for compliance with contact precautions (eg, gowns and gloves) in an easily accessible space outside of the patient's room.

ii. Place a sign indicating that the patient is under contact precautions outside of the patient's room.

iii. If there is a limited number of single-bed rooms, patients with stool incontinence should preferentially be placed in these rooms.

iv. If it is necessary to cohort patients, cohort patients who are colonized or infected with the same organism(s) (eg, do not cohort patients with CDI who are discordant in their VRE or MRSA colonization status).

v. Have systems in place to facilitate communication among infection prevention and control, admitting, nursing, and housekeeping departments and develop contingency plans for conditions of limited bed availability.

d. Provide educational materials for patients, family members, and healthcare personnel that include explanations of CDI, why contact precautions are necessary, and the importance of hand hygiene.

e. Provide adequate resources and training for housekeeping personnel to ensure proper cleaning of rooms.

3. Initiating a CDI prevention program

a. Pilot test the intervention in 1 patient care location to assess efficacy.

i. Perform CDI surveillance to determine locations where CDI rates are highest.

ii. Initiate the prevention program where there is a high concentration of patients at risk for CDI, such as an intensive care unit or an oncology ward.

iii. Start in 1 patient care location.

(a) Identify opportunities to improve the system for identifying patients with CDI.

(b) Identify opportunities to improve the process for placing patients with CDI under contact precautions and to minimize problems for family members, visitors, and healthcare personnel.

iv. Obtain the support of hospital administration and local physician and nursing leadership before starting the program.

b. Use process and outcome measures to determine whether the intervention is effective.

c. Replicate the CDI infection prevention and control program in other patient care areas when it is determined that the systems developed are effective.

SECTION 4: RECOMMENDATIONS FOR IMPLEMENTING PREVENTION AND MONITORING STRATEGIES

Recommendations for preventing and monitoring CDI are summarized in the following section. They are designed to assist acute care hospitals in prioritizing and implementing their CDI prevention efforts. Criteria for grading the strength of recommendation and quality of evidence are described in Table 2.

I. Basic practices for prevention and monitoring of CDI: recommended for all acute care hospitals

A. Components of a CDI prevention program

1. Use contact precautions for infected patients, with a single-patient room preferred (A-II for hand hygiene, A-I for gloves, B-III for gowns, and B-III for single-patient room).[22,25-27]

a. Place patients with CDI under contact precautions to help reduce patient-to-patient spread of the organism.

i. Place patients in private rooms when available.

ii. Don gown and gloves on entry to the patient's room.

(a) Gloves should be changed immediately if visibly soiled and after touching or handling surfaces or materials contaminated with feces.

iii. Remove gown and gloves before exiting the room.

iv. Conduct Centers for Disease Control and Prevention– or World Health Organization–compliant hand hygiene on exiting the patient's room.

v. Cohorting patients with CDI is acceptable when single, private rooms are not available.

(a) Place patients with stool incontinence preferentially in private rooms.

(b) Do not cohort patients who have discordant status of infection or colonization with other epidemiologically important organisms (eg, VRE and MRSA).

(c) Remove gowns and gloves and perform hand hygiene when moving from one patient to another.

b. Ensure that adequate supplies for contact precautions are readily available.

i. Management leaders are responsible to ensure that necessary barrier-equipment supplies (eg, gowns and gloves) and hand-hygiene products are readily available.

ii. Assign responsibility for monitoring the availability and restocking of supplies to specific healthcare personnel.

c. Criteria for discontinuing contact precautions

i. The Centers for Disease Control and Prevention currently recommends contact precautions for the duration of illness when caring for patients with CDI.[36] Some experts recommend continuing contact precautions for at least 48 hours after diarrhea resolves. Areas of controversy include the following:

(a) Asymptomatically colonized patients (including, in many cases, those successfully treated for CDI)

TABLE 2. Strength of Recommendation and Quality of Evidence

Category/grade	Definition
Strength of recommendation	
A	Good evidence to support a recommendation for use
B	Moderate evidence to support a recommendation for use
C	Poor evidence to support a recommendation
Quality of evidence	
I	Evidence from $\geqslant 1$ properly randomized, controlled trial
II	Evidence from $\geqslant 1$ well-designed clinical trial, without randomization; from cohort or case-control analytic studies (preferably from >1 center); from multiple time series; or from dramatic results from uncontrolled experiments
III	Evidence from opinions of respected authorities, based on clinical experience, descriptive studies, or reports of expert committees

NOTE. Adapted from the Canadian Task Force on the Periodic Health Examination.[35]

continue to shed *C. difficile* spores, but the number of spores and degree of contamination is not as great as for patients with active CDI. There are currently no data to support isolation of these asymptomatic patients.[37-39]

(b) Prolonging the duration of contact isolation for patients with CDI is recommended when CDI is not effectively controlled by the use of basic practices (see below: II. Special Approaches for the Prevention of CDI). Similarly, there are no data to indicate the efficacy of this practice at this time.

2. Ensure cleaning and disinfection of equipment and the environment (B-III for equipment and B-II for the environment).

a. *C. difficile* spores contaminate the environment in which patients are housed and the equipment used to care for them.[26,27,37-39] This includes the following:

i. Furnishings in the room, including over-bed tables, bed rails, furniture, sinks, floors, commodes, and toilets

ii. Patient care equipment that directly touches patients, such as thermometers, stethoscopes, and blood pressure cuffs

iii. "High-touch" (ie, frequently touched) surfaces, such as door knobs and intravenous fluid pumps

b. *C. difficile* appears to contaminate very few surfaces outside patient rooms.[37]

c. Contaminated surfaces and equipment are potential reservoirs for transmission of *C. difficile.*

i. Recent guidelines have outlined environmental disinfection protocols.[40] There are no US Environmental Protection Agency–registered products specific for inactivating *C. difficile* spores. Data are conflicting as to whether inactivation of spores is necessary to prevent *C. difficile* transmission, especially in a setting of endemicity.

ii. Facilities should consider using a 1 : 10 dilution of sodium hypochlorite (household bleach) for environmental disinfection in outbreak settings and settings of hyperendemicity in conjunction with other infection prevention and control measures (see below: II. Special Approaches for the Prevention of CDI). The bleach solution should have a contact time of at least 10 minutes.[41]

d. Develop and implement protocols for disinfection of equipment and the environment.

i. On a routine basis, assess adherence to protocols and the adequacy of cleaning.

ii. Assess the adequacy of cleaning before changing to a new cleaning product (eg, bleach). If cleaning is not adequate, address this before changing products (see below: II. Special Approaches for the Prevention of CDI).

iii. Because of the high turnover of housekeeping personnel, educate personnel on proper cleaning technique frequently. Ensure that education is provided in the personnel's native language.

e. Dedicate noncritical patient care items, such as blood pressure cuffs, stethoscopes, and thermometers, to a single patient with CDI.

i. When this is not possible, ensure adequate cleaning and disinfection of shared items between patient encounters. Ensure that the manufacturers' recommendations for contact time of disinfectants are followed.

3. Implement a laboratory-based alert system to provide immediate notification to infection prevention and control personnel and clinical personnel about patients with newly diagnosed CDI (B-III).

a. To place patients with CDI under contact precautions in a timely manner, it is important that an alert system be developed between the laboratory and both infection prevention and control personnel and clinical personnel caring for the patient. This alert system should immediately notify infection prevention and control and clinical personnel when a patient has newly diagnosed CDI.

b. There are a variety of methods by which this information can be transmitted, but some options include fax alerts, phone call and pager alerts, or automated secure electronic alerts.

i. The alert system should not rely on fax transmissions alone, because there may be delays from the time the transmission is received to the time it is seen by an appropriate healthcare provider.

c. Alert patient care areas of positive test results immediately, so that these patients can be placed under contact precautions.

d. When a patient has active CDI, communicate the CDI status when transferring the patient to another healthcare facility, so that appropriate precautions can be implemented at the accepting facility.

4. Conduct CDI surveillance and analyze and report CDI data (B-III).

a. At a minimum, calculate healthcare facility–onset, healthcare facility–associated CDI rates at the unit/ward and organizational levels (Table 1).[20,21]

b. Provide CDI data and other CDI prevention process and outcome measures to key stakeholders, including senior leadership, physicians, nursing staff, and other clinicians.

c. Provide the process and outcome measures outlined in the "Performance Measures" section below to appropriate hospital staff and administrators on a regular basis. The frequency with which these data are provided will depend on the hospital's existing reporting structure and the type of data collected. These data can be added to routine quality assessment and performance improvement reports.

5. Educate healthcare personnel, housekeeping personnel, and hospital administration about CDI (B-III).

a. Include risk factors, routes of transmission, local CDI epidemiology, patient outcomes and treatment, and prevention measures (including Centers for Disease Control and Prevention and World Health Organization recommendations regarding proper hand hygiene, contact precautions, and management of multidrug-resistant organisms).[34,42,43]

6. Educate patients and their families about CDI, as appropriate (B-III).

a. Although often not considered part of a program to reduce transmission of multidrug-resistant organisms, proper education may help to alleviate patient fears regarding being placed in isolation.[44]

i. Include information about anticipated questions: general information about CDI, colonization versus infection, the hospital's CDI prevention program, the components of and rationale for contact precautions, and the risk of transmission to family and visitors while in the hospital and after discharge. Helpful materials might include patient education sheets in appropriate language(s) and the use of patient education channels, Web sites, or VHS tapes and DVDs.

7. Measure compliance with Centers for Disease Control and Prevention or World Health Organization hand-hygiene and contact precaution recommendations (B-III).

a. Patient-to-patient transmission of *C. difficile* is thought to occur primarily through transient contamination of the hands of healthcare personnel with spores.

b. Glove use when caring for patients with CDI or touching surfaces in their rooms has been shown to be effective at preventing the transmission of *C. difficile.*

c. Hand-hygiene practices in compliance with Centers for Disease Control and Prevention or World Health Organization guidelines are critical to *C. difficile* control and prevention. Evidence-based recommendations for implementation and assessment of hand-hygiene programs in healthcare settings have been published.[34]

i. Area of controversy: There are concerns regarding reliance on alcohol-based hand-hygiene products, because alcohol is not sporicidal. Conversely, hand washing with soap and water is associated with much lower compliance. In settings where CDI is endemic, it appears the potential decrease in efficacy of alcohol-based hand-hygiene products for removing spores, compared with hand washing, may be offset by the increase in hand-hygiene adherence with alcohol-based hand-hygiene products, if contact precautions are followed (ie, if gloves and gowns are worn) when caring for patients with CDI.[45]

B. Accountability

1. The hospital's chief executive officer and senior management are responsible for ensuring that the healthcare system supports an infection prevention and control program that effectively prevents CDI and the transmission of epidemiologically significant pathogens.

2. Senior management is accountable for ensuring that an adequate number of trained personnel are assigned to the infection prevention and control program.

3. Senior management is accountable for ensuring that healthcare personnel, including licensed and nonlicensed personnel, are competent to perform their job responsibilities.

4. Direct healthcare providers (such as physicians, nurses, aides, and therapists) and ancillary personnel (such as housekeeping and equipment-processing personnel) are responsible for ensuring that appropriate infection prevention and control practices are used at all times (including hand hygiene, standard and isolation precautions, and cleaning and disinfection of equipment and the environment).

5. Hospital and unit leaders are responsible for holding personnel accountable for their actions.

6. The person who manages the infection prevention and control program is responsible for ensuring that an active program to identify CDI is implemented, that data on CDI are analyzed and regularly provided to those who can use the information to improve the quality of care (eg, unit staff, clinicians, and hospital administrators), and that evidence-based practices are incorporated into the program.

7. Personnel responsible for healthcare personnel and patient education are accountable for ensuring that appropriate training and educational programs to prevent CDI are developed and provided to personnel, patients, and families.

8. Personnel from the infection prevention and control program, the laboratory, and information technology departments are responsible for ensuring that systems are in place to support the surveillance program.

II. Special approaches for the prevention of CDI

Perform a CDI risk assessment. These special approaches are recommended for use in locations and/or populations within the hospital that have unacceptably high CDI rates despite implementation of the basic CDI prevention strategies listed above.

There are several unresolved issues regarding CDI prevention. This is apparent when reviewing the rankings of each recommendation on the basis of the quality of the data to support it. As a result, implementation of the recommendations beyond the basic practices to prevent CDI should be individualized at each healthcare facility. One may consider a "tiered" approach in which recommendations are instituted

individually or in groups; additional "tiers" are added if CDI rates do not improve, with implementation of basic practices as the first tier.

A. Approaches to minimize *C. difficile* transmission by healthcare personnel

1. Intensify the assessment of compliance with process measures (B-III).

a. Contact precautions: Gowns and gloves should be worn by all healthcare personnel who enter the rooms of patients under contact precautions.

b. Hand hygiene: Hand hygiene should be performed on entry and exit from patient rooms. When hand washing is performed, determine whether proper techniques are being used (eg, hand washing for at least 15 seconds).[34]

c. If hand-hygiene compliance or techniques are not adequate, conduct interventions to improve hand-hygiene compliance and techniques.

2. Perform hand hygiene with soap and water as the preferred method before exiting the room of a patient with CDI (B-III).

a. Ensure proper hand-hygiene technique when using soap and water.[34]

b. Be aware that hand-hygiene adherence may decrease when soap and water is the preferred method.

i. Additional education may be necessary to remind healthcare workers that alcohol-based hand-hygiene products are superior to hand washing for non–spore-forming organisms (eg, MRSA).

3. Place patients with diarrhea under contact precautions while *C. difficile* test results are pending (B-III).

a. To decrease transmission, it is essential to place symptomatic patients under contact precautions as soon as diarrhea symptoms are recognized.

b. If the results of *C. difficile* testing are negative, the patient has a low pretest probability of CDI, and the patient is continent of stool, contact precautions can be discontinued.

i. Because of concerns about the low sensitivity of enzyme immunoassays, clinical suspicion of CDI should outweigh negative test results for patients with a high pretest probability of having CDI.

4. Prolong the duration of contact precautions after the patient becomes asymptomatic until hospital discharge (B-III).

a. Patients may still shed *C. difficile* in their stool after diarrhea resolves.[46-48]

B. Approaches to minimize CDI transmission from the environment

1. Assess the adequacy of room cleaning (B-III).

a. If room cleaning practices are deemed to be inadequate, focus on improving room cleaning techniques.

b. Important issues to address include proper dilution of cleaning products, adequacy of cleaning technique, cleaning "high-touch" surfaces, frequency of changing rags/mop water, and moving from "clean" areas to "dirty" areas.

i. Create a checklist based on cleaning protocols and perform observations to monitor cleaning practice.

ii. Environmental culture for *C. difficile* is difficult to perform and requires specialized media; therefore, it is not routinely recommended.[49]

c. Consider environmental decontamination with sodium hypochlorite if room cleaning is deemed to be adequate but there is ongoing CDI transmission (see below).

2. Use sodium hypochlorite (bleach)–containing cleaning agents for environmental cleaning. Implement a system to coordinate with the housekeeping department if it is determined that sodium hypochlorite is needed for environmental disinfection (B-II).

a. Area of controversy: Data on the ability of diluted sodium hypochlorite or other sporicidal agents used for environmental decontamination to control CDI have not been consistent. However, a beneficial effect has been reported when bleach has been used in outbreak settings or settings of hyperendemicity, typically in conjunction with other enhanced CDI control measures.[40,50-53]

b. When diluted sodium hypochlorite is instituted for environmental decontamination, it is necessary to coordinate activities with housekeeping staff.

i. Clinical, infection prevention and control, and housekeeping staff will need to determine the location, type, and frequency of diluted sodium hypochlorite use. For instance:

(a) All rooms, only rooms of patients with CDI, or outside of patient rooms?

(b) Daily cleaning or terminal cleaning only when the patient is discharged or transferred?

c. When diluted sodium hypochlorite is used, it is important to address the following issues:

i. Avoid toxicity to patients and staff and damage to equipment and the environment from bleach use. Sodium hypochlorite can be corrosive and irritating to patients, housekeeping staff, and other healthcare personnel.

ii. The sodium hypochlorite solution must be mixed fresh daily.

d. When sodium hypochlorite will be used only in the rooms of patients with CDI, a system will need to be created to identify these patients to the housekeeping staff.

C. Approaches to reduce the risk of CDI acquisition

1. Initiate an antimicrobial stewardship program (A-II).[22,25-27,32,54,55]

a. Assess the appropriateness of antimicrobial prescribing practices.

i. Restrict antimicrobials that are strongly associated with CDI and promote appropriate antimicrobial use.

III. Approaches that should not be considered a routine part of CDI prevention

1. Do not test patients without signs or symptoms of CDI for *C. difficile* (B-II).

a. *C. difficile* toxin tests have been studied in patients with symptoms of CDI and a high pretest probability of having CDI. A positive *C. difficile* toxin test result for a patient without symptoms has a high probability of being a false-positive result.

i. Only stool culture for *C. difficile* has been confirmed to identify patients with asymptomatic *C. difficile* colonization. The sensitivity, specificity, and negative and positive prediction values of antigen and toxin assays are unknown for asymptomatic patients.

b. Obtaining stool specimens requires nursing time to collect and laboratory technician time to perform the test and report results.

c. A positive toxin test result for an asymptomatic patient may result in the initiation of unnecessary treatment for CDI, which may increase the patient's risk of developing CDI in the future.[56]

d. Do not place patients with asymptomatic *C. difficile* colonization under contact precautions.

i. Area of controversy: Previous research has demonstrated that asymptomatically colonized patients can be a source of transmission of *C. difficile* and that patients can remain colonized after symptoms cease.[38,39,47-49] However, asymptomatically colonized patients are less likely than symptomatic patients to contaminate their surrounding environment or serve as a source of transmission. In some settings, the duration of contact precautions can be extended if there is concern that asymptomatically colonized patients represent a significant source of potential *C. difficile* exposure.

e. Do not attempt to decolonize asymptomatic patients, because this has not been effective and may increase the patient's risk of developing CDI in the future.[56]

2. Do not repeat *C. difficile* testing at the end of successful therapy for a patient recently treated for CDI (B-III).

a. A positive test result may result in unnecessary prolongation of contact precautions and CDI treatment.

i. In some settings, contact precautions may be extended until hospital discharge after symptom resolution (see above). However, there are insufficient data to recommend extending the duration of contact precautions on the basis of whether *C. difficile* or its toxins can be detected in the patient's stool.

b. A positive test result at the end of therapy does not predict who will develop a recurrence or relapse.[48]

c. Repeated *C. difficile* testing does not provide any useful clinical information but requires nursing time to collect the specimen and laboratory technician time to perform the test and report results.[48]

IV. Unresolved issues

1. Use of gowns and gloves by family members and other visitors

a. The utility of requiring family members and other visitors to wear gowns and gloves to prevent *C. difficile* transmission is unknown.[57] The risk that family members and other visitors will transmit *C. difficile* between patients is likely to be related to the degree of contact the visitor has with the patient and the patient's environment, whether the visitor performs hand hygiene, and the degree of interaction the visitor has with other patients. At a minimum, family members and other visitors should be instructed to perform hand hygiene whenever entering or leaving the patient's room.

2. Standing orders or nurse-driven protocols to test all patients with diarrhea for *C. difficile*

a. Nurses frequently know, before the treating physician does, when a patient has diarrhea

3. Admitting-based alert systems that notify infection prevention and control and clinical personnel about readmitted or transferred patients with a history of CDI

a. This information can be integrated into a computerized database used during admission and registration or a separate electronic or paper-based database.

i. If an alert system is implemented, patients with a history of CDI should be placed under contact precautions if they are readmitted only if they have symptoms consistent with CDI at admission. Asymptomatic patients with a history of CDI do not require contact precautions.

ii. The duration that the alert should remain active is unknown. Nearly all cases of recurrent CDI occur within 90 days after the last episode. On the basis of this fact, it is reasonable to discontinue the alert 90 days after the last episode of CDI. However, healthcare facilities may not be aware of recurrent episodes of CDI that are diagnosed and managed in outpatient settings, so an arbitrary cutoff based on the last known episode of CDI may inadvertently remove patients with ongoing recurrent CDI.

4. Ongoing assessment of CDI knowledge and intensified CDI education among healthcare personnel

a. Re-educate staff if prior CDI training occurred more

than 12 months earlier or if overall knowledge is deemed to be inadequate.

i. Include housekeeping personnel in educational efforts.

5. Restricting the use of gastric acid suppressants[14,16]

SECTION 5: PERFORMANCE MEASURES

I. Internal reporting

These performance measures are intended to support internal hospital quality improvement efforts and do not necessarily address external reporting needs. The process and outcome measures suggested here are derived from published guidelines, other relevant literature, and the opinions of the authors. Report process and outcome measures to senior hospital leadership, nursing leadership, and clinicians who care for patients at risk for CDI.

A. Process measures

1. Compliance with hand-hygiene guidelines
   a. Preferred measure for hand-hygiene compliance
      i. Numerator: number of observed proper hand-hygiene episodes performed by healthcare personnel.
      ii. Denominator: total number of observed opportunities for hand hygiene.
      iii. Multiply by 100 so that the measure is expressed as a percentage.
   b. If hand hygiene with soap and water is the preferred method of hand hygiene when caring for patients with CDI, also assess proper hand washing techniques (minimum duration of 15 seconds).
      i. Numerator: number of proper hand washing episodes with proper technique.
      ii. Denominator: total number of hand washing episodes observed.
      iii. Multiply by 100 so that the measure is expressed as a percentage.

2. Compliance with contact precautions
   a. Preferred measure of contact precautions compliance
      i. Numerator: number of observed patient care episodes in which contact precautions are appropriately implemented.
      ii. Denominator: number of observed patient care episodes in which contact precautions are indicated.
      iii. Multiply by 100 so that the measure is expressed as a percentage.

3. Compliance with environmental cleaning
   a. One specific measure of compliance for use in all hospitals cannot be recommended. However, many hospitals use checklists and environmental rounds to assess the cleaning process and cleanliness of equipment and the environment (see above).

B. Outcome measures

Perform ongoing measurement of the incidence density of CDI to permit longitudinal assessment of the processes of care.

1. CDI rates should be calculated according to the recently published recommendations and as described above.[20,22]
   a. See Table 1 for case definitions.
      i. Numerator: number of CDI cases in the population being monitored (the specific cases included in the numerator depends on the definition used; see Table 1).
      ii. Denominator: total number of patient-days in the population being monitored.
      iii. Multiply by 10,000 so that measure is expressed as number of cases per 10,000 patient-days.
   b. To convert the rate per 10,000 patient-days to 1,000 patient-days, divide the rate by 10 (conversely, to convert a rate from 1,000 patient-days to 10,000 patient-days, multiply the rate by 10).

II. External reporting

There are many challenges in providing useful information to consumers and other stakeholders while preventing unintended adverse consequences of public reporting of healthcare-associated infections.[58] Recommendations for public reporting of healthcare-associated infections have been provided by the Hospital Infection Control Practices Advisory Committee,[59] the Healthcare-Associated Infection Working Group of the Joint Public Policy Committee,[60] and the National Quality Forum.[61]

Given the absence until recently of standardized CDI surveillance definitions and the difficulties in ascertaining the specific time and location of *C. difficile* acquisition, specific recommendations for external reporting of CDI rates cannot be made at this time.

A. State and local requirements

1. Hospitals in states that have mandatory reporting requirements for CDI must collect and report the data required by the state.

2. For information on local requirements, check with your state or local health department.

B. External quality initiatives

1. Hospitals that participate in external quality initiatives must collect and report the data if required by the initiative.

ACKNOWLEDGMENTS

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SAFE from CDI

Early Recognition

Patient Safety

Steps to take if patient has or develops diarrhoea (types 5-7 Bristol Stool Chart)

You can use this list to ensure all necessary steps are taken by ticking off each action as it is taken

ACTION	SIGNED	DATE
Assess patient to determine severity and likely cause		
Review drug chart & stop antibiotics unless essential		
Stop laxatives		
Implement Bristol stool chart to monitor severity		
Implement fluid balance chart		
Isolate or cohort patient UNLESS outbreak/ Norovirus suspected (contact Infection Control Team		
Inform Infection Control Team if 2 or more patients or any staff member affected		
Send stool specimen to microbiology (and virology if Norovirus likely)		
Use gloves and aprons for all patient contact		
Use soap and water for hand washing (not alcohol gel)		
Consider starting treatment for CDI if *C. difficile* likely cause (see algorithm for severity assessment)		
If laboratory result is *C. difficile* positive complete Patient Checklist		

Surname:
Forename:
Date of birth:
Hospital No:

Ward: _____

Sheet No: _____

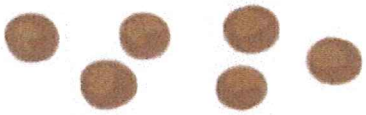
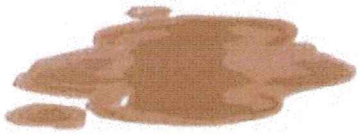
STOOL ASSESSMENT

Bristol Stool Chart

Type 1  Separate hard lumps, like nuts (hard to pass)	Type 2  Sausage-shaped but lumpy
Type 3  Like a sausage but with cracks on its surface	Type 4  Like a sausage or snake, smooth and soft
Type 5  Soft blobs with clear-cut edges (passed easily)	Type 6  Fluffy pieces with ragged edges, a mushy stool
Type 7  Watery, no solid pieces. **Entirely Liquid**	Reproduced by kind permission of Dr KW Heaton, Reader in Medicine at the University of Bristol

Date	Time	Colour	Type No	Blood	Mucus	Amount	Comments	Initials

Appendix D: Bristol Stool Chart

Type 1		Seperate hard lumps, like nuts (hard to pass)
Type 2		Sausage-shaped but lumpy
Type 3		Like a sausage but with crakes on its surface
Type 4		Like a sausage or snake, smooth and soft
Type 5		Soft blobs with clear cut edges (passed easily)
Type 6		Fluffy pieces, a mush stool
Type 7		Watery, no solid pieces ENTIRELY LIQUID

Adapted from: Lewis, S.J., Heaton, K.W., *Stool form scale as a useful guide to intestinal transit time*. Scand. J. Gastroenterol, 1997. **32** (9): 920–4.

Clostridium difficile Infection (CDI) Do's and Don'ts for Diagnostic Testing

Guidance for stool collection and submission

DO's	DON'Ts
Submit fresh stool samples for CDI testing from patient with suspected CDI: ≥3 unformed stools per 24 hours.	Test asymptomatic patients for CDI.
Avoid repeat testing; submit one specimen per patient.	Perform tests-of-cure on any patients post-treatment.
Retest for CDI only if CDI symptoms continue or recur after 10 days of treatment.	Conduct repeat testing during the same episode of diarrhea for confirmed CDI patient.
Refrigerate (store at 2 - 8 degrees Celsius) until tested stool specimen until testing can be done.	Transport specimen in media, this may increase false positive test results.
Collect specimen in clean, watertight container.	Wait to transport specimens, transport specimens as soon as possible after collection.
Consider diagnoses other than CDI first for patients 1-2 years; if no recent antimicrobial exposure, use more than one diagnostic test (include culture).	Routinely test for CDI in patients <1 year of age.

No single best laboratory testing scheme for the diagnosis of CDI has been established. The Society for Healthcare Epidemiology Association have recommended combining tissue culture cytotoxin testing with stool culture for optimal diagnostic sensitivity (culture) and specificity (cytotoxin assay).

Norovirus infection is not a reason to exclude CDI as diagnosis, as coinfection with norovirus and *C. difficile* is possible. Norovirus infection may predispose the patient for developing CDI as the normal gut flora is disturbed by the norovirus infection. When a patient has tested positive for both *C. difficile* toxin and norovirus a clinical assessment is required to determine the most likely diagnosis.

Resources

Cohen SH, Gerding DN, Johnson S, et al. Clinical Practice Guidelines for Clostridium difficile Infection in Adults: 2010 Update by the Society for Healthcare Epidemiology of America (SHEA) and the Infectious Diseases Society of America (IDSA). Infect Control Hosp Epidemiol. 2010 May;31(5):431-55.

APIC. Guide to the Elimination of *Clostridium difficile* in Healthcare Settings. 2008. Available at: http://www.apic.org/Content/NavigationMenu/PracticeGuidance/APICEliminationGuides/C.diff_Elimination_guide_logo.pdf.

Gerding DN, Johnson S, Peterson LR, Mulligan ME, Silva J Jr. Clostridium difficile-associated diarrhea and colitis. Infect Control Hosp Epidemiol. 1995;16(8):459-477.

Methodist Hospital

PROCEDURE

TOPIC: Identification of *Clostridium Difficile* Patients **DATE:** 12/06

AUTHOR: Infection Control Services **REVISION DATE:** 5/07, 7/07

SERVICE/DEPARTMENT: Nursing

***PURPOSE*:**
To ensure early identification and treatment for patients and minimize risk of nosocomial transmission of *Clostridium difficile* colitis.

GENERAL INFORMATION:
1. The nurse can order and collect stool for *Clostridium difficile* toxin using COE.
2. Patient hospitalized at Methodist Hospital fulfilling the following criteria will undergo testing for *Clostridium difficile* toxin.
3. Criteria for ordering LAB *Clostridium difficile* toxin A&B:
   a. Patient has greater than 3 diarrheal stools in 24 hours **AND** one of the following risk factors:
      1. On or has received antibiotic therapy within the last 3 months or
      2. History of *Clostridium difficile* infection or
      3. Elevated White Blood Count or Fever
   b. **Exception:** This does not include patients anticipated to have diarrheal stools following bowel surgery or bowel mobility medication.

EQUIPMENT/SUPPLIES NEEDED:
Clean gloves
Sterile specimen container

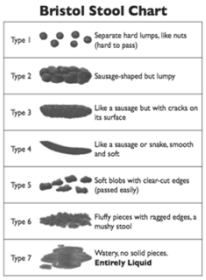
PROCEDURE:
1. Order a *Clostridium Difficile* toxin screening test
2. Use Lab order name: LAB *Clostridium dificile* toxin A&B
   Ordering clinician: Dr. Leslie Baken (2381)
   Signing clinician: attending MD.
3. Obtain 5 milliliters/ 1 gram or more of unformed stool and place in sterile specimen container. Send to laboratory.
4. Notify attending physician that stool sample for *Clostridium difficile* has been submitted to the laboratory.
5. Positive test results should be called or e-paged to the attending clinician, and patient should be placed in Enteric Contact Isolation.

Approved by Medical Director of Infection Prevention & Control Service

Reduction Strategies

1) Early Recognition
   - Suspect CDI in anyone who is admitted with diarrhea or develops diarrhea of undetermined cause
   - People can develop symptoms from 2 or 3 days to one month after exposure to the bacteria

Bristol Stool Chart



- Types 5 – 7 are considered diarrhea for purposes of lab testing
- The stool specimen should change form if the container is tipped to the side (it should not be formed).

CDI Nurse's Charting

- For known CDI
  - Initial Interview – chart under "resistant micro-organisms" section
  - Initial Physical Assessment – loose stools charted under GI section
  - Daily Flow Sheet – Chart pertinent information under Isolation section

CDI Nurse's Charting (cont)

- When patient develops 3 or more loose stools in 24 hours:
  - Chart in daily flow chart in GI section.
    - There is a new pre-defined answer ">3 loose stools in 24 hours"
    - This will send a message to the med-act and notify the Infection Preventionist.
  - The nurse must then contact the physician with this information to obtain an order for CDI testing.

Pediatric CDI testing

- Patients <1 year of age should not be routinely tested.
- For patients 1-2 years of age, consider other diagnoses other than CDI first. If no recent antimicrobial exposure, use more than diagnostic test (include culture).
- For patients > 2 years of age with recent antimicrobial exposure, test and treat as adults.

LIFECARE MEDICAL CENTER POLICY AND PROCEDURE

Department: Laboratory
Subject: Specimen collection (non-blood)

Prepared by: N. Mostofi MT (ASCP)
Approved by: A. M. Cooley MD

EXPLANATION

Properly collected and labeled samples by lab or nursing staff will result in accurate and timely test result. To follow national patient safety guidelines each sample must be collected according to recommendations provided by the test manufacturer.

LABELING

All specimens must be labeled at the bed side (per TJC standard NPSG 01.01.01).
All specimens must be labeled with the following:

1. Two patient identifier such as name, date of birth, and or medical record number.
2. Time and date of collection.
3. Collector's initial.

STREP A

Swab: BBL Culture Swab (red with twin shaft) this swab contains liquid Stuart media).
Site: Throat and tonsils, press and role swab again the back of the throat or the tonsils.
Storage: Room temp.

RSV

Swab: Pur-Wraps (sterile polyester tipped applicator with aluminum shaft).
Site: Nasopharyngeal area. Carefully insert the swab into the nostril and using gentle rotation, push the swab into the posterior nasophaynx. Gently rotate the swab 3 times and then remove.
Storage: Room temp.

INFLUENZA A&B

Swab: Pur-Wraps (Sterile FOAM tipped applicator) for in-house testing. You may use the Pur-Wrap (aluminum shaft for recollection and referral to Department of Health)
Site: Nasopharyngeal area. Carefully insert the swab into the nostril that presents the most secretions under visual inspection. Keep the swab near the septum floor of the nose while gently pushing the swab into the posterior nasopharynx. Gently rotate the swab several times and then remove.
Storage: Room temp

MRSA SCREEN

Swab: BBL Culture Swab (red with twin shaft) this swab contains liquid Stuart media).

Site: Preferable site is the anterior nares. For best result, moisten swab with transport media prior to sample collection.
Temp: Room temp.

STOOL FOR C-DIFF TOXIN
Container: Any sterile container.
Stool sample:
1. Unformed stool (loose) sample
2. Fresh in sterile cup (with no other additives)
3. Delivered to lab ASAP (during evening and night shift, please notify lab staff of the sample).

Rejection criteria:
1. Formed stool.
2. Rectal swab.
3. Stool collected in any culture or ova and parasite transport containers.
4. Stool mixed with excessive urine.
5. Specimens that are not labeled properly (see above).

Storage: Deliver to lab ASAP. Inform lab techs so the sample can be processed without any delay. If testing is not done immediately, the sample must be refrigerated (good for 5 days).

CSF
Please notify lab of the CSF sample being collected so they can be ready for immediate testing.
Container: CSF collection kit (obtain from materials management).
Site: Spinal tap.
Storage: Room temp, deliver to lab immediately (this test is performed ASAP).

BODY FLUIDS OTHER THAN CSF
Container: Any sterile container.
Site: Any site other than spinal fluid
Storage: Room temp.

URINE
Container: Sterile urine collection container.
Specimen: Clean catch or Cath urine (please indicate on specimen container if it is cath urine.
Storage: Room temp (refrigerate if techs not available to setup immediately).

OTHER ROUTINE CULTURE SITES
Swab: BBL Culture Swab (red with twin shaft) this swab contains liquid Stuart media)
Sites: Wound, Eye, Ear, Throat, Genital, etc.

Storage: Room temp.

UNUSUAL SITES AND CULTURE
Please contact lab staff for appropriate collection device and delivery.

Pp/Lab/Specimen collection guide non-blood
Original date: 1/22/10
Review and revised: 1/31/11nm 2/11nm

CDI RECOGNITION & ENVIRONMENTAL MANAGEMENT

Patient has Diarrhea
The passage of 3 or more unformed stools within a 24-hour period due to an unknown causation, long term antibiotic use and/or chemotherapy.

Notify physician. Obtain order from physician for lab work.

Place in contact enteric precautions with appropriate signage including hand washing with soap & water.

Positive C-Diff
Or unknown test results
* See below

Negative C-Diff

Patient in **double** room

- Remove uninfected patient to private room
- Infected patient may remain in room or may consider move to room 4 or 5
- If private rooms are unavailable, may cohort two +C-Diff patients

Patient in single room

- Remain in contact enteric precautions with hand washing sign posted for duration of hospital stay or until precautions are removed per guidelines below
- Instruct patients to wash their hands with soap and water
- Instruct visitors to wash their hands with soap and water upon entry and exit of patient's room
- Document completion of education with patient and visitors

Unexplained diarrhea

- Contact precautions

Non-infectious, explained diarrhea (IBS, Meds)

- Remove contact enteric precautions
- Standard precautions required

- If patient is moved or discharged, notify Housekeeping to perform terminal cleaning per their policy

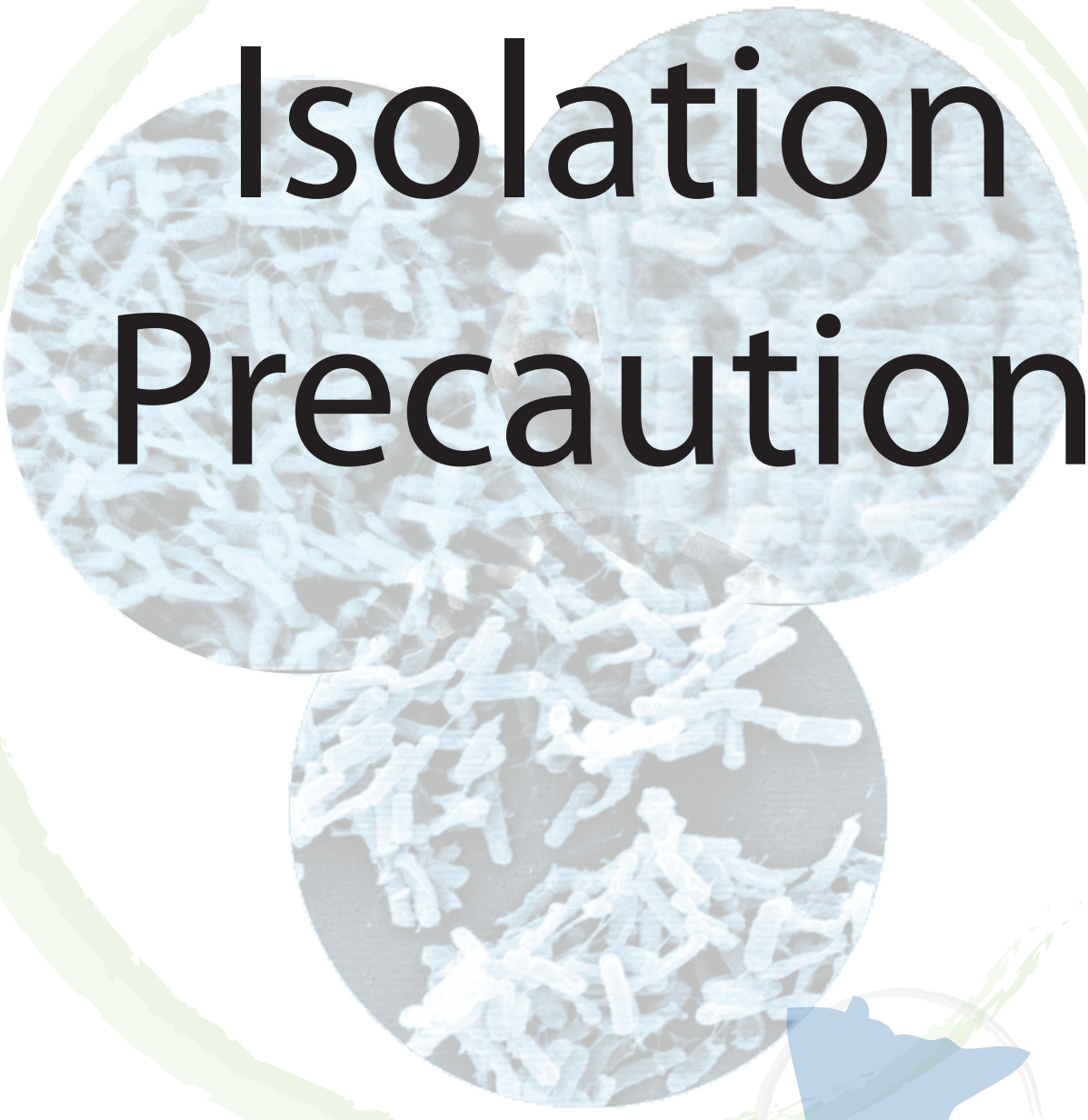
Discontinue Precaution Guideline: If you want to discontinue the contact enteric precautions for the patient who has tested positive to C-Diff but is no longer having loose stools or has had no stools for >48 hours, the patient must be transferred to a new room and the original room as well as the associated medical equipment must be completely cleaned using a sporicidal solution. Clothing and personal items should be bagged and brought home for cleaning.

* In all cases, signage needs to remain at the door until cleaning is complete so that housekeeping is aware and room is cleaned properly.
* Collaboration will occur between charge nurse and housekeeping to allow appropriate time for room to be cleaned. Contact enteric precaution rooms should never be cleaned on a stat basis.

LifeCare Medical Center

SAFE from CDI

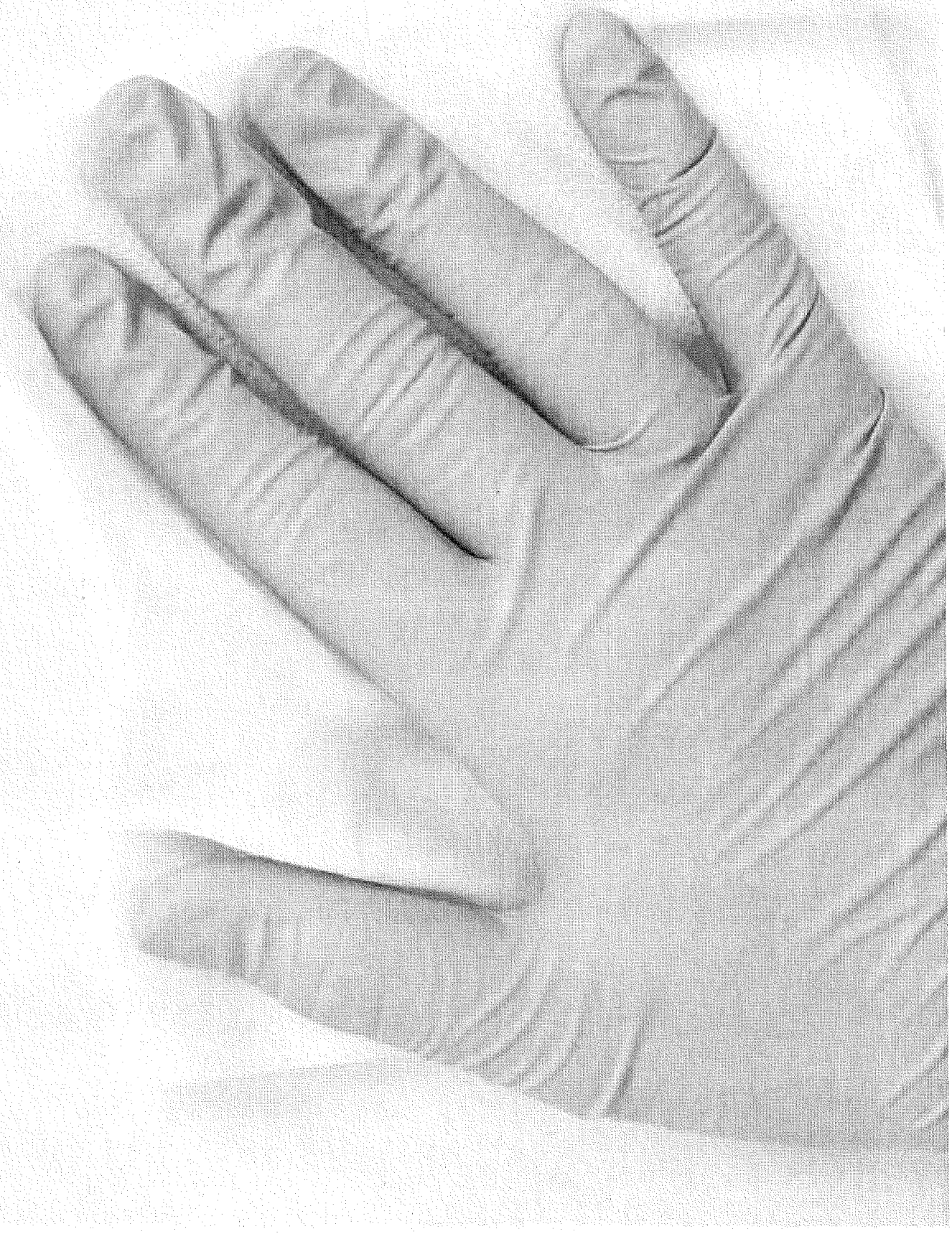
Isolation Precautions



Patient Safety

Clostridium Difficile

PREVENTION GUIDE



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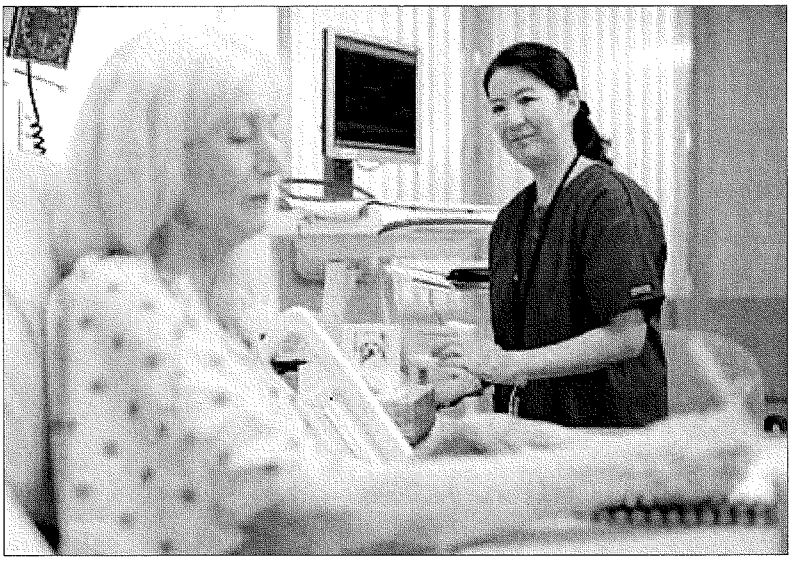
Introduction: About Healthcare-Associated Infections

Healthcare-Associated Infections, or HAIs, affect up to 2.4 million patients in U.S. hospitals every year. They are estimated to account for 100,000 deaths annually.[1] In addition, HAIs can be costly to a hospital and its reputation.

According to economist R. Douglas Scott II of the Centers for Disease Control and Prevention (CDC), the annual direct medical costs of HAIs to U.S. hospitals range from $35.7 billion to $45 billion for inpatient hospital services.[2] In 2008, legislation eliminated the Centers for Medicare and Medicaid Services (CMS) reimbursement for many HAIs over and above the typical Inpatient Prospective Payment System (IPPS) rate.[3]

Broader awareness of the problem—and increased pressure on healthcare facilities to prevent HAIs—is growing as public reporting of HAI data has become mandated. Currently, public reporting has broad support among many state governments, healthcare regulatory agencies and trade groups:[4]

- As of February 2011, 28 states have implemented public reporting laws
- Centers for Disease Control and Prevention (CDC)
- Association of Professionals in Infection Control and Epidemiology (APIC)
- Society of Healthcare Epidemiology of America (SHEA)
- Infectious Diseases Society of America (IDSA)
- Council of State and Territorial Epidemiologists (CSTE)



1. "Infection Prevention Products and Services: Industry Study 2526," The Freedonia Group Inc., August 2009.
2. "The Direct Medical Costs of Healthcare-Associated Infections in U.S. Hospitals and the Benefits of Prevention" (http://www.cdc.gov/ncidod/dhqp/pdf/Scott_CostPaper.pdf)
3. "Inpatient Prospective Payment System (IPPS) Fiscal Year (FY) 2009 Final Rule" 7/31/2008. (https://www.cms.gov/HospitalAcqCond/06_Hospital-Acquired_Conditions.asp#TopOfPage)
4. Public Reporting of Hospital Acquired Infections (http://www.healthwatchusa.org/downloads/PR-HAI-2010-Support-Document.pdf)

About *Clostridium difficile*

Clostridium difficile **(or C. difficile) is a spore-forming bacterium found in the intestines that causes a variety of symptoms, from diarrhea to more serious, life-threatening intestinal disease.**

A survey by the Association for Professionals in Infection Control (APIC) found that the *C. difficile* incidence rate of 13 out of every 1,000 inpatients either infected or colonized with *C. difficile* is 6.5 to 20 times greater than previous incidence estimates.[5]

Dr. Becky Miller of Duke University Medical Center has found that, in a recent study of 28 Southeast hospitals, *C. difficile* has surpassed methicilin-resistant *Staphylococcus aureus* (MRSA) as the most prevalent cause of HAIs. *C. difficile* was found to be 25% more common than MRSA.[6] The CDC estimates that 28,000 deaths annually are caused by *C. difficile* bacteria. In addition, *C. difficile* exacts a financial toll on healthcare facilities. Economist R. Douglas Scott II of the CDC conservatively estimates the cost per case of *clostridium difficile* infection (CDI)—not including operating room costs—to range from $5,042 to $7,179.

Environmental Transmission

C. difficile bacteria is found in feces and can be transmitted by hand to frequently touched surfaces such as bedding, toilets, bedpans, light switches and grab bars. People can become infected if they touch contaminated surfaces or items and then touch their mouths or mucous membranes.

Who is at risk?

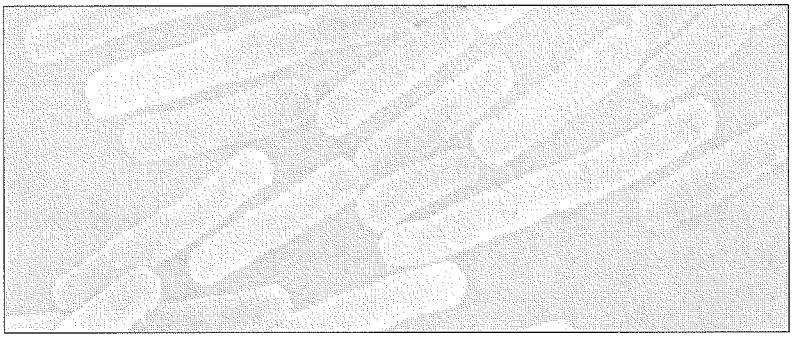
The risk of contracting *C. difficile* increases in the elderly and in patients with previous antibiotic use, gastrointestinal surgery, serious underlying illness, immunocompromising conditions and long stays in healthcare settings such as hospitals, nursing homes and other healthcare institutions.

Decontamination of environmental surfaces

C. difficile spores are resistant to many commonly used disinfectants, sanitizers and cleaning agents, including alcohol-based hand sanitizers. Because *C. difficile*-infected patients can contaminate their environment and the spores can persist on surfaces for months, adherence to the CDC "Guidelines for Environmental Infection Control in Healthcare Facilities" is critical to help reduce the spread of *C. difficile* spores. Multiple studies have shown sodium hypochlorite bleach to be an effective disinfectant against *C. difficile* on surfaces.

The role of proper hand hygiene

Washing hands with non-antimicrobial or antimicrobial soap and water may help to physically remove spores from the surface of contaminated hands. Healthcare workers should be encouraged to wear gloves when caring for patients with *C. difficile*-associated diarrhea.[7]



5. Association for Professionals in Infection Control, "Intestinal Infection Afflicts 13 of 1,000 Hospital Patients; Infection Rates 6.5-20 Times Greater Than Previous Estimates, New Study Says," November 11, 2008. APIC Elimination Guide, "Guide to the Elimination of *Clostridium difficile* in Healthcare Settings" 2008.
6. "Lesser-known C. diff a bigger hospital threat than MRSA?," *USA Today*. March 22, 2010.
7. "Guideline for Hand Hygiene in Healthcare Settings." (http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5116a1.htm).

Step 1: Getting Started

1.1 Making the Financial Case with a *C. difficile* Cost Calculator

Implementing a comprehensive program can help prevent *C. difficile* in your facility. Doing so often requires gaining senior leadership approval for additional resources (labor and/or disinfecting products).

To place additional upfront expenses in perspective, the calculator below can help you assess how costly *C.difficile* infections can be to your facility—and discover the positive savings impact a bundled program can have. Additional resource expenditure upfront may help your facility save significant funds down the road.

Research suggests that implementing a multi-tiered approach, including, but not limited to, staff education, antibiotic stewardship and surface disinfection using a 1:10 dilution of sodium hypochlorite bleach (consistent with CDC guidelines) can help reduce CDI rates.

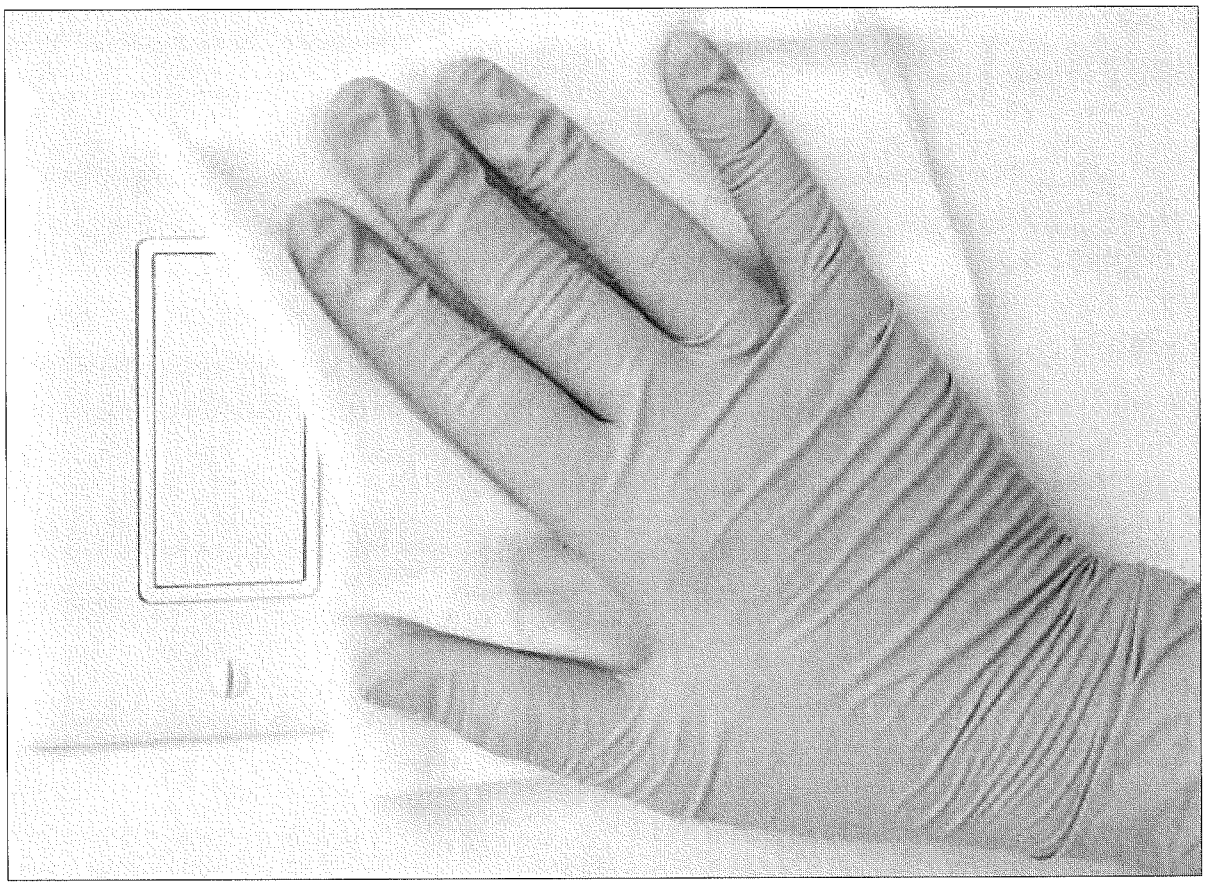
	Example	Your Organization
Cases of *C. difficile* per 10,000 patient days[8]	12.1	= $
	X	X
Estimated per case cost to facility, excluding surgical costs[9]	$5,042 - $7,719	$5,042 - $7,719
Estimated cost to facility per 10,000 patient days	$61,008 - $93,400	= $
	X	X
Potential decrease in CDI cases[10]	Up to 83%	Up to 83%
Potential savings per 10,000 patient days	$50,636 - $77,522	= $

8. Sohn S, Climo M, Diekema D, et al. "Varying rates of *Clostridium difficile*–associated diarrhea at prevention epicenter hospitals." Infect Control Hosp Epidemiol 2005; 26:676-679.
9. Dubberke ER, Reske KA, Olsen MA, McDonald, LC, Fraser VJ. "Short- and-long-term attributable costs of *Clostridium difficile*-associated disease in non-surgical patients." Clinical Infectious Diseases 2008; 46: 497-504.
10. McMullen KM, Zack J, Coopersmith CM, Kollef M, Dubberke E, and Warren DK. "Use of hypochlorite solution to decrease rates of *Clostridium difficile*-associated diarrhea." Infect Control Hosp Epidemiol 2007; 28:205-7.
    Mayfield JL, Leet, T, Miller J and Murdy LM. "Environmental Control to Reduce Transmission of *Clostridium difficile*." Clin Dis 2000; 31:995-1000.
    Note: success may vary per facility based on a number of factors.

1.2 Reinforcing Institutional Collaboration

A successful CDI initiative begins with teamwork between Infection Prevention and Environmental Services (EVS) staff at kickoff. Key steps to successful collaboration include, but are not limited to:

1. Alignment across functions on the common problem faced in your facility
2. Gaining administrative approval on priority setting and resource expenditure (labor, product expense)
3. Assigning a project manager to draft a project plan across functions—key decision point is IP/EVS alignment on disinfectant active/product and where it will be used
4. Measuring baseline data (which subsequent data will be measured against)
5. Setting common goals to keep collective "eye on prize" and "focus on being successful"
6. Working as a team to drive results



1.3 Addressing Concerns Associated with Bleach Usage

To drive overall program compliance and success, it can help to proactively address two concerns associated with bleach usage—the salt residue that bleach can leave on surfaces and bleach's odor (which is augmented when it comes into contact with soils).

Addressing your team's potential concerns with constructive solutions can help avoid mission creep and reinforce your credibility.

1. Addressing Residue

The "residue" sometimes seen on shiny surfaces disinfected with bleach is salt. The residue can be simply wiped away with a clean damp cloth. A simple way to address the residue is to instruct EVS staff to keep a water bucket and clean cotton wipes on their carts to wipe away residue if needed.

2. Addressing Bleach's Odor

It is important to proactively address any potential concerns your EVS team might have about bleach's odor in several ways:

- Offer mitigation steps—masks, fan usage—to team members if requested.
- Arrange for colleagues in Infection Prevention to speak with the team to assure them that there are no long-term respiratory effects associated with using bleach, when it is used as directed.

Clinical studies on bleach odor

With regard to bleach odor, multiple leading hospital studies have noted that when patients and Environmental Services' personnel were exposed to bleach, little or no concern about the odor of bleach was expressed.

- At Barnes-Jewish Hospital (St. Louis), an 18-month study was conducted demonstrating 1:10 bleach's efficacy against *C. difficile* spores as part of a bundled program. The authors noted that "during the study, patients, family and staff did not complain about the odor of bleach."[11]
- At Cleveland Veterans Affairs Medical Center, during a five-and-a-half month study involving routine use of 1:10 bleach as part of a tiered program with documented decreases in *C. difficile* incidence, authors found that "EVS reported no surface damage or complaints due to use of bleach."[12]
- A Mayo Clinic study on patient and staff tolerance of bleach wipes reported: "Most (67.6 %) patients were in their rooms while ESE cleaned with bleach wipes, and of those only a few (8.8 %) noticed odor with the germicidal bleach used for cleaning. None of these patients found the odor bothersome."[13]

11. J. L. Mayfield et al., Clinical Infectious Diseases 2000; 31:995-1000.
12. B.D. Eckstein et al. BMC Infectious Diseases 2007, 7:61.
13. Aronhalt, K. "Patient and Environmental Service employee satisfaction and tolerance of using germicidal bleach wipes for patient room cleaning to reduce transmission of *Clostridium difficile* infection" 2010. Study presented at the Association for Professionals in Infection Control (APIC) Annual Meeting, New Orleans, Louisiana.

Step 2: Focus on the Frontline Activities as Part of a Tiered Approach to *C. difficile*

A bundled Infection Prevention program has been shown to be effective in fighting HAIs, especially *C. difficile*, versus a single approach. Examples of comprehensive program bundles for *C. difficile* include: APIC "Guide to the Elimination of *C. difficile* in Healthcare Settings" and Minnesota Department of Health's "Safe from CDI" initiative.

Within a bundled program, five frontline activities are important steps to addressing *C. difficile* on an immediate and day-to-day basis. The next sections of this toolkit will discuss how to best implement the environmental cleaning and disinfection component.

Frontline Activities

Step	Activity	Detail
2.1	Rapid Identification of Potential CDI Patients	• Prompt confirmatory testing should be executed as soon as possible • Implement easy-to-follow procedures—such as a color-coded door card system—to clearly delineate Isolation rooms from general patient rooms
2.2	Isolation Precautions	• Patients with diarrhea and coming from long-term care facilities should be isolated prior to confirmatory testing
2.3	Hand Hygiene Procedures	• Proper hand hygiene by all personnel prior to, during and following patient interaction and environmental disinfection is critical *Note: Remember that alcohol-based hand santizers are not effective against C. difficile spores.*
2.4	Barriers	• Environmental Services should don appropriate Personal Protective Equipment (PPE) prior to entering patient room
2.5	Environmental Cleaning and Disinfection	• See next section "The 4 Key Success Drivers" for implementation of best practices.

Best Practice: Choose the right product

An important element of a successful *C. difficile* prevention bundle is to use a proven EPA-registered disinfectant for environmental cleaning and disinfection. Multiple studies have proven that 1:10 sodium hypochlorite bleach is effective in killing *Clostridium difficile* spores. Among these are:

- Brigham & Women's Hospital (Boston): Implementation of the SHEA-IDSA bundle—including use of DISPATCH® for patient room cleaning/disinfection—reduced healthcare-associated CDI incidence by 40%. Results were sustained for 21 months after implementation of bundle.[14]
- The Cleveland Veterans Affair Medical Center: A bundled infection prevention program that included a 1:10 bleach (DISPATCH®) solution for routine disinfection of high-touch surfaces reduced positive CDI rates by 67%.[15]

14. S.K. Abbett et al., Infect. Control Hosp. Epidemiology, 2009; 30:1062-1069
15. B.D. Eckstein et al. BMC Infectious Diseases 2007: 7:61

Step 3: 4 Key Success Drivers for Disinfection of *C. difficile* Spores

As part of an integrated *C. difficile* initiative, four key drivers for successful, day-to-day environmental infection prevention have been identified.

	Key Driver	Elements
3.1	Education and Training of EVS Staff	1. Communicate and prioritize Environmental Services key role in preventing infection 2. Set clear objectives—achieving high-quality outcomes in appearance and infection prevention 3. Provide specific training tools—checklists, protocols and just-in-time (JIT) job aids
3.2	Competency & Verification *(for New Hires and Annually)*	1. Disinfecting technique demonstration and return demonstration 2. Written competency testing for: • Disinfecting process and techniques • Policy and procedures 3. Verification (60 days—new hires and annual) Practice vs. Procedure observation in occupied patient room and at discharge
3.3	Proper Disinfecting Process *(applying disinfectant actives to the surface at the intended dilution)*	1. Best Practice: Use Clorox® Germicidal Wipes as an optimal closed-bucket system with minimal variability achieving maximum process capability. • Keep lid closed on wipes when not in use • Change wipe when unable to achieve appropriate wet contact time and when visibly soiled Benefit: Improved staff safety—reduced splash hazard Benefit: Yields zero probability of the reintroduction of microorganisms back into the environment after the laundry process 2. An open-bucket system adds variation to process and is not preferred because: • Diluted disinfectant must be changed often to maintain stability • Measuring and mixing disinfectant solution opens risk of human error • Risks potential double-dipping or re-dipping of wipes • Disinfectant may not be compatible with wipes • Wipes may not be changed as frequently if/when unable to achieve appropriate wet time or visibly soiled
3.4	ATP science-based Evidence on Surface Cleanliness	1. Develop an Antimicrobial Testing Plan to regularly perform surveillance of surface cleanliness and disinfection. • Objective assessments of surface cleanliness • Science-based evidence on surface cleanliness 2. This is one of several key areas of collaboration between Infection Preventionists, Environmental Services and Infectious Disease.

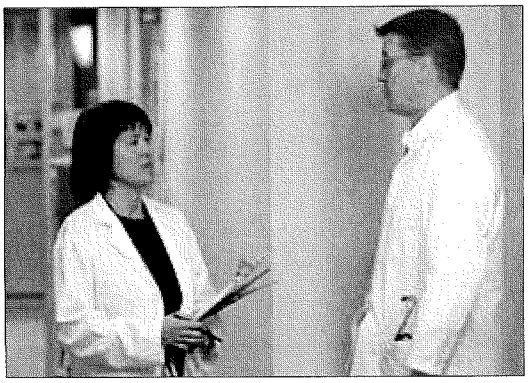
Step 3.1 1st Key Driver: Education and Training

Devoting proper time and detail to EVS education and training is important to a successful infection prevention program. The following steps—and corresponding toolkit resources—are recommended:

Step	Recommendation — What	How	Resources Provided in Kit
1	Communicate and prioritize EVS key role in infection prevention	• Schedule 2-3 days of onboard training including detailed review of protocols • Discuss the "big picture" including EVS role in helping to save lives	• HAIs and *C. difficile* overview
2	Set clear objectives	• Appearance (cleaning) • Infection Prevention (disinfection)	• Per your facility's objectives
3	Provide specific training tools—checklists, protocols and JIT job aids	• Clear disinfecting protocols for occupied, discharge and isolation rooms • Just-in-time job aids for high-touch surfaces	• Checklists and protocols

Best Practice: Tribal leadership

For Environmental Services managers, tribal leadership can play a role in driving optimal buy-in to the team's mission and day-to-day execution. The following elements of tribal leadership may support your leadership style:



- Build trust and enduring bonds with your team from day one. This starts in the initial training session by communicating staff's critical role in preventing infection and by providing them with the information and tools to succeed.
- Manage a flat organization. Treat everyone equally, from your most senior to your newest employee.
- Roll up your sleeves and join them on the frontline.
- Recognition is critical to achieve staff buy-in, ownership and pride: upon success with a CDI initiative, one EVS manager invited his entire team to the boardroom for lunch. Gestures such as these can help a team feel involved.

Step 3.2 2nd Key Driver: Competency and Verification

Training and measurement of competency feed a cycle of continuous improvement in an Environmental Services organization and ensure that the team is aligned to the fundamental elements of the job.

Step	Recommendation	Activity	Resources Provided
1	Disinfecting Technique and Return Demonstration	• Show cleaning procedure and product demonstration • Demonstrate product usage in room during initial training	• Protocols to use for demonstration
2	Written Competency Testing in: a. Disinfecting Process and Techniques b. Policy and Procedures	• Provide multiple choice and open-ended quizzes at onboard training and annually • Topics include disinfectants/chemicals used in facility, and cleaning process and protocols for occupied and discharge settings • 100% required to pass	• Compliance quizzes
3	Verification (60 days—New Hires and Annual) Practice vs. Procedure Observation in Occupied Patient Room and at Discharge	• New employees shadow veteran employees—and are shadowed—for initial 2 weeks on job, prior to being able to work independently • Annual testing • Spot-check shadowing of all employees is done during first 60 days of employment and annually—"Trust but verify"—by EVS supervisor	• Protocols and checklists to use while shadowing

Best Practice: Regular compliance audits

Engaging EVS supervisors to shadow and audit disinfecting practices of all staff is an excellent way to drive compliance.

Step 3.3 3rd Key Driver: Disinfecting Process Design

It is critical to ensure your team is applying the disinfectant active to the surface at the intended dilution for the required contact time.

To do so, select a disinfecting process with less variation. A closed-bucket system, such as using Clorox® Germicidal Wipes, can offer less variation—and labor for mixing—than an open-bucket system. Below is a table that compares elements of the two systems.

	Variation Detail	Closed-Bucket, e.g., Clorox® Germicidal Wipes	Open-Bucket
1	Dilution of Active	None	Possible if active not changed
2	Measuring or Mixing	None	Often Required unless using a pre-mixed 1:10 solution such as DISPATCH® Hospital Cleaner Disinfectant with Bleach
3	Wiper Compatibility with Active	Non-issue	Possible—requires managing
4	Change Wipe if/when Unable to Achieve Appropriate Wet Contact Time or When Visibly Soiled	Yes	Yes
5	Double-Dipping or Re-Dipping of Wiper	No	Yes
6	Staff Safety Concerns via Splashing	No	Yes
7	Potential to Reintroduce Microorganisms Back into Environment After Equipment Laundry Process	No	Yes

Best Practice: Recommendations for using Clorox® Germicidal Wipes most effectively

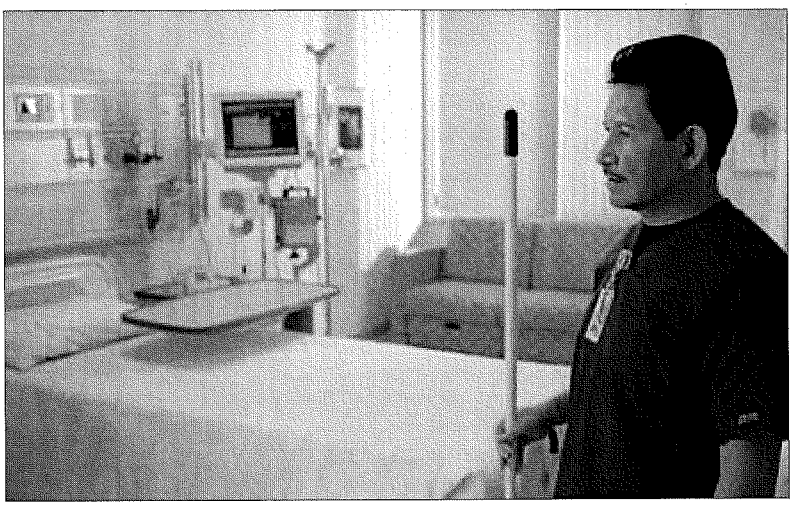
1. Keep lid of container closed when not pulling out wipe.
2. Apply to a surface, achieving a deep wet glare—a potential sign of maximum wet contact time.
3. Change wipe when unable to achieve appropriate wet contact or if visibly soiled.
4. Upon opening refill pouches, transfer wipes to bucket container to avoid wipes' prematurely drying out.

Step 3.4 4th Key Driver: ATP Surface Hygiene Testing for Monitoring

A regular surface disinfection surveillance program objectively measures surface cleanliness and disinfection. For this task, automated adenosine triphosphate (ATP) testing devices output results based on the U.K. Pass/Fail benchmark setting <250 RLU. If such as program is not available to your facility, continue to focus on Key Success Factors 1-3.

ATP testing programs involve close collaboration between Infection Prevention and Environmental Services at kickoff in several areas, including, but not limited to:

- Understanding benchmark data
- Planning a surveillance schedule, including how often hospital areas will be tested
- Executing the plan and recording the data
- Implementation of environmental control and proper surface disinfection to address any cleaning or disinfection needs



Best Practice: Infection Preventionist and Environmental Services collaboration

A close relationship between Infection Prevention and Environmental Services enables each function to rely on the other for expertise and problem solving. To address concerns Environmental Services teams may have about the odor of bleach, it may be helpful to engage Infection Preventionists to reassure the team with facts, especially that there are no long-term respiratory effects associated with bleach when it is used as directed.

Appendix: Additional Studies Involving Bleach

While this guide discusses the use of 1:10 bleach and its role as part of a bundled approach to *C. difficile* spores, bleach has also been shown to be effective against other pathogens in published clinical studies. Two examples are:

- Cleveland Veterans Affairs Medical Center evaluated six high-touch surfaces in rooms with *Vancomycin-resistant Enterococcus* (VRE)—before cleaning and after typical cleaning and after 1:10 bleach disinfection by the research staff—to determine if a bundled intervention including 1:10 bleach for surface disinfection could reduce contamination of these surfaces. Using 1:10 bleach (DISPATCH®) solution for routine disinfection of high-touch surfaces as part a bundled infection prevention program reduced positive VRE detection rates by 100%. The program was sustained for four months with results maintained.[16]
- In February 2004, Johns Hopkins Hospital (JHH) identified a norovirus outbreak with 335 individual cases affecting 90 patients and 265 healthcare workers in its coronary care unit. An aggressive infection control program, including healthcare worker education, frequent hand hygiene, furlough of employees, closure of units and thorough disinfection with bleach, was set in place to terminate the outbreak. Extensive environmental decontamination—using 1:50 bleach solution as the primary disinfectant for all surfaces as part of an infection control bundle—terminated the outbreak. In the published study, bleach is cited as the "disinfectant of choice" based on its efficacy against feline caliciviruses (i.e., noroviruses) compared with quaternary compounds or alcohol.[17]

16. B.D. Eckstein et al. MBC Infectious Diseases 2007, 7 :61.
17. Johnston et al. Clinical Infectious Diseases 2007, 45: 534.

For more information, contact your Clorox sales representative or call **800-234-7700.**
email: healthcare@clorox.com
visit us: cloroxprofessional.com

NI-15977 PDI

Contact Isolation

Staff entering this room MUST do the following if entering beyond the swing of the door:

Clean Hands

Gloves

Gown

Everyone leaving the patient room must remove PPE and Clean Hands

Visitors do not need to wear gloves and a gown, unless in contact with patient body fluids but must clean hands upon entering and leaving this room

Questions? Contact staff or see hospital policy.

UMMC/UMACH

149597

Visitors: ***must be instructed by patient's nurse before entering room***

Enteric Isolation

Staff entering this room <u>MUST</u> do the following if entering beyond the swing of the door:

Clean Hands

Gloves

Gown

<u>Everyone leaving the patient</u> room must remove PPE then Clean Hands with Soap and water

**** Do not use waterless based hand sanitizer****

Visitors do not need to wear gloves and a gown, unless in contact with patient body fluids but must clean hands upon entering and leaving this room

Questions? Contact staff or see hospital policy.

UMMC/UMACH

508051

Visitors: ***must be instructed by patient's nurse before entering room***

CONTACT PRECAUTIONS

(In addition to Standard Precautions)

Families and Visitors follow instructions from information sheet.

(If you have questions, go to Nurse Station)

Everyone Must:

Clean hands when entering and leaving room

Doctors and Staff Must:

Gown and glove at door

Use patient dedicated or disposable equipment. Clean and disinfect shared equipment.

Washington State Hospital Association

Orange
Pantone 144 C
Last revised 4/16/09

Washington Hospitals – *Collaborating to Keep Our Patients Safe*

Contact Precautions

Display sign outside the door. Remove sign after room is cleaned.

Common Conditions: ***If patient has diarrhea (C. difficile) use Contact Enteric Precautions***

- Multidrug resistant organisms
  - Carbapenem resistant Gram-negative rods/ESBL
  - Methicillin-resistant *Staphylococcus aureus* (MRSA)
  - Vancomycin-resistant *Enterococcus* (VRE)
- Scabies
- Wounds or abscesses with uncontained drainage

Dishes/Utensils:
No special precautions. Kitchenware sanitized in dishwasher.

Equipment and Supplies:

- Use dedicated or disposable equipment when available.
- Clean and disinfect reusable equipment including IV pumps, cell phone or pagers (if used in room), and other electronics, supplies, and equipment prior to removing from patient's room.
- Ensure blood pressure cuff and stethoscope are cleaned and disinfected between patients.
- Only essential supplies in room.

Linen Management:
Bag linen in the patient's room.

Patient Identification Procedure:
Use patient label for validation of patient identity and destroy in room after use.

Personal Protective Equipment:

Put **ON** in this order:	Take **OFF** & dispose in this order:
1. Wash or gel hands	1. Gloves
2. Gown	2. Eye cover (if used)
3. Mask (if needed)	3. Gown
4. Eye cover (if needed)	4. Mask (if used)
5. Gloves	5. Wash or gel hands (even if gloves used)

Private Room:
If not available, room with patient that has the same organism but no other infection.

Room Cleaning:
Routine cleaning procedures with addition of cubicle curtain changes per hospital procedure.

Transport:
Essential transport only. Place patient in clean gown. Clean and disinfect transport vehicle. Alert receiving department regarding patient's isolation precaution status.

Discontinue precautions as per hospital policy or Infection Preventionist instructions.

Washington State Hospital Association

Orange
Pantone 144 C
Last revised 4/16/09

Washington Hospitals – *Collaborating to Keep Our Patients Safe*

PATIENT, FAMILY, AND VISITORS

Contact Precautions

You or your loved one is in Contact Precautions. These precautions prevent spread of infection between patients in hospitals. This type of infection is spread by directly touching the patient or something they have touched.

An orange sign saying “Contact Precautions” is outside the room letting staff, families, and visitors know what they can do to help keep patients safe.

As a patient, family, or visitor you must help by:

- Cleaning hands when you enter and leave the room.
- Limiting where you go outside the room unless given permission by the nurse so that germs are not spread to other patients, visitors, and staff.
- Asking physicians and staff to wash or sanitize their hands as they enter and leave the room even if they are using gloves.
- Limiting visitors to close contacts only.

You will see doctors and staff doing the following:

Hand Hygiene

- Cleaning hands before and after caring for the patient.

Gloves, Gowns, Masks, Goggles

- They must wear gloves and gown while in the room and remove them before leaving. They might also wear mask and goggles.

Transportation

- If the patient needs to go out of the room for a test, staff will help patient to wear a clean gown.
- Staff will clean their hands.

If you have additional questions about Contact Precautions, ask your nurse.

Washington State Hospital Association

Orange/Yellow
Pantone144 C/Process Yellow
Last revised 1/23/09

CONTACT ENTERIC PRECAUTIONS

(In addition to Standard Precautions)

Families and Visitors follow instructions from information sheet.

(If you have questions, go to Nurse Station)

Everyone Must:

Wash or gel hands when entering and wash on leaving room

Doctors and Staff Must:

Gown and glove at door

Use patient dedicated or disposable equipment. Clean and disinfect shared equipment.

Washington State Hospital Association

Orange/Brown
Pantone 144 C/463 C
Last revised 4/16/09

Washington Hospitals – *Collaborating to Keep Our Patients Safe*

Contact Enteric Precautions

Display sign outside the door. Remove sign after room is cleaned.

Common Conditions:
- Acute diarrhea with unknown etiology
- Clostridium *difficile* (C. *difficile*, C. *diff*)
- Norovirus
- Rotavirus

Dietary:
Family and visitors should not eat in the room.

Dishes/Utensils:
No special precautions. Kitchenware sanitized in dishwasher.

Equipment and Supplies:
- Use dedicated or disposable equipment when available.
- Clean and disinfect reusable equipment including IV pumps, cell phone or pagers (if used in room), and other electronics, supplies, and equipment prior to removing from patient's room.
- Ensure blood pressure cuff and stethoscope are cleaned and disinfected between patients.
- Only essential supplies in room.

Linen Management:
Bag linen in the patient's room.

Patient Identification Procedure:
Use patient label for validation of patient identity and destroy in room after use.

Personal Protective Equipment: USE SOAP AND WATER TO WASH HANDS WHEN LEAVING ROOM

Put **ON** in this order:	Take **OFF** & dispose in this order:
1. Wash or gel hands	1. Gloves
2. Gown	2. Eye cover (if used)
3. Mask (if needed)	3. Gown
4. Eye cover (if needed)	4. Mask (if used)
5. Gloves	5. Must wash with soap and water (even if gloves used)

Private Room:
If not available, room with patient that has the same organism but no other infection.

Room Cleaning:
Thorough cleaning for enteric precautions with cubicle curtain changes per hospital procedure.
Clean and disinfect with chlorine-based disinfectant as per hospital policy.

Transport:
Essential transport only. Place patient in clean gown. Clean and disinfect transport vehicle. Alert receiving department regarding patient's isolation precaution status.

Discontinue precautions as per hospital policy or Infection Preventionist instructions.

Washington State Hospital Association

Orange
Pantone 144 C
Last revised 4/16/09

Washington Hospitals – *Collaborating to Keep Our Patients Safe*

PATIENTS, FAMILY, AND VISITORS

Contact Enteric Precautions

You or your loved one is in Contact Enteric Precautions. These precautions prevent spread of infection between patients in hospitals. This type of infection is spread by directly touching the patient or something they have touched.

An orange with brown sign saying “Contact Enteric Precautions” is outside the room letting staff, families, and visitors know what they can do to help keep patients safe.

As patient, family, or visitor you must help by:

- Cleaning hands with soap and water when you enter and leave the room.
- Family and visitors should not eat in room.
- Limiting where you go outside the room unless given permission by the nurse so that germs are not spread to other patients, visitors, and staff.
- Asking doctors and staff to wash their hands as they enter and leave the room even if they are using gloves.
- Limiting visitors to close contacts only.

You will see doctors and staff doing the following:

Hand Hygiene

- Cleaning hands before and after caring for the patient.

Gloves, Gowns, Masks, Goggles

- They must wear gloves and gown while in the room and remove them before leaving. They might also wear mask and goggles.

Transportation

- If the patient needs to go out of the room for a test, staff will help the patient to put on a clean gown.
- Staff will clean their hands.

If you have additional questions about Contact Enteric Precautions, ask your nurse.

Washington State Hospital Association

Orange/Brown/Yellow
Pantone 144 C/463 C/Process Yellow
Last revised 1/23/09

CONTACT PRECAUTIONS: Level C

VISITORS: Please ask nursing staff for instructions TO ENTER THE ROOM

1. Gown

AND

2. Glove

Hand Hygiene

Use LIQUID antiseptic soap and water to clean hands upon leaving the patient room.

Do NOT use waterless antiseptic.

Thank You

ADDITIONAL INSTRUCTIONS ON BACK

- Use these precautions **<u>until 48 hours</u>** after diarrhea ceases.
- **<u>Gown and gloves</u>** to enter the room

STOP

CHECK WITH NURSE BEFORE ENTERING

ENTERIC PRECAUTIONS

(In addition to Standard Precautions)

To be used only at direction of Infection Control.

STAFF and PHYSICIANS

Gloves	**Always** • Hand hygiene before donning
Gown	**Always**
Mask	**When patient is vomiting**
Equipment	**Disinfect with bleach wipes between patients**
Transport	**For essential purposes only** **Patient:** • Clean gown • Wash hands to elbows **Staff:** Clean gloves only if patient transported in own bed or contact with blood or body fluids expected
Environment	**Terminal clean room with bleach**

08-0832 ISOLATION SIGNS 11 X 8.5 SIZE

VISITORS, STAFF and PHYSICIANS

Each time you enter the room: Wash hands with soap and water or use waterless foam.

Wash your hands
with soap and water each time you leave the room.

1. Apply soap to wet hands. Wash 15-20 seconds. Rinse completely.
2. Dry hands with paper towel. Use a towel to turn off water.

Allina Hospitals and Clinics, Mercy Hospital

SAFE from CDI

Environmental Cleaning and Disinfection

Patient Safety

Occupied – Isolation Room Cleaning Protocol

Step 1 | Prepare for Isolation Cleaning

Check door to see if the Isolation Precaution sign is present. Follow your facility's requirements for donning personal protective equipment when cleaning and disinfecting isolation rooms. Wash hands with soap and water and put on PPE prior to entering room. Gather all equipment and cleaning supplies required and leave supply cart outside of door of patient room to avoid contamination. Knock and announce self prior to entering room.

Step 2 | Collect Trash and Soiled Linens

Collect all trash and put into a garbage bag. Remove general waste and soiled linens in accordance with your facility's policy. Use Clorox® Germicidal Wipes to disinfect the surfaces of the waste container and allow to air dry. Place all soiled linens — including gowns, towels and curtains — into a sealed bag and dispose of once you leave the room, in accordance with your facility's protocols.

Step 3 | Clean and Disinfect Room

Working from the cleanest to dirtiest surfaces and from highest to lowest, use Clorox® Germicidal Wipes to clean and disinfect furniture and high-touch areas including: door handles, both bathroom and room entrances, light switches, hand sanitizer bottle, bed buttons and hand rails, keyboard and mouse, telephone, tray table and TV remote. Change disinfecting wipe when unable to achieve appropriate wet contact and when visibly soiled.

Step 4 | Clean and Disinfect Bathroom

Clean and disinfect all hard, nonporous bathroom surfaces. Start with the highest surface (like the mirror) and leave the toilet for last. Ensure that all surfaces are disinfected, including the mirror, shower grab bars, shower fixtures, bathroom sink handles, toilet flush handle and bathroom toilet seat (disinfect top first). Note: Change disinfecting wipe when unable to achieve appropriate wet contact time and when visibly soiled.

Step 5 | Mop Room and Prepare to Exit

Using a microfiber mop, mop the entire floor surface, working your way from the far corner back to the front entrance. Dispose of mop head and post Wet Floor sign when complete. Prior to exiting, inspect the room and ensure all surfaces have been cleaned and disinfected. Then disinfect any cleaning equipment (like mop handles) before returning to the cleaning cart. Remove PPE and place in trash or laundry bag prior to leaving room, in accordance with your facility's guidelines. Wash your hands with soap and water.

Discharge - Isolation Room Cleaning Protocol

Step 1 | Prepare for Isolation Cleaning

Check door to see if the Isolation Precaution sign is present. Follow your facility's requirements for donning personal protective equipment PPE when cleaning and disinfecting isolation rooms. Wash hands with soap and water and put on appropriate PPE prior to entering room. Gather all equipment and cleaning supplies required and leave supply cart outside of door of patient room to avoid contamination. Knock and announce self prior to entering room.

Step 2 | Collect Trash and Soiled Linens

Collect all trash and put into a garbage bag. Use Clorox® Germicidal Wipes to disinfect the surfaces of the waste container and allow to air dry. Place all soiled linens — including gowns, towels and curtains — into a sealed bag and dispose of once you leave the room, in accordance with your facility's protocols.

Step 3 | High Dust

Thoroughly high dust areas at shoulder height and above, including light recesses, vents, curtain tracks and TV surfaces. Dispose of high duster head when complete.

Step 4 | Clean and Disinfect Room

Working from the cleanest to dirtiest surfaces and from highest to lowest, use Clorox® Germicidal Wipes to clean and disinfect furniture and high-touch areas including: door handles, both bathroom and room entrances, light switches, hand sanitizer bottle, bed buttons and hand rails, keyboard and mouse, telephone, tray table and TV remote. Change disinfecting wipe when unable to achieve appropriate wet contact and when visibly soiled.

Step 5 | Clean and Disinfect Bathroom

Use Clorox® Germicidal Wipes to clean and disinfect all hard, nonporous bathroom surfaces. Start with the highest surface (like the mirror) and leave the toilet for last. Ensure that all surfaces are disinfected, including the mirror, shower grab bars, shower fixtures, bathroom sink handles, toilet flush handle and bathroom toilet seat (disinfect top first). Note: Change disinfecting wipe when unable to achieve appropriate wet contact time and when visibly soiled.

Step 6 | Mop Room and Prepare to Exit

Using a microfiber mop, mop the entire floor surface, working your way from the far corner back to the front entrance. Dispose of mop head and post Wet Floor sign when complete. Prior to exiting, inspect the room and ensure all surfaces have been cleaned and disinfected. Then disinfect any cleaning equipment (like mop handles) before returning to the cleaning cart. Remove PPE and place in trash or laundry bag prior to leaving room, in accordance with your facility's guidelines. Wash your hands with soap and water.

Hospital _____ Observer_____

Unit/Department _____ Role _____ Date _____

Cleaning Step **Please indicate ALL that apply. Document routine PRACTICE and not policy.**	Observation Audit- √ if observed	Frequency D= Daily T= Terminal P= After each Use	Routine Product Q= Quat B= Bleach O= Other W= Wipe S= Spray	Routine use of bleach for CDI patient? Y/N	Process vary by unit or day of week? Y/N	Who does the task?				
						Env Service	Unit Support	Patient care staff	Central Equipment	Other
1. High Dust										
1a. Ledges: shoulder and higher										
1b. Vents										
1c. Lights (patient room)										
1d. Lights (bathroom)										
1e. TV – rotate and clean all surfaces										
1f. TV cabinet										
1g. TV Screen and wires										
1h. Go to ES cart and gently shake dust into waste bag										
2. Damp dust – Cloth and squirt bottle or bucket of disinfectant – damp wipe all surfaces in room										
2a. Ledges (shoulder high)										
2b. Door handles/knobs										
2c. Door hinges										
2d. Light switches										
2e. Call button										
2f. TV remote										
2g. Telephone										
2h. Patient storage cabinets and drawers										
3. Bed (top to bottom, head to foot, and left to right) Bring bed up to highest position										
3a. Raise mattress and disinfect										

Hospital _____ Observer_____

Unit/Department _____ Role _____ Date _____

top, sides and bottom										
Cleaning Step **Please indicate ALL that apply. Document routine PRACTICE and not policy.**	Observation Audit- √ if observed	Task Done Daily(D) Terminal (T) After each Use (P)	Routine Product Quat (Q) Bleach (B) Other (O)	Routine use of bleach for CDI patient? Y/N	Process vary by unit or day of week? Y/N	Who does the task?				
						Env Service	Unit Support	Patient care staff	Central Equipment	Other
3b. Disinfect exposed frame, springs or bed panels										
3c. Headboard: disinfect top, front and back										
3d. Disinfect side rails, undercarriage and lower ledges										
3e. Disinfect all bed controls										
3f. Disinfect the foot-board (top, front, back)										
3g. Allow moisture to dry before placing linen on bed										
3h. Pillows										
4. Overbed Table										
4a. Disinfect surfaces and legs										
4b. Wipe out drawer										
4c. Wipe off mirror										
5. Bedside Table										
5a. Disinfect surface and legs										
5b. Wipe out drawer										
6. Glass surfaces										
6a. Wipe spots										
7. Bathroom										
7a. Use toilet chemical, don't flush										
7b. Light switches										
7c. Ledges/shelves										
7d. Door handles/knobs										
7e. Sink and faucets										

Hospital _____ Observer_____

Unit/Department _____ Role _____ Date _____

7f. Toilet surfaces										
Cleaning Step **Please indicate ALL that apply. Document routine PRACTICE and not policy.**	Observation Audit- √ if observed	Task Done Daily(D) Terminal (T) After each Use (P)	Routine Product Quat (Q) Bleach (B) Other (O)	Routine use of bleach for CDI patient? Y/N	Process vary by unit or day of week? Y/N	Who does the task?				
						Env Service	Unit Support	Patient care staff	Central Equipment	Other
7g. Cabinets if present										
7h. Handrails										
7i. Emergency call pull cord										
7j. Dirty linen storage located in bathroom?										
7k. Linen bin (lid and stand)										
7l. Paper towel dispensor										
7m. Bathroom cupboards										
7n. Towel rack/rod										
7o. Soap dispensers										
8. Shower stall and faucets										
8a. After running water, leave shower head dangling down (do not loop)										
8b. Wipe walls, curtain, check for signs of mildew/mold										
8c. Soap dispensers										
8d. Shower curtains/ doors										
9. Floor Cleaning										
9a. Place mop head in detergent/ disinfectant										
9b. Mop (farthest from door) ½ of room										
9c. Mop shower floor										
9d. Bathroom floor										
9e. Flip mop head- do remainder of room										
9f. Frequency										
9g. OR suites										

Hospital _____ Observer_____

Unit/Department _____ Role _____ Date _____

9h. Neutral product for routine rm										
Cleaning Step **Please indicate ALL that apply. Document routine PRACTICE and not policy.**	Observation Audit- √ if observed	Task Done Daily(D) Terminal (T) After each Use (P)	Routine Product Quat (Q) Bleach (B) Other (O)	Routine use of bleach for CDI patient? Y/N	Process vary by unit or day of week? Y/N	Who does the task?				
						Env Service	Unit Support	Patient care staff	Central Equipment	Other
9i. Quat MDRO/procedure rooms										
10. Patient Equipment										
10a. commode										
10b. BP cuff										
10c. Thermometer										
10d. Leads										
10e. Oximeter										
10f. Wheelchair										
10g. flashlight										
10h. IV pump										
10i. Safe patient moving										
10j. Slip sheets										
10k. Glucometers										
10l. Electronic monitors										
10m. Other (List)										
10n. Anesthesia carts										
10o. Suction and O2 regulator/knobs										
11. Computers										
11a. Keyboards										
11b. Keyboard covers										
11c. Screen										
11d. PC										
11e. Stand or Wall mounted brackets										
11f. Computer wires										

Hospital _____ Observer_____

Unit/Department _____ Role _____ Date _____

12. Enteric Precaution (when diluted bleach used)**										
Cleaning Step **Please indicate ALL that apply. Document routine PRACTICE and not policy.**	Observation Audit- √ if observed	Task Done Daily(D) Terminal (T) After each Use (P)	Routine Product Quat (Q) Bleach (B) Other (O)	Routine use of bleach for CDI patient? Y/N	Process vary by unit or day of week? Y/N					
12a. Cleaning with Quat detergent product										
12b. Quat allowed to dry										
12c. All surfaces disinfected with dilute bleach solution										
12d. Patient equipment disinfected using bleach on room exit										
12e. Diluted bleach disposed <= 24 hrs										
13. Misc. Items										
13a. Courtesy chair/bed										
13b. Menus/Hospital info book										
13c. Biohazard can										
13d. Toys										
13e. Books										
13f. Dry erase marker and eraser										
13g. Step stool										
13h. Scissors										
13i. Whirlpool										
14. Inroom sink- if present										
14a. Basin										
14b. Faucet										
14c. Paper towel dispensor										
14d. Soap dispensor										
14e. Lotion dispensor										

** Complete if manually diluted bleach product is used.

Hospital _____ Observer_____
Unit/Department _____ Role _____ Date _____

1. Do you have handwashing sinks located on the unit? Y / N How many?_____

2. Are handwashing sinks located within 15 feet of most patient rooms? Y / N

3. Do you have separate handwashing sinks in patient rooms? Y / N

4. If handwashing sinks are not conveniently located, do staff use patient bathroom sink? Y / N

5. Are there alternate hand hygiene options available (e.g. Resurgent Hand Hygiene stations)? Y / N

6. Is Quik-Care foam located at room entrances and other locations for ease of use? Y / N

7. Is there a separate sprayer in patient bathrooms for commode/bedpan cleaning? Y / N
   If no, are patient sinks used for this purpose? Y / N

8. How many minutes are ES staff allocated for:
   A. Daily cleaning of each patient room _____
   B. Routine terminal clean after discharge _____
   C. Special projects _____

9. How frequently are privacy curtains changed?
   A. Once per year
   B. Every 6 months
   C. Every 3-6 months
   D. Every 1-3 months
   E. After each patient discharge
   F. Only when visibly soiled

10. Do you have in-room supply cabinets (nurse servers)? Y / N
    A. If yes, are they used to store supplies between patients? Y / N
    B. Who cleans supply cabinets? _____
    C. How frequently? _____

11. Are the amounts of supplies and linens stored in patient rooms kept to a minimum? Y / N

Hospital _____ Observer_____
Unit/Department _____ Role _____ Date _____

12. Are supplies and linens stored in patient rooms discarded at discharge when patient has been in Contact Precautions? Y / N

13. Are there med drawers in the patient room?
    A. If yes, how frequently are they cleaned? _____
    B. Who cleans the med drawers? _____

14. Is there a cleaning/disinfecting protocol for Pyxis machines?
    A. Who cleans?_____
    B. How frequently? _____
    C. What product? _____

15. How frequently is bed linen changed? _____

16. Do you use single use cleaning clothes? Y / N

17. Do you use microfiber clothes and mops? Y / N

18. Is a 2 step cleaning/disinfecting process used for all surfaces and equipment? Y / N
    A. Using a single detergent/disinfectant product? Y / N
    B. Which product?_____

19. Have you ever implemented Enteric Precautions and bleach disinfecting?
    A. Using a stable detergent/ bleach product (e.g. Dispatch)? Y / N
    B. If you dilute a bleach disinfectant, what is the concentration of the final dilution?_____
    C. How do you verify concentration?_____
    D. How frequently is the diluted bleach disinfectant changed?_____

20. Are disinfectant wipes located in each patient room? Y / N
    A. If not in each patient room, are they conveniently located on the unit for staff use? Y / N
    B. Which product?_____
    C. What is the dry time for the product? _____

21. Have observational audits confirmed compliance with disinfection of equipment (including personal stethoscopes) between patients? Y / N

22. Do physicians and other staff wear white lab coats on the unit?
    A. How frequently are the lab coats washed?_____

Hospital _____ Observer_____
Unit/Department _____ Role _____ Date _____

23. Are cloth stethoscope sleeves allowed? Y / N

24. Do you have hands-free communication devices? Y / N
    A. If no, are cell phones used in contact precautions rooms?

25. Are OR suites terminally cleaned on weekends or if the room is not used during the day as per AORN/CDC standard? Y / N

26. Type of emergency pull cord used:
    A. Plastic Y / N
    B. Rope Y / N

27. How frequently are shower curtains changed, if present? _____

Other opportunities observed?

_____
_____
_____
_____

APIC Guide to the Elimination of Clostridium difficile in Healthcare Settings

ENVIRONMENTAL CHECKLIST -

FOR DAILY CLEANING - ROOM OBSERVATIONS: Please review a sample of 5 patients per week (1 patient per day)

Hospital:_____

Date:_____

Unit:_____

Room:_____

Time:_____

Instruction	Component	Yes	No	N/A
At start, perform hand hygiene.				
Put on PPE.				
Disinfect high-touch surfaces:	Door knobs/handles			
	Door surface			
	Bed rails			
	Call button			
	Phone			
	Overbed table & drawer			
	Countertop			
	Light switches			
	Furniture			
	Arms of patient chair			
	Seat of patient chair			
	All other miscellaneous horizontal surfaces			
	Window sills			
	Bedside commode			
	Medical equipment (e.g., IV controls)			
	Spot clean walls with disinfectant cloth			
Disinfect:	BATHROOM, including:			
	Bathroom door knob			
	Toilet horizontal surface/seat			
	Toilet lever/flush			
	Faucets (at sink)			
	Bathroom handrails			
	Sink			
	Tub/shower			
	Mirror			
Damp dust:	Overhead light (if the bed is empty)			
	TV & stand			
Clean:	Lights			
Clean floor:	Dust mop tile			
	Wet mop tile			
Replace as needed:	Hand sanitizer			
	Paper towels			
	Soiled curtains			
For terminal cleaning, damp dust:	Bed frame			
	Mattress			
	Remake bed with clean linen			
	Replace as needed: Pillows, mattresses, pillow covers, mattress covers			
Other:	Empty trash & replace liner			
Discard dust cloths.				
Change mop heads after each isolation room.				
Remove PPE before exit.				
Perform hand hygiene.				

Any significant areas not mentioned above (please describe):

This room looks clean and ready for use:
Sign-off by environmental services employee cleaning the room:_____

Sign-off by TBD, based on your hospital process for cleaning room:_____

Table 10.1 - Environmental Checklist for Daily Cleaning

CDC Environmental Checklist for Monitoring Terminal Cleaning[1]

Date:	
Unit:	
Room Number:	
Initials of ES staff (optional):[2]	

Evaluate the following priority sites for each patient room:

High-touch Room Surfaces[3]	Cleaned	Not Cleaned	Not Present in Room
Bed rails / controls			
Tray table			
IV pole (grab area)			
Call box / button			
Telephone			
Bedside table handle			
Chair			
Room sink			
Room light switch			
Room inner door knob			
Bathroom inner door knob / plate			
Bathroom light switch			
Bathroom handrails by toilet			
Bathroom sink			
Toilet seat			
Toilet flush handle			
Toilet bedpan cleaner			

Evaluate the following additional sites if these equipment are present in the room:

High-touch Room Surfaces[3]	Cleaned	Not Cleaned	Not Present in Room
IV pump control			
Multi-module monitor controls			
Multi-module monitor touch screen			
Multi-module monitor cables			
Ventilator control panel			

Mark the monitoring method used:

☐ Direct observation ☐ Fluorescent gel
☐ Swab cultures ☐ ATP system ☐ Agar slide cultures

---

[1]Selection of detergents and disinfectants should be according to institutional policies and procedures
[2]Hospitals may choose to include identifiers of individual environmental services staff for feedback purposes.
[3]Sites most frequently contaminated and touched by patients and/or healthcare workers

TERMINAL CLEANING

Record results of evaluation for each surface on the check list for every room monitored. Use the following symbols for marking:
O = NOT CLEAN, X = CLEAN, LEAVE BLANK = NOT EVALUABLE NOTE - USE CAP LETTERS "X" AND "O"
The percentage of individual surfaces cleaned will be automatically calculated in Sheet 2 (Aggregate Score Sheet).
Please report aggregate scores calculated for each category highlighted in Sheet 2 (Aggregate Score Sheet).

				High Touch I			High Touch II			High Touch III				Bathroom Surfaces							Equipment Surfaces					Surfaces Cleaned for Each Room		
Unit	Rm No.	Date of Marking if applicable	Date of Evaluation	Bed rails	Tray table	IV pole	Call box / button	Telephone	Bedside table handle	Chair	Rm sink	Rm light switch	Rm inner doorknob	BR inner doorknob	BR light switch	BR handrails	BR sink	Toilet seat	Toilet flush handle	Toliet bedpan cleaner	IV pump control	Monitor controls	Monitor touch screen	Monitor cables	Ventilator panel	# Surfaces Cleaned	# Surfaces Evaluated	% of Surfaces Cleaned
																										0	0	#DIV/0!
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Centers for Disease Control and Prevention
http://www.cdc.gov/HAI/toolkits/Appendices-Evaluating-Environ-Cleaning.html

TERMINAL CLEANING

Automatic calculation of Aggregate Scores Across Surfaces and Rooms

	High Touch I			High Touch II			High Touch III				Bathroom Surfaces							Euipment Surfaces					
	Bed rails	Tray table	IV pole	Call box / button	Telephone	Bedside table handle	Chair	Rm sink	Rm light switch	Rm inner doorknob	BR inner doorknob	BR light switch	BR handrails	BR sink	Toilet seat	Toilet flush handle	Toliet bedpan cleaner	IV pump control	Monitor controls	Monitor touch screen	Monitor cables	Ventilator panel	
# of Surfaces Cleaned	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
# of Surfaces Evaluated	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
% of Surfaces Cleaned	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	
Category: Total # of Surfaces Cleaned	0			0			0				0							0					
Category: Total # of Surfaces Evaluated	0			0			0				0							0					Aggregate TDC Score:
Category TDC Score: % of Surfaces Cleaned	#DIV/0!			#DIV/0!			#DIV/0!				#DIV/0!							#DIV/0!					#DIV/0!

Sanford Medical Center Canby

Sylvan Court (1st Floor) daily Check off sheet

Please check off the duties as you complete them, sign the bottom of your day section. This sheet ***must*** be returned to me daily.

1st Floor Housekeeper_____

Sunday_____**(Date)**

Remember to have your radio on. Radio must be placed in charger at the end of your day

Duties that must be completed every day.

Two compartment bins

Clean the two compartment soiled linen and trash bins. There are two on this floor Done__

Utility/Laundry Room

Clean Counters	Done___
Wash trash can	Done___
Wet Mop floors	Done___
Check Neutral Quat bottle, fill & date (***as needed***)	Done___

Utility (Large)

Clean Flushing hopper, mop floors	Done___
Wash trash can	Done___
Check Neutral Quat bottle, fill & date (***as needed***)	Done___

Public Bathroom (Check Twice Daily)

Clean Toilet & Sink	AM___	PM___
De-lime fixtures (***If needed***)	AM___	PM___
check Divider, (remove if needed)	AM___	PM___
Paper towels & toilet paper	AM___	PM___
Remove trash	AM___	PM___
Wet Mop floors	AM___	PM___

Nurse Bathroom (Check Twice Daily)

Clean Toilet, Counters & sink,	AM___	PM___
De-lime fixtures (***If needed***)	AM___	PM___
Wet Mop floors & Remove trash	AM___	PM___
Paper towels & toilet paper	AM___	PM___

TV Area

Dust TVs in both areas	Done___
Dust tables in both TV areas	Done___
Dust window ledges	Done___
Dust wood bar infornt of windows	Done___
Dust window ledges	Done___

Kitchenette

Wipe counter tops & Refrigerator	Done___
Clean coffee machine & Microwave	Done___
Wipe Ice Machine and Counter	Done___

Check under the sinks & make sure nothing is under them such as chemicals, dishes etc. Done__

Commode room

Remove commodes & wash floor Done__

Showers

Clean Shower on West wing	Done__
Clean Shower on East Wing	Done__
Wash soap dispensors down	Done__

Ramp Entrance

Tidy room and Mop floor

Maintenance Radio - 223-5984
Maintenance Cell - 507-828-2029
Duane Cell - 507-829-5037

Nurse Station

Wipe off phones	Done___
Dust tops of Nurse Station dividers	Done___
Empty trash/vacuum carpet	Done___

Dining Rooms (after meals)

Remove dishes & wipe off tables &	Done___
Wipe off all tables, chairs & vac Dir	Done___
Tidy up dining room after Lunch	Done___
Wipe down the walls where the steam ta	Done__
Spray the arms & seats of all the chairs in dining rooms w/lysol disinfectant spary	Done__
Did you get clean up help after brea	N Y
Did you get clean up help after lunc	N Y

Care Coordinator Office

Tidy Room, Mop Floor, dust counte	Done___
Empty trash/vacuum carpet	Done___

Water fountain

Clean water fountain	Done___
Wipe out drain daily	Done___

Privacy room

Vacuum Floors, Dust furniture	Done___
Wipe spots from windows	Done___

Small Dining room

Remove dishes & wipe off tables	Done___
Tidy up dining room after Lunch	Done___
Vacuum up food crumbs	Done___
Check the cloth chairs for cleaning if they need it, use	
Vanish in the spray bottle to addres	Done___

1st Floor Door handles

All door handles, on all doors on 1st floor were wiped down today. Room doors, bathroom doors, Fire doors Exit doors, staff bathroom door, exit doors, stair well doors Privacy room door, utility room doors,

Done_____

Elevator Hall

Check Elevators door for spots Done___

Carpets (list new spots)

Notes

Call light checks

Make sure once you have completed the clean of all resident rooms that the call bell is left within reach of the Resident Done_____

Remember to wash all call cords during the normal clean of each area with a call cord

To be done in Each Room Sunday

Beds

List beds you washed today

Room #_____ Bed 1____ Bed 2____

Room #_____ Bed 1____ Bed 2____

Divider Curtains

List rooms dividers were removed for laundering

Room #_____ Bed 1____ Bed 2____

Room #_____ Bed 1____ Bed 2____

Dividers can be washed on 1st floor in the laundry Room, wash warm tumble dry low or hang wet

Terminal Cleans

List rooms you did a terminal clean in

Room #_____ Bed 1____ Bed 2____

Room #_____ Bed 1____ Bed 2____

Complete terminical clean/iinspection form per room and list all Items for Work Orders Done___

Extras (Nursing duties)

Helped with meals Meal 1___ Meal 2 ___

(Those who are CNA's)

Extra

Extra

Work orders Written

Work Order #	Initials	Purpose for Work Order

Locking Cabinets

East Shower All locks work & Drs closed Y__ N__

West Shower All locks work & Drs closed Y__ N__

When cleaning showers make sure cabinets are shut as well as all personal care soaps a in the locked cabinets. Write work orders when broken.

Faucets de-limed

Mixing Quat

Make sure there is premixed bottles of quat in the soiled utility for nursing to clean instruments with. Done

This room needs bathroom closet floors checked

Did you remember to shut the water off in the hskp closet?

Take wheeled garbage container to the Garbage room in the Basement and take up an empty unit at 6 AM, 10 AM, & 2 PM

HK MM 3/04, 10/05, 2/06, 6/08, 3/10, 1/11

Any room with Isolation setup on room door with Brown label stating "Contact Precautions Level C"

Will have the following clean with bleach

Bedside	**Daily**	**Twice daily**
Chair	√	
*Door handles		√
Floor	√	
Glove Holder	√	
IV pole, if soiled	√	
*Light Switches		√
Night Stand	√	
*Over-bed Table		√
Pictures	√	
Sharps Containers	√	
Shelves	√	
*Side rails, Bed Frame Controls (including head and foot of bed		√
Table	√	
Telephone	√	
TV and Remote	√	
Walls-Spot clean	√	
Wastebasket	√	
Wet Floor sign	√	
Window Sill	√	

Bathroom	**Daily**	**Twice daily**
Baseboard	√	
Bedpan	√	
Door/Fram	√	
*Door		√
*Grab		√
*Light		√
Light	√	
Mirror	√	

Rooms Cleaned Today

122		Bed 1	Dn__	Bed 2	Done___
123		Bed 1	Dn__	Bed 2	Done___
124		Bed 1	Dn__	Bed 2	Done___
125		Bed 1	Dn__	Bed 2	Done___
126		Bed 1	Dn__	Bed 2	Done___
127		Bed 1	Dn__	Bed 2	Done___
129		Bed 1	Dn__	Bed 2	Done___
130		Bed 1	Dn__	Bed 2	Done___
133		Bed 1	Dn__	Bed 2	Done___
142		Single		Done___	
143		Single		Done___	
145		Single		Done___	
146		Single		Done___	
150		Bed 1	Dn__	Bed 2	Done___
151		Bed 1	Dn__	Bed 2	Done___
152		Bed 1	Dn__	Bed 2	Done___
153		Bed 1	Dn__	Bed 2	Done___

These bathroom must be cleaned daily and periodically checked

Sanford Medical Center Canby

Hospital Housekeeping Daily Cleans

Date: Assist with Breakfast___

Housekeeper 1: Assist with Lunch____

Door codes on your Punch Detail Card

Maintenance Radio 223-5984 - Maintenance Cell # 507-828-2029 - Duane Cell - 507-829-5037

OP - OutPatient, FC - Full (Discharge) Clean, OC - Occupied, T - Trash Pickup,
UOC - UnOccupied Clean, CF - Chemical Free Clean, P - Partial Clean,

	OP - T - UOC		FC		T		P		OC - CF		Contact Level
	Other		Full Clean		Trash pick up		Partial Clean		Occupied		"C" Precaution
Rm #	Nrsg	Hskp	Nrsg	Hskp	Nrsg	Hskp	Nrsg	Hskp	Nrsg	Hskp	Clean
LDPR 101											
LDPR 102											
103											
104											
105											
*106**											
*107**											
108											
109											
110											
111											
112											
113											
114											
115											
116											
117											
118											
119											
120											
121											
122											
123											
124											
125											

Work orders written

Wk Order #	Initials	Purpose for Work Order

Sinks De-limed

Sinks De-limed

Area to be cleaned	Done
Nursery	Done___
Nurse Station	Done___
Soiled Utility Rom	Done___
Clean Utility Room	Done___
Tub Room	Done___
Shower	Done___
Clean Diet Kitchen + dust wall vents	Done___
Pharmacy & buffer area daily	Done___

Area to be cleaned			Done
Linen Closet 1 2 3			Done___
OR 1 OR 2			Done___
Jessica's Office			Done___
Cardiac Rehab			Done___
Lab	Done___	PT	Done___

Wednesdays

Cleaning of "Clean areas in Pharmacy, document on Pharmacy sheet kept in Pharmacy. Done___

Mon	Flush 101 tub	Done___	Flush 102 tub	Done___
Thur	Flush 101 tub	Done___	Flush 102 tub	Done___

Pharmacy Chemo areas will be cleaned on ***Wednesdays*** following protocal listed in Pharmacy.
Set up time with Pharmacy Staff for this clean. Document the clean on sheet in Buffer Area

Signature -

Sanford Medical Center Canby

Hospital Housekeeping Daily Cleans

Date: Assist with Breakfast___

Housekeeper 1: Assist with Lunch____

Door codes on your Punch Detail Card

Maintenance Radio 223-5984 - Maintenance Cell # 507-828-2029 - Duane Cell - 507-829-5037

OP - OutPatient, FC - Full (Discharge) Clean, OC - Occupied, T - Trash Pickup,
UOC - UnOccupied Clean, CF - Chemical Free Clean, P - Partial Clean

	OP - T - UOC		FC		T		P		OC - CF		Contact Level
	Other		Full Clean		Trash pick up		Partial Clean		Occupied		"C" Precaution
Rm #	Nrsg	Hskp	Nrsg	Hskp	Nrsg	Hskp	Nrsg	Hskp	Nrsg	Hskp	Clean
LDPR 101											
LDPR 102											
103											
104											
105											
*106**											
*107**											
108											
109											
110											
111											
112											
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118											
119											
120											
121											
122											
123											
124											
125											

Work orders written

Wk Order #	Initials	Purpose for Work Order

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Sinks De-limed

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Cardiac Rehab			Done___
Lab	Done___	PT	Done___

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Pharmacy Chemo areas will be cleaned on ***Wednesdays*** following protocal listed in Pharmacy.
Set up time with Pharmacy Staff for this clean. Document the clean on sheet in Buffer Area

Signature -

C. difficile Isolation Room Daily Cleaning Checklist

Any room with Isolation setup on room door with Brown label stating

"Contact Precautions Level C"

Will have the following clean with Dispatch

Bedside	Daily	Twice daily
Chair	X	
*Computer Keyboard		X
*Door handles		X
Floor	X	
Glove Holder	X	
IV pole, if soiled	X	
*Light Switches		X
Night Stand	X	
*Over-bed Table		X
Pictures	X	
Sharps Containers	X	
Shelves	X	
*Side rails, Bed Frame Controls (including head and foot of bed controls		X
Table	X	
Telephone	X	
TV and Remote	X	
Walls-Spot clean	X	
Wastebasket	X	
Wet Floor sign	X	
Window Sill	X	
Bathroom	**Daily**	**Twice daily**
Baseboards and Floor	X	
Bedpan spray nozzle/holder	X	
Door/Frame/Hinges	X	
*Door handle		X
*Grab Bars and Cords		X
*Light Switch		X
Light	X	
Mirror	X	
Red Bag waste	X	
Shower	X	

C. difficile Isolation Room Daily Cleaning Checklist

Any room with Isolation setup on room door with Brown label stating

"Contact Precautions Level C"

Will have the following clean with Dispatch

Bedside	Daily	Twice daily
Chair	X	
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*Door handles		X
Floor	X	
Glove Holder	X	
IV pole, if soiled	X	
*Light Switches		X
Night Stand	X	
*Over-bed Table		X
Pictures	X	
Sharps Containers	X	
Shelves	X	
*Side rails, Bed Frame Controls (including head and foot of bed controls		X
Table	X	
Telephone	X	
TV and Remote	X	
Walls-Spot clean	X	
Wastebasket	X	
Wet Floor sign	X	
Window Sill	X	
Bathroom	**Daily**	**Twice daily**
Baseboards and Floor	X	
Bedpan spray nozzle/holder	X	
Door/Frame/Hinges	X	
*Door handle		X
*Grab Bars and Cords		X
*Light Switch		X
Light	X	
Mirror	X	
Red Bag waste	X	
Shower	X	

Environmental Services

The Front Line Of Infection Prevention

Hospital Education Resource – **High Touch Surfaces**

When disinfecting daily occupied, discharge and enhanced patient rooms pay particular attention to the following surfaces:

- **Door handles both bathroom & room entrance**
- **Light switches**
- **Hand sanitizer bottle**
- **Bed buttons and hand rails**
- **Keyboard & mouse**
- **Telephone**
- **Tray Table**
- **TV remote**
- **Bathroom sink handles**
- **Bathroom flush handle**
- **Bathroom hand rail**
- **Bathroom toilet seat (disinfect top first)**

✳ Change disinfecting wiper when unable to achieve appropriate wet contact time and when visibly soiled

- Approved – ES Educator & Infection Prevention and Control

Environmental Services

The Front Line Of Infection Prevention

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- Approved – ES Educator & Infection Prevention and Control

Options for Evaluating Environmental Cleaning

Prepared by:
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Philip Carling, MD[2]
Environmental Evaluation Workgroup[3]

December 2010

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[2]Carney Hospital and Boston University School of Medicine, Boston, MA; Dr. Philip Carling has been compensated as a consultant of Ecolab and Steris. He owns a patent for the fluorescent targeting evaluation system described in this document (DAZO Fluorescent Marking Gel).
[3]Brian Koll, Beth Israel Medical Center, New York, NY; Marion Kainer and Ellen Borchers, Tennessee Department of Health, Nashville, TN; and Brandi Jordan, Illinois Department of Public Health, Chicago, IL

National Center for Emerging and Zoonotic Infectious Diseases
Division of Healthcare Quality Promotion

Introduction:

In view of the evidence that transmission of many healthcare acquired pathogens (HAPs) is related to contamination of near-patient surfaces and equipment, all hospitals are encouraged to develop programs to optimize the thoroughness of high touch surface cleaning as part of terminal room cleaning at the time of discharge or transfer of patients. Since dedicated resources to implement objective monitoring programs may need to be developed, hospitals can initially implement a basic or Level I program, the elements of which are outlined below. Some hospitals should consider implementing the advanced or Level II program from the start, particularly those with increased rates of infection caused by healthcare acquired pathogens (e.g., high *Clostridium difficile* infection rate). All hospitals that have successfully achieved a Level I program should advance to Level II.

At present, the objective monitoring of the cleaning process of certain high touch surfaces (e.g., the curtain that separates patient beds) beyond those outlined in the attached checklist is not well defined. Additionally, there is no standard method for measuring actual cleanliness of surfaces or the achievement of certain cleaning parameters (e.g., adequate contact time of disinfectant) or for defining the level of microbial contamination that correlates with good or poor environmental hygienic practices. As our understanding of these issues evolve and a standardization of assessment in these respective areas can be developed and practically implemented, hospitals that have obtained a high compliance rate with surface cleaning as outlined in the Level II program are encouraged to advance their efforts in optimizing environmental hygienic practices.

Level I Program

Elements of the program:

1. The program will be an infection preventionist/hospital epidemiologist infection prevention & control (IPC) based program internally coordinated and maintained through environmental services (ES) management level participation. The goal should be seen as a joint (IPC/ES), team effort during planning implementation and ongoing follow-up phases.

2. Each program will be hospital-specific and based on a joint (IC/ES) definition of institutional expectations consistent with the CDC standards[1,2] and the attached check list. The responsibilities of ES staff and other hospital personnel for cleaning high touch surfaces (e.g., equipment in ICU rooms) will be clearly defined.

3. Structured education of the ES staff to define programmatic and institutional expectations will be carried out and the proportion of ES staff who participate

will be monitored (see Elements of the Educational Intervention – Appendix A).

4. Development of measures for monitoring along with methods and identified staff for carrying out monitoring will be undertaken by the IPC/ES team. Monitoring measures may include competency evaluation of ES staff by ES management, IPC staff or, preferably, both. Teams are also encouraged to utilize patient satisfaction survey results in developing measures. Regular ongoing structured monitoring of the program will be performed and documented.

5 Interventions to optimize the thoroughness of terminal room cleaning and disinfection will be a standing agenda item for the Infection Control Committee (ICC) or Quality Committee as appropriate for the facility.

6. Consideration of the feasibility of moving to the Level II program will be discussed by the ICC and documented in the committee minutes.

Reporting:

Results should be reported to the ICC and facility leadership.

Level II Program

Elements of the Program

1. The program will be an infection preventionist/hospital epidemiologist infection prevention & control (IPC) based program internally coordinated and maintained through environmental services (ES) management level participation. The goal should be seen as a joint (IPC/ES), team effort during planning implementation and ongoing follow-up phases.

2. Each program will be hospital-specific and based on a joint (IC/ES) definition of institutional expectations consistent with the CDC standards[1,2] and the attached check list. The responsibilities of ES staff and other hospital personnel for cleaning high touch surfaces (e.g., equipment in ICU rooms) will be clearly defined.

3. Either covertly or in conjunction with ES staff, an objective assessment of the terminal room thoroughness of surface disinfection cleaning will be done using one or more of the methods discussed below (see Objective Methods for

Evaluating Environmental Hygiene - Appendix B) to document the pre-intervention thoroughness of disinfection cleaning (generally referred to as the "TDC Score" calculated as # of objects cleaned / total # of objects evaluated X 100). Such results will be maintained by the institution and used internally to optimize programmatic and educational interventions.

4. Structured education of the ES staff to define programmatic and institutional expectations will be carried out and the proportion of ES staff who participate will be monitored. It would be expected that the results of the pre-intervention objective evaluation of disinfection cleaning be incorporated into the ES educational activity in a non-punitive manner (see Elements of the Educational Intervention – Appendix A).

5. Scheduled ongoing monitoring of the TDC cleaning using one or more of the objective monitoring approaches discussed in Appendix B will be performed at least three times a year. The monitoring will use a projected sample size based on the previous level of TDC in order to detect a 10-20% change in performance (see Sample Size Determination – Appendix C). The results will be recorded in an excel spreadsheet to calculate aggregate TDC scores (see Appendix D).

6. The results of the objective monitoring program and the objectively developed TDC scores will be used in ongoing educational activity and feedback to the ES staff following each cycle of evaluation. It is recommended that such results be shared more widely within and beyond the institution as useful and appropriate.

7. Results of the objective monitoring program and interventions to optimize the thoroughness of terminal room cleaning and disinfection will be a standing agenda item for the Infection Control Committee (ICC).

Reporting:

Results should be reported to the ICC and facility leadership and could be reported to the state health department through the state prevention collaborative coordinator by various mechanisms (e.g., NHSN template), depending on infrastructure.

---

[1] Guidelines for Environmental Infection Control in Healthcare Facilities, 2003 (http://www.cdc.gov/hicpac/pdf/guidelines/eic_in_HCF_03.pdf)

[2] Guideline for Disinfection and Sterilization in Healthcare Facilities, 2008 (http://www.cdc.gov/hicpac/pdf/guidelines/Disinfection_Nov_2008.pdf)

Appendices to the Conceptual Program Model for Environmental Evaluation

APPENDIX A

Elements of the Educational Intervention

Environmental Services Line Personnel – A presentation should be developed for all line staff involved in terminal room cleaning and should:

A. Provide an overview of the importance of HAIs in a manner commensurate with their educational level using as many pictorial illustrations as is feasible.
B. Explain their role in improving patient safety through optimized hygienic practice.
C. Review specific terminal room cleaning practice expectations.
D. Discuss the manner in which their practice will be evaluated. For Level II programs, a participatory demonstration of the monitoring method is very useful.
E. Provide them with information from the baseline evaluation emphasizing or possibly exclusively showing them results for those objects which have been most thoroughly cleaned (Level II).
F. Stress the non-punitive nature of the program.
G. Inform them that their good performance will be broadly recognized (i.e., beyond their department) and highlighted within their department for others to emulate. (Level II)
H. Repeatedly reinforce the importance of their work, and how it directly relates to the hospital's goals and mission and how it is appreciated by patients and plays a major role in a patient's satisfaction with the hospital.

Many hospitals have provided a small (possibly ES staff-language specific) pictorial booklet to the environmental services personnel at the conclusion of the presentation which is often developed to be language skill appropriate.

ES managers – As senior managers will be actively involved in the design and implementation of either Level I or Level II programs, educational interventions for them will need to be customized. While many of these individuals have an excellent understanding of the basic policies and procedures involved in terminal room cleaning, most will benefit from focused educational interventions related to our evolving understanding of the role of the environment in healthcare-associated pathogen (HAP) transmission. Evaluation of mid-level managers also needs to be customized. Most importantly, the impact of the program on mid-level ES managers needs to be monitored since additional formal and informal education is frequently needed for those individuals who are somewhat unsure of the importance of developing programmatic approaches to optimize terminal room cleaning.

Other groups – Given the overall importance of optimizing the thoroughness of hygienic practice in healthcare settings, hospital specific educational interventions graphically illustrating the impact of the program should be considered for both Level I and Level II programs. Such communications should be developed for a range of audiences within the hospital including the senior hospital administration, the medical staff, nursing personnel on the units, executive nursing and medical staff committees and the hospital's board of managers or directors.

APPENDIX B

Objective Methods for Evaluating Environmental Hygiene

In considering implementation of a Level II program, the advantages and limitations of various monitoring approaches must be considered carefully. The factors which distinguish each approach to Level II monitoring are discussed below and summarized in Fig.1. With any method or methods used it is important that neither the system itself (fluorescent marker) nor its use (precleaning cultures or ATP measurements) induce a Hawthorne type effect.

Direct Practice Observation – Covert monitoring of disinfection cleaning can provide an objective assessment of individual ES staff performance and compliance with cleaning protocols. This approach has been used to objectively evaluate and improve ICU environmental hygiene in one hospital.[1] While conceptually feasible, logistical issues related to maintaining such a program outside a research setting may limit adaptation of this form of Level II monitoring. Furthermore, the complexity of monitoring cleaning practice in individual patient rooms without the evaluator being recognized as such might represent a difficult confounding issue.

Swab Cultures – While several outbreak intervention studies have associated decreased environmental contamination by target organisms as a result of modified cleaning practice leading to decreased acquisition of targeted pathogens, none of the reports specifically note if serial environmental culture results were actually used to provide practice feedback to the ES staff. Although swab cultures are easy to use, the cost of processing, including isolate identification, the delay in analyzing results, the need to determine pre-cleaning levels of contamination for each object evaluated in order to accurately assess cleaning practice, and the limited feasibility of monitoring multiple surfaces in multiple patient rooms as part of an ongoing Level II monitoring program represent issues which could limit the broad application of this system.

Agar Slide Cultures – Agar coated glass slides with finger holds were developed to simplify quantitative cultures of liquids. The slides have been adopted for use in environmental surface monitoring in healthcare settings.[2] These studies have used agar

coated slide systems to evaluate cleaning practice by quantifying aerobic colony counts (ACCs) per cm.[2,3] While studies have measured aggregate ACCs before and after cleaning, no studies to date have evaluated the actual thoroughness of cleaning of the same objects to determine if objects with relatively high ACCs were either poorly cleaned or actually overlooked by the ES staff. Although some difficulties have been encountered in utilizing the agar slide cultures on other than large, flat surfaces, they potentially provide an easy method for quantifying viable microbial surface contamination. There is a need, similar to that noted above for swab cultures, to determine pre-cleaning levels of contamination for each object evaluated in order to accurately assess cleaning practice.

Fluorescent Markers – Fluorescent gel, powder, and lotion have all been developed for the purpose of marking high touch objects prior to room cleaning. While the powder and lotion have been used as part of educational interventions, their overt visibility (lotions and powder), ease with which they can be disturbed (powder), and difficulty with easy removal (lotion if allowed to air dry) may limit their use in a monitoring system and there is little or no published experience in their use for this purpose. In contrast, the fluorescent gel dries transparent on surfaces, resists abrasion, and there are several studies demonstrating the accuracy of the system in objectively evaluating cleaning practice and quantifying the impact of educational interventions on such cleaning.[4,5] Because these fluorescent markers are all designed to indicate physical removal of an applied substance, surfaces that are effectively disinfected but less effectively cleaned may be more likely flagged as failing to meet a quality standard using one of these markers than one of the culture techniques.

ATP Bioluminesence – The measurement of organic ATP on surfaces using a luciferase assay and luminometer has been used to evaluate cleanliness of food preparation surfaces for more than thirty years. A specialized swab is used to sample a standardized surface area which is then analyzed using a portable handheld luminometer. The total amount of ATP, both microbial and non-microbial, is quantified and expressed as relative light units. Although readout scales vary more than 10 fold and sensitivity varies between commercially available systems, very low readings are typically associated with low aerobic colony counts (ACCs).[6] Very high readings may represent either a viable bioburden, organic debris including dead bacteria or a combination of both. An independent study in 2007 by the U.K. National Health Service evaluating the potential role of the ATP tool in assessing cleaning practice concluded that the tool could potentially be used effectively for ES education.[7] Although it is likely that part of the lack of correlation between ATP readings and ACCs noted in the preceding studies relates to the fact that ATP systems measure organic debris as well as viable bacterial counts, several studies have noted additional environmental factors which may increase or decrease ATP readings. Because a large proportion of surface contamination with ATP is non-microbial in origin, surfaces that are effectively disinfected but less effectively cleaned may be more likely flagged as failing to meet a quality standard

using the ATP tool than one of the culture techniques. Additionally, high concentrations of bleach may potentially quench the ATP bioluminescence reaction and result in a signal reduction, but further research is needed to better understand the impact of bleach-based disinfectants on the use of the ATP system. If a bleach-based disinfectant is used, it is important that the surface is dry before using the ATP tool. Similar to the culture methods described above, it is unclear whether "threshold values" for a clean hospital surface can be established using existing methods, suggesting use of the ATP tool is likely to require pre-cleaning levels of contamination for each object evaluated in order to accurately assess cleaning practice. Despite these limitations, the ATP system has been used to broadly document significant improvement in daily cleaning as well as provide quantitative measurement to indicate the level of cleanliness of high touch surfaces.[8,9]

Final Points

No matter which of the Level II monitoring approaches is chosen by the hospital, it is important that the monitoring be performed by hospital epidemiologists, infection preventionists or their designees who are not part of the actual ES cleaning program. Such an approach assures the validity of the information collected and provides an opportunity for the Infection Control and Prevention Department to independently champion the value of well performed disinfection cleaning.

A more detailed and fully referenced discussion of the above noted approaches to Level II monitoring of terminal room cleaning, may be found in the article **Evaluating Hygienic Cleaning in Healthcare Settings: What You Don't Know Can Harm Your Patients** by P.C. Carling and J.M. Bartley in the June, 2010 supplement to the American Journal of Infection Control
http://www.ajicjournal.org/issues/contents?issue_key=S0196-6553(10)X0005-0

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APPENDIX C

Sample Size Determination
Logistical issues must also be considered as part of planning for the implementation of an enhanced program. Before a decision has been made to use one of the Level II methods to objectively monitor cleaning practice, it is important to determine the number of surfaces to be evaluated for establishing baseline level of thoroughness of cleaning and the number of data points which must be monitored on a regular basis to accurately assess improvement or deterioration in practice. While it would be ideal to be able to identify small fluctuations in practice accurately (e.g., 10% relative change), such an approach would be highly labor intensive. Instead, a meaningful change in cleaning practice (e.g., 20% relative change) can be detected without having to evaluate a substantial number of surfaces. Previous experience suggests that conducting a baseline

evaluation of all available surfaces (listed in the checklist) in a 10-15% sample of representative patient rooms is reasonable in a hospital with ≥150 beds. When hospitals have achieved a thoroughness of cleaning rate of >80%, the number of surfaces to be monitored can be decreased to those available in a 5% sample of rooms per evaluation cycle unless there is a deterioration in practice. In hospitals with less than 150 beds, all available surfaces (listed in the checklist) in a minimum of 15 rooms may be monitored for baseline and ongoing evaluation.

APPENDIX D

Calculation of Aggregate Thoroughness of Disinfection Cleaning (TDC) Score

The results of the evaluation of each object listed on the check list can be recorded in the attached excel spreadsheet template. The percentage of individual surfaces cleaned across multiple patient rooms will be automatically calculated by the excel spreadsheet. Because it has been found that cleaning practice within an institution is more likely to vary between types of objects than by patient units, the high touch surfaces listed in the check list have been grouped into 5 categories for calculating aggregate TDC scores: High Touch I, High Touch II, High Touch III, Bathroom Surfaces, and Equipment Surfaces. The aggregate TDC scores for each category of objects can be reported to the HAI prevention collaborative coordinator by various mechanisms (e.g., NHSN), depending on infrastructure.

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Figure 1

Evaluating Patient Zone Environmental Hygiene

Method	Ease of Use	Identifies Pathogens	Useful for Individual Teaching	Directly Evaluates Cleaning	Published Use in Programmatic Improvement
Direct Practice Observation	Low	No	Yes	Yes	1 Hospital
Swab cultures	High	Yes	Not Studied	Potentially	1 Hospital
Agar slide cultures	Good	Limited	Not Studied	Potentially	1 Hospital
Fluorescent gel	High	No	Yes	Yes	49 Hospitals
ATP system	High	No	Yes	Potentially	2 Hospitals

INSTRUCTIONS FOR EVALUATING THE CLEANING OF OBJECTS IN THE PATIENT ZONE

The group of objects on the checklist was chosen on the basis of information regarding the contamination of these surfaces with healthcare-associated pathogens (HAPs) as well as a consideration of the likelihood they would be touched during routine care by healthcare personnel without changing gloves or performing hand hygiene prior to using these items.

The following descriptions and suggestions should be used to standardize, to the degree feasible, the manner in which the thoroughness of cleaning can be most consistently evaluated. If the evaluation system utilizes a fluorescent gel targeting system, the targets should generally be placed very near but not in/on the area of the object touched in routine use (as noted in the outline below) in order to avoid disturbing the target during actual use of the object. If one of the direct evaluation systems (one of the two culture methods or the ATP method as described in the Appendix) is being used, the primary hand touch area of each object should be evaluated as noted in the outline below, taking particular care to evaluate exactly the same area of the object before and after cleaning.

All available objects noted below should be marked in each room.

Patient Area

Bed rails – If the bed rail incorporates bed controls, evaluate the control area (on the patient side) slightly away from the control buttons. If the rails do not contain the new style control areas, the rails are best evaluated on the smooth inner surface in an area easily accessible to cleaning.

Tray table - The top of the tray table should be evaluated in one corner.

Call boxes – Evaluation is done on the back mid portion of the call box in an area easily accessible to cleaning. If tiny call buttons are used, mark the separate TV control box instead if feasible.

Telephones – Evaluation is best done on the back side of the hand-held portion of the telephone near the top of the phone, away from the end that is attached to the phone wire.

Bedside tables – The drawer pull is evaluated.

Patient chair – Evaluation is done in the center of the seat of the chair close to the rear of the cushion. If the cushion is covered in textured fabric, evaluate the arm of the chair.

IV pole – For hanging IV poles, the shaft of the pole just above the textured grab area should be evaluated. For standing IV poles, the chest-high portion where hand contact is most common should be evaluated.

Toilet Area

Sinks – If using a targeting system, the best place to mark the sink rim is towards the rear in order to avoid water splash interference with evaluation of the target. If direct evaluation is used, the faucet handle should be evaluated.

Bathroom and patient room light switches – When using a targeting method, a target is placed on the plate portion of the light switch. When using a direct evaluation system, the switch or plate should be evaluated because of its relatively large surface area.

Door knobs and door levers – The inside door knob or lever is marked for each bathroom door and each patient room door. If using a targeting system on a round door knob, the mark is best placed as close to the middle of the face of the door knob as possible. If the knob has a locking mechanism, place the target on the circular door plate that surrounds the handle. Lever-type handles are marked on any easily cleanable surface somewhat away from the end of the lever where direct hand contact would be most frequent. Similarly, when using a fluorescent system, door push plates are marked in the middle of the smooth part of the plate. When using direct evaluation systems, the most frequently contacted portion of the door knob, lever or push plate should be evaluated.

Toilet area hand holds (bathroom handrails) – Evaluate the most accessible surface of the hand hold just off the edge of the textured surface at the curve where the hand hold goes towards the wall. If there are two hand holds, mark the one most likely to be touched by a patient using the toilet.

Toilet seats – When using a targeting method, the target is placed on the back of the toilet seat just below the outside edge of the seat in an area readily accessible to cleaning activities. When using a direct evaluation method, the surface of the toilet seat should be evaluated, being sure to evaluate the same area before and after cleaning.

Toilet handles – When using a targeting method, the target is placed on top of the handle approximately two thirds away from the end of the handle.

Bed pan cleaning equipment – Two types of bed pan cleaning equipment designed as part of toilet units are in general use in hospitals.

Hinged pipe type cleaner - The most commonly used bed pan cleaner consists of a pipe with a small shower head type device that is lowered over the toilet bowl by the user. When the arm is lowered, the toilet flush water is sprayed in a stream through the cleaner head. This device is best targeted by marking the spray head (the most common area which would be touched by users).

Spray hoses – Some toilets have a spray hose with a lever-type trigger on the handle which is depressed to activate the spray head. Evaluate the handle itself.

Where Applicable

IV Pump control panel – Evaluate an area that is just adjacent to the portion of the panel that is most frequently touched by healthcare providers.

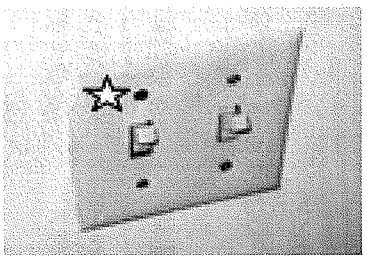
Monitor control panel – When using a targeting method, the control panel should be evaluated in an area immediately adjacent to a part of the panel which is directly contacted by caregivers' hands. When using a direct method, the control area itself is evaluated.

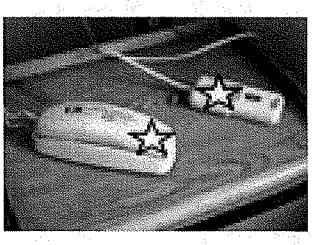
Monitor touch screen – The touch screen should be evaluated in the lower right hand corner in an area easily accessible to cleaning.

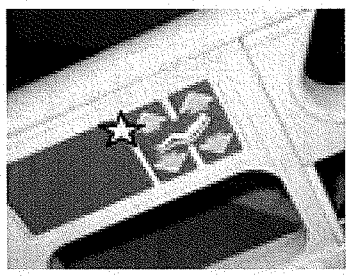
Monitor cables – Evaluate the junction box area.

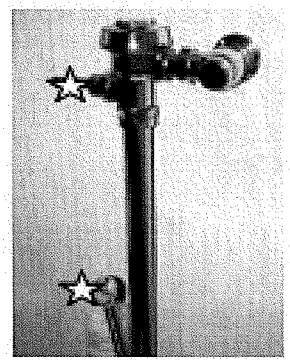
Ventilator control panel – Evaluate an area immediately adjacent to a part of the panel which is most frequently touched by healthcare provider.

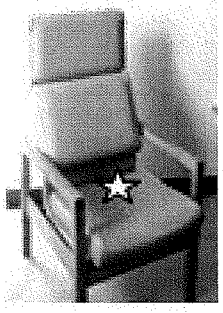
TARGET PLACMENT ON HIGH TOUCH OBJECTS

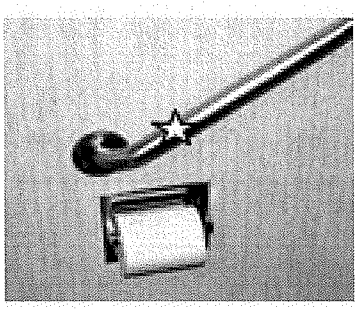


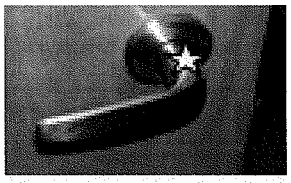












SAFE from CDI

Antimicrobial Stewardship

Patient Safety

Infectious Diseases Society of America and the Society for Healthcare Epidemiology of America Guidelines for Developing an Institutional Program to Enhance Antimicrobial Stewardship

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EXECUTIVE SUMMARY

This document presents guidelines for developing institutional programs to enhance antimicrobial stewardship, an activity that includes appropriate selection, dosing, route, and duration of antimicrobial therapy. The multifaceted nature of antimicrobial stewardship has led to collaborative review and support of these recommendations by the following organizations: American Academy of Pediatrics, American Society of Health-System Pharmacists, Infectious Diseases Society for Obstetrics and Gynecology, Pediatric Infectious Diseases Society, Society for Hospital Medicine, and Society of Infectious Diseases Pharmacists. The primary goal of antimicrobial stewardship is to optimize clinical outcomes while minimizing unintended consequences of antimicrobial use, including toxicity, the selection of pathogenic organisms (such as *Clostridium difficile*), and the emergence of resistance. Thus, the appropriate use of antimicrobials is an essential part of patient safety and deserves careful oversight and guidance. Given the association between antimicrobial use and the selection of resistant pathogens, the frequency of inappropriate antimicrobial use is often used as a surrogate marker for the avoidable impact on antimicrobial resistance. The combination of effective antimicrobial stewardship with a comprehensive infection control program has been shown to limit the emergence and transmission of antimicrobial-resistant bacteria. A secondary goal of antimicrobial stewardship is to reduce health care costs without adversely impacting quality of care.

These guidelines focus on the development of effective hospital-based stewardship programs and do not include specific outpatient recommendations. Although judicious use of antimicrobials is important in outpatient clinics and long-term care facilities, there are very few data regarding effective interventions, and it is unclear which interventions are most responsible for improvement in these settings.

The population targeted by these guidelines includes all patients in acute care hospitals. Most of the evidence supporting the recommendations in these guidelines is derived from studies of interventions to improve antimicrobial use for hospitalized adults. Many of these studies have focused on adults in intensive care units. Only a handful of studies have focused on hospitalized newborns, children, and adolescents. Few studies have included substantial populations of severely immunocompromised patients, such as patients undergoing

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hematopoetic stem cell transplantation or receiving chemotherapy likely to cause prolonged neutropenia. Nonetheless, the recommendations in these guidelines are likely to be broadly applicable to all hospitalized patients.

The ratings of the practices recommended in this document reflect the likely impact of stewardship practices on improving antimicrobial use and, consequently, minimizing the emergence and spread of antimicrobial resistance. Each recommendation is rated on the basis of the strength of the recommendation and the quality of evidence supporting it, using the rating system of the Infectious Disease Society of America (IDSA), as shown in table 1 [1]. The ratings provided also reflect the likely ability of the recommendation to reduce health care costs. Some strategies to reduce resistance may actually result in an increase in drug acquisition costs as part of a more comprehensive plan to reduce overall costs, including the attributable costs of resistance. In situations in which the likely impact of a recommendation on appropriate use of antimicrobials and health care costs diverge or in which cost data are not available, separate ratings are given.

Effective antimicrobial stewardship programs can be financially self-supporting and improve patient care [2–7] (A-II). Comprehensive programs have consistently demonstrated a decrease in antimicrobial use (22%–36%), with annual savings of $200,000–$900,000 in both larger academic hospitals [2, 3, 5, 7, 8] and smaller community hospitals [4, 6]. Thus, health care facilities are encouraged to implement antimicrobial stewardship programs. A comprehensive evidence-based stewardship program to combat antimicrobial resistance includes elements chosen from among the following recommendations based on local antimicrobial use and resistance problems and on available resources that may differ, depending on the size of the institution or clinical setting.

1. Core members of a multidisciplinary antimicrobial stewardship team include an infectious diseases physician and a clinical pharmacist with infectious diseases training (A-II) who should be compensated for their time (A-III), with the inclusion of a clinical microbiologist, an information system specialist, an infection control professional, and hospital epidemiologist being optimal (A-III). Because antimicrobial stewardship, an important component of patient safety, is considered to be a medical staff function, the program is usually directed by an infectious diseases physician or codirected by an infectious diseases physician and a clinical pharmacist with infectious diseases training (A-III).

2. Collaboration between the antimicrobial stewardship team and the hospital infection control and pharmacy and therapeutics committees or their equivalents is essential (A-III).

3. The support and collaboration of hospital administration, medical staff leadership, and local providers in the development and maintenance of antimicrobial stewardship programs is essential (A-III). It is desirable that antimicrobial stewardship programs function under the auspices of quality assurance and patient safety (A-III).

4. The infectious diseases physician and the head of pharmacy, as appropriate, should negotiate with hospital administration to obtain adequate authority, compensation, and expected outcomes for the program (A-III).

5. Hospital administrative support for the necessary infrastructure to measure antimicrobial use and to track use on an ongoing basis is essential (A-III).

6. There are 2 core strategies, both proactive, that provide the foundation for an antimicrobial stewardship program. These strategies are not mutually exclusive.

A. ***Prospective audit with intervention and feedback.*** Prospective audit of antimicrobial use with direct interaction and feedback to the prescriber, performed by either an infectious diseases physician or a clinical pharmacist with infectious diseases training, can result in reduced inappropriate use of antimicrobials (A-I).

Table 1. Infectious Diseases Society of America–United States Public Health Service grading system for ranking recommendations in clinical guidelines.

Category, grade	Definition
Strength of recommendation	
A	Good evidence to support a recommendation for use
B	Moderate evidence to support a recommendation for use
C	Poor evidence to support a recommendation for use
Quality of evidence	
I	Evidence from ⩾1 properly randomized, controlled trial
II	Evidence from ⩾1 well-designed clinical trial, without randomization; from cohort or case-controlled analytic studies (preferably from >1 center); from multiple time-series; or from dramatic results from uncontrolled experiments
III	Evidence from opinions of respected authorities, based on clinical experience, descriptive studies, or reports of expert committees

NOTE. Adapted from [1].

B. ***Formulary restriction and preauthorization.*** Formulary restriction and preauthorization requirements can lead to immediate and significant reductions in antimicrobial use and cost (A-II) and may be beneficial as part of a multifaceted response to a nosocomial outbreak of infection (B-II). The use of preauthorization requirements as a means of controlling antimicrobial resistance is less clear, because a long-term beneficial impact on resistance has not been established, and in some circumstances, use may simply shift to an alternative agent with resulting increased resistance (B-II). In institutions that use preauthorization to limit the use of selected antimicrobials, monitoring overall trends in antimicrobial use is necessary to assess and respond to such shifts in use (B-III).

7. The following elements may be considered and prioritized as supplements to the core active antimicrobial stewardship strategies based on local practice patterns and resources.

A. ***Education.*** Education is considered to be an essential element of any program designed to influence prescribing behavior and can provide a foundation of knowledge that will enhance and increase the acceptance of stewardship strategies (A-III). However, education alone, without incorporation of active intervention, is only marginally effective in changing antimicrobial prescribing practices and has not demonstrated a sustained impact (B-II).

B. ***Guidelines and clinical pathways.*** Multidisciplinary development of evidence-based practice guidelines incorporating local microbiology and resistance patterns can improve antimicrobial utilization (A-I). Guideline implementation can be facilitated through provider education and feedback on antimicrobial use and patient outcomes (A-III).

C. ***Antimicrobial cycling.*** There are insufficient data to recommend the routine use of antimicrobial cycling as a means of preventing or reducing antimicrobial resistance over a prolonged period of time (C-II). Substituting one antimicrobial for another may transiently decrease selection pressure and reduce resistance to the restricted agent. Unless the resistance determinant has been eliminated from the bacterial population, however, reintroduction of the original antimicrobial is again likely to select for the expression of the resistance determinant in the exposed bacterial population.

D. ***Antimicrobial order forms.*** Antimicrobial order forms can be an effective component of antimicrobial stewardship (B-II) and can facilitate implementation of practice guidelines.

E. ***Combination therapy.*** There are insufficient data to recommend the routine use of combination therapy to prevent the emergence of resistance (C-II). Combination therapy does have a role in certain clinical contexts, including use for empirical therapy for critically ill patients at risk of infection with multidrug-resistant pathogens, to increase the breadth of coverage and the likelihood of adequate initial therapy (A-II).

F. ***Streamlining or de-escalation of therapy.*** Streamlining or de-escalation of empirical antimicrobial therapy on the basis of culture results and elimination of redundant combination therapy can more effectively target the causative pathogen, resulting in decreased antimicrobial exposure and substantial cost savings (A-II).

G. ***Dose optimization.*** Optimization of antimicrobial dosing based on individual patient characteristics, causative organism, site of infection, and pharmacokinetic and pharmacodynamic characteristics of the drug is an important part of antimicrobial stewardship (A-II).

H. ***Parenteral to oral conversion.*** A systematic plan for parenteral to oral conversion of antimicrobials with excellent bioavailability, when the patient's condition allows, can decrease the length of hospital stay and health care costs (A-I). Development of clinical criteria and guidelines allowing switch to use of oral agents can facilitate implementation at the institutional level (A-III).

8. Health care information technology in the form of electronic medical records (A-III), computer physician order entry (B-II), and clinical decision support (B-II) can improve antimicrobial decisions through the incorporation of data on patient-specific microbiology cultures and susceptibilities, hepatic and renal function, drug-drug interactions, allergies, and cost. However, implementation of these features has been slow, and conformation of the technology to the clinical environment remains a challenge.

9. Computer-based surveillance can facilitate good stewardship by more efficient targeting of antimicrobial interventions, tracking of antimicrobial resistance patterns, and identification of nosocomial infections and adverse drug events (B-II).

10. The clinical microbiology laboratory plays a critical role in antimicrobial stewardship by providing patient-specific culture and susceptibility data to optimize individual antimicrobial management and by assisting infection control efforts in the surveillance of resistant organisms and in the molecular epidemiologic investigation of outbreaks (A-III).

11. Both process measures (did the intervention result in the desired change in antimicrobial use?) and outcome measures (did the process implemented reduce or prevent resistance or other unintended consequences of antimicrobial use?) are useful in determining the impact of antimicrobial stewardship on antimicrobial use and resistance patterns (B-III).

INTRODUCTION

Purpose. In recognition that antimicrobial resistance results in increased morbidity, mortality, and cost of health care, the IDSA initially published guidelines for improving the use of

antimicrobial agents in hospitals in 1988 [9] and then jointly published guidelines with the Society for Healthcare Epidemiology of America in 1997 for the prevention of antimicrobial resistance in hospitals [10]. However, subsequent surveys of hospitals have found that practices to improve antimicrobial use are frequently inadequate and not routinely implemented [11–13]. The purpose of these guidelines is to build on the previous position statements, as well as to provide evidence-based recommendations for developing a program to enhance antimicrobial stewardship in the hospital setting to improve the quality of care. These guidelines are not a substitute for clinical judgment, and clinical discretion is required in the application of guidelines to individual patients.

Effective antimicrobial stewardship programs, also known as antimicrobial management programs, can be financially self-supporting and can improve patient care [2–7] (A-II). Antimicrobial stewardship includes not only limiting inappropriate use but also optimizing antimicrobial selection, dosing, route, and duration of therapy to maximize clinical cure or prevention of infection while limiting the unintended consequences, such as the emergence of resistance, adverse drug events, and cost. Given the emergence of multidrug-resistant pathogens and their impact on clinical care, appropriate use of antimicrobial agents has become a focus of patient safety and quality assurance along with medication errors, allergy identification, and drug-drug interactions [14]. The ultimate goal of antimicrobial stewardship is to improve patient care and health care outcomes.

From the institutional perspective, antimicrobials account for upwards of 30% of hospital pharmacy budgets [15]. It has been recognized for several decades that up to 50% of antimicrobial use is inappropriate, adding considerable cost to patient care [8, 9, 15–18]. In addition to direct pharmacy acquisition costs, numerous reports suggest that inappropriate and unnecessary antimicrobial use leads to increased selection of resistant pathogens (table 2). Once antimicrobial resistance emerges, it can have a significant impact on patient morbidity and mortality, as well as increased health care costs [32, 33]. Bacteremia [34, 35] and surgical site infections [36] due to methicillin-resistant *Staphylococcus aureus* (MRSA) have been associated with a higher mortality rate than similar infections due to methicillin-susceptible *S. aureus*, with the mean attributable cost of an MRSA infection ranging from $9275 to $13,901 [36, 37]. Similarly, compared with vancomycin-susceptible *Enterococcus faecium* infections, bloodstream infections due to vancomycin-resistant *E. faecium* (VRE) were associated with decreased survival (24% vs. 59%), increased length of hospital stay (34.8 vs. 16.7 days), and an attributable cost of $27,190 per episode [38, 39]. A meta-analysis of 9 studies of VRE bloodstream infections found an attributable excess mortality of 30%, compared with vancomycin-susceptible *Enterococcus* bloodstream infections [40]. Similar adverse outcomes have also been reported for infections with resistant gram-negative organisms, including *Pseudomonas, Acinetobacter,* and *Enterobacter* species and extended-spectrum β-lactamase–producing organisms [41]. A case-control study found that third-generation cephalosporin–resistant *Enterobacter* infections were associated with increased mortality (relative risk, 5.02), length of hospital stay (1.5-fold increase), and an attributable cost of $29,379 [42]. The emergence of infections with multidrug-resistant gram-negative organisms, combined with a paucity of new drug development, has unfortunately led to the resurgent use of colistin, a polymyxin antimicrobial previously abandoned because of its high rates of nephrotoxicity and neurotoxicity [43]. In 1998, the Institute of Medicine estimated that the annual cost of infections caused by antimicrobial-resistant bacteria was $4–$5 billion [44].

Table 2. Causal associations between antimicrobial use and the emergence of antimicrobial resistance.

Changes in antimicrobial use are paralleled by changes in the prevalence of resistance.
Antimicrobial resistance is more prevalent in health care–associated bacterial infections, compared with those from community-acquired infections.
Patients with health care–associated infections caused by resistant strains are more likely than control patients to have received prior antimicrobials.
Areas within hospitals that have the highest rates of antimicrobial resistance also have the highest rates of antimicrobial use.
Increasing duration of patient exposure to antimicrobials increases the likelihood of colonization with resistant organisms.

NOTE. A causal association between antimicrobial use and the emergence of antimicrobial resistance has been reviewed elsewhere [9, 19–22] and is strongly suggested on the basis of several lines of evidence that are derived from patient and population levels of analysis, colonization and infection data, and retrospective and prospective studies [23–31]. Adapted from [10].

Methods. The recommendations in this guideline are based on a review of published studies identified through a search of the PubMed database (search terms used alone and in combination included "antimicrobial," "antibiotic," "stewardship," "management," "resistance," "cost," "education," "guidelines," "restriction," "cycling," "order forms," and "combination therapy") supplemented by review of references of relevant articles to identify additional reports. Committee members were also asked to cite additional relevant studies to support the recommendations. Because of the limited number of randomized, controlled trials, results from prospective cohort studies, case-control studies, longitudinal time series, and other descriptive studies are included in the review. The ratings of the practices recommended in this document reflect the likely impact of such practices on improving antimicrobial use and, ultimately, antimicrobial resistance. Given the association between antimicrobial use and the selection of resistant pathogens, rates of

inappropriate antimicrobial use are considered as surrogate markers for the avoidable impact on antimicrobial resistance.

The strength of the recommendations and quality of evidence are rated using IDSA criteria (table 1) [1]. Individual studies were evaluated both for their impact on the targeted antimicrobial(s) or resistance problem and for any secondary impact on local antimicrobial use and resistance patterns. The ratings also reflect the likely ability of the recommendation to reduce health care costs. In situations in which the likely impact of a recommendation on appropriate use of antimicrobials and health care costs diverge or cost data are not available, separate ratings are given. Recommendations reflect a compilation of the studies in each section, as well as the opinions of the committee members.

GUIDELINES FOR DEVELOPING AN INSTITUTIONAL PROGRAM TO ENHANCE ANTIMICROBIAL STEWARDSHIP

THE ANTIMICROBIAL STEWARDSHIP TEAM AND ADMINISTRATIVE SUPPORT

It is essential that the antimicrobial stewardship team includes an infectious diseases physician and a clinical pharmacist with infectious diseases training and that both of these individuals are compensated appropriately for their time. Optimally, the team should include a clinical microbiologist who can provide surveillance data on antimicrobial resistance, as well as an information system specialist who can provide the computer support necessary for surveillance and implementation of recommendations. In addition, it is optimal that the team includes an infection control professional and hospital epidemiologist to coordinate efforts on improving antimicrobial use, because reduction of antimicrobial resistance is a common goal of these persons. Because antimicrobial stewardship, an important component of patient safety, is considered to be a medical staff function, the program is usually directed by an infectious diseases physician or codirected by an infectious diseases physician and a clinical pharmacist with infectious diseases training. The clinical pharmacist should be knowledgeable on the appropriate use of antimicrobials, and appropriate training should be made available to achieve and maintain this expertise. It is essential that there be support and collaboration between the antimicrobial stewardship team and the hospital infection control and pharmacy and therapeutics committees or their equivalents.

The support and collaboration of hospital administration, medical staff leadership, and local providers in the development and maintenance of antimicrobial stewardship programs is essential to success of the program. In this regard, the infectious diseases physician and the head of pharmacy, as appropriate, should negotiate with hospital administration to obtain adequate authority, compensation, and expected outcomes for the program (A-III). It is essential that there be hospital administrative support for the necessary infrastructure, to measure antimicrobial use and to track use on an ongoing basis (A-III). It is desirable that antimicrobial stewardship programs function under the auspices of quality assurance and patient safety. Prior to program implementation, the antimicrobial stewardship strategic plan should be presented to and approved by the chiefs of professional services, hospital medical staff executive committee, and/or other medical staff governing bodies, to ensure their acceptance and support.

Recommendations

- Core members of a multidisciplinary antimicrobial stewardship team include an infectious diseases physician and a clinical pharmacist with infectious diseases training (A-II) who should be compensated for their time (A-III), with the inclusion of a clinical microbiologist, an information system specialist, an infection control professional, and hospital epidemiologist being optimal (A-III). Because antimicrobial stewardship, an important component of patient safety, is considered to be a medical staff function, the program is usually directed by an infectious diseases physician or codirected by an infectious diseases physician and a clinical pharmacist with infectious diseases training (A-III).
- Collaboration between the antimicrobial stewardship team and the hospital infection control and pharmacy and therapeutics committees, or their equivalents, is essential (A-III).
- The support and collaboration of hospital administration, medical staff leadership, and local providers in the development and maintenance of antimicrobial stewardship programs is essential (A-III). It is desirable that antimicrobial stewardship programs function under the auspices of quality assurance and patient safety (A-III).
- The infectious diseases physician and the head of pharmacy, as appropriate, should negotiate with hospital administration to obtain adequate authority, compensation, and expected outcomes for the program (A-III).
- Hospital administrative support for the necessary infrastructure to measure antimicrobial use and to track use on an ongoing basis is essential (A-III).

ELEMENTS OF AN ANTIMICROBIAL STEWARDSHIP PROGRAM

The best strategies for the prevention and containment of antimicrobial resistance are not definitively established, because there is a paucity of randomized, controlled trials in this field [45]. Often, multiple interventions have been made simultaneously, making it difficult to assess the benefit attributable to any one specific intervention. However, a comprehensive program that includes active monitoring of resistance, fostering of

appropriate antimicrobial use, and collaboration with an effective infection control program to minimize secondary spread of resistance [46, 47] is considered to be optimal [48]. A comprehensive evidence-based stewardship program to combat antimicrobial resistance includes elements chosen from among the following strategies, which are based on local antimicrobial use and resistance problems, and on available resources that may differ depending on the size of the institution or clinical setting.

Active Antimicrobial Stewardship Strategies

Prospective audit with intervention and feedback. Prospective audit of antimicrobial use with intervention and feedback to the prescriber have been demonstrated to improve antimicrobial use. In a large teaching hospital, house staff were randomized by the medical service to receive either no intervention or one-on-one education by a clinical specialist (academic detailing) on a patient-specific basis, emphasizing microbiologic data, local resistance patterns, and clinical literature, when the pharmacy received an order for either levofloxacin or ceftazidime. This resulted in a 37% reduction in the number of days of unnecessary levofloxacin or ceftazidime use by decreasing the duration of therapy, as well as reducing new starts, suggesting that house staff learned not to initiate unnecessary antibiotic treatment regimens [49]. At a 600-bed tertiary teaching hospital, inpatients receiving parenteral antimicrobials chosen by their primary care physician were randomized to an intervention group that received antimicrobial-related suggestions from an infectious diseases fellow and a clinical pharmacist versus no antimicrobial suggestions. Physicians in the intervention group received 74 suggestions for 62 of 127 patients, including suggestions on a more appropriate agent, route of administration, dosing, discontinuation of the drug, or toxicity monitoring. Eighty-five percent of the suggestions were implemented, resulting in 1.6 fewer days of parenteral therapy and a cost savings of $400 per patient, with no adverse impact on clinical response, compared with the control group [50]. There was a trend, however, toward increasing rates of readmission in the intervention group, emphasizing the need to monitor the impact of such interventions designed to decrease length of hospital stay.

Prospective audit and interventions by a clinical pharmacist and infectious diseases physician at a medium-sized community hospital resulted in a 22% decrease in the use of parenteral broad-spectrum antimicrobials, despite a 15% increase in patient acuity over a 7-year period [3]. They also demonstrated a decrease in rates of *C. difficile* infection and nosocomial infection caused by drug-resistant Enterobacteriaceae, compared with the preintervention period.

In hospitals where daily review of antimicrobial use is not feasible because of limited resources, a scaled-down model can still have a significant impact, as illustrated by a small, 120-bed community hospital that used an infectious diseases physician and clinical pharmacist 3 days per week to review patients receiving multiple, prolonged, or high-cost courses of antimicrobial therapy [4]. Sixty-nine percent of 488 recommendations were implemented, resulting in a 19% reduction in antimicrobial expenditures for an estimated annual savings of $177,000, compared with the preintervention period. In these studies, interventions were communicated to prescribers either verbally or in writing. Written communication was typically accomplished by using special, nonpermanent forms that were placed in the medical record or chart but were subsequently removed after the intervention or at the time of discharge from the hospital. Each intervention provides the opportunity for provider education.

Effective audit with intervention and feedback can be facilitated through computer surveillance of antimicrobial use, allowing the targeting of specific services or units where problems exist, as well as identification of patients receiving particular agents or combinations of agents that might benefit from intervention.

Recommendation

- Prospective audit of antimicrobial use with direct interaction and feedback to the prescriber, performed by either an infectious diseases physician or a clinical pharmacist with infectious diseases training, can result in reduced inappropriate use of antimicrobials (A-I).

Formulary restriction and preauthorization requirements for specific agents. Most hospitals have a pharmacy and therapeutics committee or an equivalent group that evaluates drugs for inclusion on the hospital formulary on the basis of considerations of therapeutic efficacy, toxicity, and cost while limiting redundant new agents with no significant additional benefit. Antimicrobial restriction—either through formulary limitation by this method or by the requirement of preauthorization and justification—is the most effective method of achieving the process goal of controlling antimicrobial use. Longitudinal studies implementing restrictive policies have demonstrated significant initial decreases in the use of the targeted antimicrobials, with annual antimicrobial cost savings ranging upwards of $800,000 [14, 51–57]. The achievement of the outcome goal of reducing antimicrobial resistance has not been as clear, as illustrated by the following studies.

Both formulary restriction [58] and preauthorization requirements for use of clindamycin [59] during nosocomial epidemics of *C. difficile* infection have led to prompt cessation of the outbreaks, whereas preapproval restriction of broad-spectrum antimicrobials has led to short-term increased susceptibilities among gram-negative pathogens, such as *Pseudomonas aeruginosa, Klebsiella pneumoniae,* and *Enterobacter*

cloacae, during a 6–12-month period [57, 60]. Restriction of vancomycin and third-generation cephalosporins in response to increasing rates of VRE has demonstrated mixed results [61–63]. Fecal VRE colonization rates of 47% (despite barrier precautions) led one center to restrict vancomycin and cefotaxime use while encouraging the replacement of third-generation cephalosporins with β-lactam/β-lactamase inhibitor combinations. This led to a reduction in the rates of monthly use of vancomycin, cefotaxime, and ceftazidime by 34%, 84%, and 55%, respectively, and rates of ampicillin-sulbactam and piperacillin-tazobactam use increased. This was accompanied by a decrease in the fecal VRE point prevalence from 47% to 15% during 6 months [59]. In contrast, in another study, the prevalence of VRE increased from 17% to 30%, despite the restriction on the use of vancomycin and third-generation cephalosporins during a 10-year period [64]. The interpretation of these study results is often confounded by concomitant changes in infection control practices and by the influence of nonrestricted antimicrobial agents on gut flora.

Studies of antibiotic-restriction policies among pediatric patients have demonstrated inconsistent results. A crossover study of 2 neonatal intensive care units (ICUs) compared 2 approaches for empirical treatment of early- and late-onset suspected sepsis—a "broad-spectrum" regimen consisting of ampicillin and cefotaxime versus a "narrow-spectrum" regimen consisting of penicillin and tobramycin—on the prevalence of colonization with bacteria resistant to each of the regimens [65]. The narrow-spectrum regimen was associated with a markedly lower prevalence of colonization with resistant gram-negative bacilli. In contrast, a quasi experimental study from a pediatric ICU of a policy to restrict ceftazidime use (piperacillin-tazobactam was the preferred regimen) found no change in the incidence of colonization with ceftazidime-resistant gram-negative bacilli, although there was a decrease in the prevalence of colonization with specific species of gram-negative bacilli that commonly harbor inducible AmpC β-lactamases (e.g., *E. cloacae, Serratia marcesens, Citrobacter freundii,* and *P. aeruginosa*) [66].

The effectiveness of a preauthorization program depends on who is making the recommendations. Restriction of cefotaxime use through a program requiring approval from a chief resident or attending physician had no impact on its use [67]. Recommendations from an antimicrobial management team consisting of a pharmacist and an infectious diseases physician resulted in increased antimicrobial appropriateness, increased clinical cure, and a trend towards improved economic outcome, compared with recommendations made by infectious diseases fellows [68].

The challenge of antimicrobial restriction and its effect on antimicrobial resistance is exemplified in a study by Rahal et al. [27]. In response to an increasing incidence of cephalosporin-resistant *Klebsiella,* a preapproval policy was implemented for cephalosporins. This resulted in an 80% reduction in hospital-wide cephalosporin use and a subsequent 44% reduction in the incidence of ceftazidime-resistant *Klebsiella* throughout the medical center, as well as a 71% reduction in the ICUs. Concomitantly, however, imipenem use increased 141%, accompanied by a 69% increase in the incidence of imipenem-resistant *P. aeruginosa.* This untoward restrictive effect of "squeezing the balloon" may counteract the originally sought benefits [69]. Furthermore, restricting use of a single drug to prevent or reverse antimicrobial resistance may be ineffective, because multiple antimicrobials may be associated with changes in susceptibility to other drugs for a given pathogen [70].

Recommendation

- Formulary restriction and preauthorization requirements can lead to immediate and significant reductions in antimicrobial use and cost (A-II) and may be beneficial as part of a multifaceted response to a nosocomial outbreak of infection (B-II). The use of preauthorization requirements as a means of controlling antimicrobial resistance is less clear, because a long-term beneficial impact on resistance has not been established, and in some circumstances, use may simply shift to an alternative agent with resulting increased resistance (B-II). In institutions that use preauthorization to limit the use of selected antimicrobials, monitoring overall trends in antimicrobial use is necessary to assess and respond to such shifts in use (B-III).

Supplemental Antimicrobial Stewardship Strategies

Education. Education is the most frequently employed intervention and is considered to be an essential element of any program designed to influence prescribing behavior. Educational efforts include passive activities, such as conference presentations, student and house staff teaching sessions, and provision of written guidelines or e-mail alerts. However, education alone, without incorporation of active intervention, is only marginally effective and has not demonstrated a sustained impact [71–73].

Step-wise implementation of an antimicrobial stewardship program initially with passive strategies, such as education and order forms, followed by an active strategy with prospective audit and intervention demonstrated progressive decreases in antimicrobial consumption, resulting in a savings of $913,236 over 18 months. During the period of active intervention, 25% of antimicrobial orders were modified (86% resulted in less expensive therapy, and 47% resulted in use of a drug with a narrower spectrum of activity), resulting in a significant increase in microbiologically based prescribing (63% vs. 27%) [71].

In an attempt to improve adherence to recommendations for perioperative antimicrobial prophylaxis, a before-and-after

study compared prescribing practices after distribution of an educational handbook with those after the introduction of an order form. The educational handbook led to a marginal improvement in compliance (from 11% to 18%), whereas introduction of the order form led to significantly improved compliance (from 17% to 78%) [73].

Recommendation

- Education is considered to be an essential element of any program designed to influence prescribing behavior and can provide a foundation of knowledge that will enhance and increase the acceptance of stewardship strategies (A-III). However, education alone, without incorporation of active intervention, is only marginally effective in changing antimicrobial prescribing practices and has not demonstrated a sustained impact (B-II).

Guidelines and clinical pathways. Clinical practice guidelines are being produced with increasing frequency, with the goal of ensuring high-quality care. However, the impact on provider behavior and improved clinical outcomes has been difficult to measure. Although physicians usually agree, in principle, with national guidelines, the absence of accompanying strategies for local implementation often presents a formidable barrier [74]. Antimicrobial stewardship programs can facilitate multidisciplinary development of evidence-based practice guidelines that incorporate local microbiology and resistance patterns.

Randomized implementation of a clinical pathway, compared with conventional management of community-acquired pneumonia, among 20 hospitals led to a 1.7-day decrease in the median length of hospital stay, an 18% decrease in the rate of admissions of low-risk patients, and 1.7 fewer mean days of intravenous therapy in the intervention group, without an increase in complications, readmissions, or mortality [75]. In another study, multidisciplinary development of practice guidelines based on evidence in the literature and local microbiology and resistance patterns and implementation in a surgical ICU led to a 77% reduction in antimicrobial use and cost, a 30% reduction in overall cost of care, decreased mortality among patients with infection, and a trend towards reduced length of ICU stay, compared with the preimplementation time period [76]. Importantly, both of these studies demonstrate that antimicrobial selection is only 1 component in improving the management of infectious diseases and cannot be done without recommendations for diagnosis and testing, admission criteria, nursing care, conversion to oral medication, and discharge planning. Whether the use of guidelines will lead to a long-term impact on antimicrobial resistance remains to be determined, but the following studies of hospital-acquired pneumonia (HAP) and ventilator-associated pneumonia (VAP) suggest that improving antimicrobial use through the use of guidelines may decrease the emergence of resistant pathogens.

The increasing incidence of multidrug-resistant organisms in cases of HAP and VAP, the diagnostic challenge of these entities, and the mortality benefit associated with initial appropriate therapy [77] have led to an increased use of broad-spectrum antimicrobials, which must be balanced against further selection of resistant pathogens. Invasive diagnosis of VAP with quantitative bronchoscopy for diagnosis and antimicrobial guidance led to reduced mortality at 14 days and a decrease in antimicrobial use [78]. Another strategy to address the inappropriate use of antimicrobials in the ICU setting used an algorithm incorporating the clinical pulmonary infection score to identify patients with a low likelihood of pneumonia. Patients randomized to the intervention group who continued to have a low clinical pulmonary infection score ($\leq$6) had their antimicrobial therapy discontinued at day 3, and the control group received the standard 10–21 days of therapy. This led to a significant decrease in duration of therapy (3 vs. 9.8 days) and antimicrobial cost ($400 per patient), with no difference in mortality. In addition, the development of antimicrobial resistance and/or superinfections was less common in the group receiving the short-course antimicrobial therapy (15% vs. 35%) [79]. A prospective before-and-after study of a clinical guideline for the management of VAP incorporated broad empirical therapy based on local microbiology with culture-driven de-escalation and a standard 7-day course of therapy. Implementation of the protocol led to increased initial administration of adequate antimicrobial therapy (94% vs. 48%), decreased duration of therapy (8.6 vs. 14.8 days), and decreased VAP recurrence (8% vs. 24%), without affecting patient mortality [80]. The efficacy of short-course therapy for VAP was subsequently confirmed in a randomized study of 8 versus 15 days of antimicrobial therapy in patients with VAP documented by quantitative culture of samples obtained by bronchoscopy. There was no difference in mortality or recurrent infection in patients who received the shorter course of therapy, but the short-course group did have more antimicrobial-free days (13.1 vs. 8.7) and a decreased rate of emergence of multidrug-resistant pathogens among those patients with recurrences of pulmonary infection (42% vs. 62%) [81]. These studies support the development and implementation of evidence-based guidelines for diagnosis and antimicrobial therapy for HAP and VAP.

A quasi experimental study in a pediatric hospital in Australia demonstrated similar results regarding the use of guidelines to improve therapy for common infections [82]. The investigators provided recommendations for the treatment of childhood infections on a laminated card that could be clipped to a hospital badge. When the 6-month period during implementation of the intervention (intervention period) was compared with the prior 6 months (baseline period), the intervention was asso-

ciated with substantial increases in the percentage of prescriptions with the correct choice and dose of antimicrobial agents for 2 of 3 indicator infections (pneumonia and orbital/periorbital cellulitis). The cost of third-generation cephalosporins was reduced by more than one-half in the intervention period.

Recommendation

- Multidisciplinary development of evidence-based practice guidelines incorporating local microbiology and resistance patterns can improve antimicrobial utilization (A-I). Guideline implementation can be facilitated through provider education and feedback on antimicrobial use and patient outcomes (A-III).

Antimicrobial cycling and scheduled antimicrobial switch. "Antimicrobial cycling" refers to the scheduled removal and substitution of a specific antimicrobial or antimicrobial class to prevent or reverse the development of antimicrobial resistance within an institution or specific unit. In true cycling, there is a return to the original antimicrobial after a defined time, as opposed to a simple switch of antimicrobials [83–86]. In many respects, cycling is an attempt at controlled heterogeneity of antimicrobial use to minimize antimicrobial selection pressures. Studies of true antimicrobial cycling are limited and vary in terms of antimicrobial class selection, duration of cycling, therapeutic options offered during cycling periods, and cycling by time period versus by patient. Concerns about allergies, adverse drug events, and conflicts with national guidelines have led to 10%–50% of patients in cycling programs to receive "off-cycle" antimicrobials, resulting in poor implementation of the intended process change, with multiple antimicrobials being used at the same time by different patients [85].

Driven by both increasing resistance among Enterobacteriaceae and pricing changes, the largest cycling experience has been reported for changes in aminoglycoside use—particularly, substituting amikacin for gentamicin. Such a switch in aminoglycoside use has been associated with a significant reduction in gentamicin resistance [87–93]; however, rapid reintroduction of gentamicin was accompanied by a rapid return of gentamicin resistance [89, 92]. In one institution with 10 years of experience, this led to an additional cycle of amikacin followed by a more gradual return of gentamicin, without an associated increase in resistance once the original gentamicin resistance plasmids could no longer be detected [92]. This last example highlights the importance of understanding and monitoring mechanisms of resistance over the long term when developing protocols for antimicrobial cycling. Once antimicrobial resistance emerges, it will often persist even in the absence of direct antimicrobial selection pressure, potentially minimizing the impact of antimicrobial removal strategies [21].

A switch from the empirical use of ceftazidime to ciprofloxacin for suspected gram-negative bacterial infection in a cardiothoracic ICU led to a decreased incidence of VAP due to multidrug-resistant, gram-negative bacteria (1% vs. 4%) [94]. Restriction of ceftazidime and ciprofloxacin in a medical ICU, combined with cycling of the preferred β-lactam agent at monthly intervals, led to a decreased incidence of VAP and improved susceptibilities for *P. aeruginosa.* Because these maneuvers, as well as de-escalation of therapy based on culture results, led to a 50% reduction in overall antimicrobial use, the benefit of cycling alone cannot be ascertained [95]. Quarterly rotation of empirical antimicrobial regimens in a surgical ICU for pneumonia and peritonitis/sepsis led to a decreased incidence of resistant bacterial infections and mortality due to infection [96]. However, significant patient population differences and the simultaneous changes in infection control, including institution of an antibiotic surveillance team and the introduction of alcohol gel dispensers, confounded interpretation of the results. In addition, only 62%–83% of patients received the "on-cycle" antimicrobial intended in the process change, resulting in antimicrobial mixing as opposed to time period–based cycling.

It should be noted that mathematical modeling suggests that true cycling is unlikely to reduce the evolution or spread of antimicrobial resistance. Rather, such modeling suggests that the simultaneous mixed use of different antimicrobial classes in a heterogeneous fashion may slow the spread of resistance [97, 98].

In an attempt to examine this hypothesis, a prospective crossover study compared the effects of monthly cycling of antipseudomonal agents (cefepime or ceftazidime, ciprofloxacin, imipenem or meropenem, or piperacillin-tazobactam) with the use of these agents in the same order by consecutive patients (i.e., mixing) [99]. During mixing, a significantly higher proportion of patients acquired a strain of *P. aeruginosa* that was resistant to cefepime (9% vs. 3%; $P = .01$). As in previous cycling studies, however, adherence to the cycling regimen was problematic, with scheduled antimicrobials never accounting for more than 45% of all antipseudomonal antimicrobials. Additional clinical studies to examine optimal cycling parameters and the role of antimicrobial diversity are needed.

Recommendation

- There are insufficient data to recommend the routine use of antimicrobial cycling as a means of preventing or reducing antimicrobial resistance over a prolonged period of time (C-II). Substituting one antimicrobial for another may transiently decrease selection pressure and reduce resistance to the restricted agent. Unless the resistance determinant has been eliminated from the bacterial population, however, reintroduction of the original antimicrobial is again likely to select for the expression of the resistance determinant in the exposed bacterial population.

Antimicrobial order forms. Antimicrobial order forms decrease antimicrobial consumption in longitudinal studies through the use of automatic stop orders and the requirement of physician justification [100, 101]. Prior to more recent studies further defining the optimal timing and duration of perioperative antimicrobial prophylaxis [102, 103], use of perioperative prophylactic order forms with automatic discontinuation at 2 days resulted in a decrease in the mean duration of antimicrobial prophylaxis (from 4.9 to 2.4 days) and a decrease in the percentage of patients receiving perioperative prophylaxis for >2 days (from 85% to 44%) [100]. The rate of inappropriate initiation of antimicrobial prophylaxis postoperatively decreased from 30% to 11% with use of the order form. The use of an order form for all inpatient antimicrobial orders in an 800-bed hospital that required clinical indication, as well as a defined duration before order renewal, led to a 30% decrease in antibiotic courses and a 2% decrease in the hospital pharmacy budget for parenteral antibiotics over a 25-month period, during which time most hospitals were experiencing an increase in expenditures [101]. Use of an antibiotic order form for vancomycin did not improve appropriate use of vancomycin in a pediatric hospital [104]. Automatic stop orders should not replace clinical judgment, and renewal requirements must be clearly communicated to providers to avoid inappropriate treatment interruptions.

Recommendation

- Antimicrobial order forms can be an effective component of antimicrobial stewardship (B-II) and can facilitate implementation of practice guidelines.

Combination therapy: prevention of resistance versus redundant antimicrobial coverage. The rationale for combination antimicrobial therapy includes broad-spectrum empirical therapy for serious infections, improved clinical outcomes, and the prevention of resistance. Inadequate initial antimicrobial therapy was found to be an independent risk factor for mortality in nonurinary infections due to extended-spectrum β-lactamase–producing *Escherichia coli* and *Klebsiella* species [105]. Similarly, inadequate early antimicrobial coverage has been associated with increased mortality in patients with microbiologically confirmed severe sepsis (39% vs. 24%) [106] and critically ill ICU patients (42% vs. 18%) [55], leading to incorporation of empirical combination therapy for late-onset VAP in the recent IDSA–American Thoracic Society guidelines [107]. These studies highlight the need to assess risk factors for multidrug-resistant pathogens when selecting empirical antimicrobial therapy for critically ill patients.

However, in many situations, combination therapy is redundant and unnecessary. Evidence supporting the role of combination antimicrobial therapy for the prevention of resistance is limited to those situations in which there is a high organism load combined with a high frequency of mutational resistance during therapy. Classic examples are tuberculosis or HIV infection. There is often debate about the role of combination therapy in serious infections due to gram-negative organisms, such as *Pseudomonas* species, but clear evidence supporting a clinical benefit or resistance benefit is lacking [108–118]. A meta-analysis of randomized, controlled trials comparing a β-lactam plus an aminoglycoside as combination therapy with β-lactam monotherapy for the treatment of hospitalized patients with serious infections found no difference in the emergence of antimicrobial resistance. In fact, β-lactam monotherapy was associated with fewer superinfections [119].

Recommendation

- There are insufficient data to recommend the routine use of combination therapy to prevent the emergence of resistance (C-II). Combination therapy does have a role in certain clinical contexts, including use for empirical therapy for critically ill patients at risk of infection with multidrug-resistant pathogens, to increase the breadth of coverage and the likelihood of adequate initial therapy (A-II).

Streamlining or de-escalation of therapy. Good stewardship to optimize empirical initial antimicrobial therapy may conflict with good stewardship to promote judicious use, because continuing excessively broad therapy contributes to the selection of antimicrobial resistant pathogens [120]. This conflict can be resolved when culture results become available by streamlining or de-escalating antimicrobial therapy to more targeted therapy that decreases antimicrobial exposure and contains cost. De-escalation may also include discontinuation of empirical antimicrobial therapy based on clinical criteria and negative culture results as demonstrated in the management of suspected VAP [79, 107, 121]. Review by a pharmacist and an infectious diseases physician of 625 patients receiving combination antimicrobial therapy led to streamlining recommendations in 54% of antimicrobial courses over 7 months, resulting in a projected annual savings of $107,637 [122].

In another study, a computer query to mine the hospital pharmacy database followed by targeted review by an infectious diseases clinical pharmacist facilitated the identification of potentially redundant antimicrobial combinations in 16% of patients receiving ⩾2 antimicrobials. Even after accepting the debatable "double gram-negative coverage," 71% of the combinations were deemed to be inappropriate. Interestingly, half of the redundancy was due to physician prescribing error, whereas the other half was due to medication ordering and distribution system errors. The annualized potential savings from this intervention was estimated to be $60,000, and ~3500 redundant inpatient antibiotic–days were avoided [123].

Recommendation

- Streamlining or de-escalation of empirical antimicrobial

therapy on the basis of culture results and elimination of redundant combination therapy can more effectively target the causative pathogen, resulting in decreased antimicrobial exposure and substantial cost savings (A-II).

Dose optimization. Optimization of antimicrobial dosing that accounts for individual patient characteristics (e.g., age, renal function, and weight), causative organism and site of infection (e.g., endocarditis, meningitis, and osteomyelitis), and pharmacokinetic and pharmacodynamic characteristics of the drug is an important part of antimicrobial stewardship. For instance, the bactericidal activity of β-lactams correlates with the percentage of time that the drug concentration remains greater than the MIC, whereas fluoroquinolones and aminoglycosides are concentration-dependent agents, with the ratio of the maximum concentration to the MIC or the ratio of the area under the curve to the MIC being important predictors of activity. Examples of these principles in practice include prolonged or continuous infusion of β-lactams [124], extended-interval dosing of aminoglycosides [125], and dosing of fluoroquinolones for *Streptococcus pneumoniae* in community-acquired pneumonia [126, 127] and for *Pseudomonas* in HAP and VAP [107]. The use of pharmacokinetic and pharmacodynamic principles is more likely to be in development of antimicrobial use guidelines than in individual patients' care.

Recommendation

- Optimization of antimicrobial dosing based on individual patient characteristics, causative organism, site of infection, and pharmacokinetic and pharmacodynamic characteristics of the drug is an important part of antimicrobial stewardship (A-II).

Conversion from parenteral to oral therapy. Antimicrobial therapy for patients with serious infections requiring hospitalization is generally initiated with parenteral therapy. Enhanced oral bioavailability among certain antimicrobials—such as fluoroquinolones, oxazolidinones, metronidazole, clindamycin, trimethoprim-sulfamethoxazole, fluconazole, and voriconazole—allows conversion to oral therapy once a patient meets defined clinical criteria. This can result in reduced length of hospital stay, health care costs, and potential complications due to intravenous access.

Randomized studies evaluating early transition from parenteral to oral therapy in the management of adults with community-acquired pneumonia have demonstrated significant reductions in length of hospital stay and cost of care with no adverse effect on clinical outcomes [128–130]. A similar decrease in length of hospital stay, with a 52% reduction in total health care costs, was noted in the treatment of lower respiratory tract infections in children, compared with historical control subjects [131]. A pharmacist-initiated program utilizing predetermined clinical criteria for general conversion from parenteral to oral therapy decreased length of hospital stay by 1.53 days, with cost savings for drug acquisition and reduced length of hospital stay of $15,149 and $161,072, respectively, over 12 months [132].

A randomized study of oral linezolid versus intravenous vancomycin in patients with complicated skin and soft-tissue infections due to MRSA demonstrated a decreased mean length of hospital stay of 5 days for the linezolid group [133], and a switch from vancomycin to oral linezolid for early discharge from the hospital resulted in an annual savings of $294,750 [134]. The use of new agents, such as linezolid, in this manner must be done judiciously and with the direct oversight of an antimicrobial-management program to balance concerns about the development of resistance and added antimicrobial acquisition costs.

A systematic plan for switching from parenteral to oral treatment may have an added benefit of aiding in early hospital discharge planning, if needed, to provide surge capacity during local or national problems (e.g., epidemic influenza).

Recommendation

- A systematic plan for parenteral to oral conversion of antimicrobials with excellent bioavailability, when the patient's condition allows, can decrease length of hospital stay and health care costs (A-I). Development of clinical criteria and guidelines allowing conversion to use of oral agents can facilitate implementation at the institutional level (A-III).

Computer Surveillance and Decision Support

Increased focus on medical errors and patient safety led to a series of reports by the Institute of Medicine's National Roundtable on Health Care Quality to emphasize the role of information technology in the delivery of health care [135–137]. The Leapfrog Group has identified computer physician order entry (CPOE) as 1 of the 3 most important "leaps" that organizations can take to substantially improve patient safety. CPOE has the potential to incorporate clinical decision support and to facilitate quality monitoring [138]. Progress to this end, however, remains slow, with only 13% of US hospitals converting to electronic medical records and 5% implementing CPOE as of 2002 [139, 140].

The most well-described computer surveillance and decision-support system related to antimicrobial prescribing linked to electronic medical records is from LDS Hospital in Salt Lake City, Utah [141]. This program presents epidemiologic information with detailed recommendations and warnings regarding antimicrobial regimens and courses of therapy. Even if a physician overrides the recommendation for the antimicrobial and selects his or her own treatment plan, the computer still automatically reviews the patient's allergies and potential drug-drug interactions, recommending a dosage and interval based

on the patient's renal and hepatic function. A prospective study of the use of this program in an ICU demonstrated significant reductions in orders for drugs to which the patients had reported allergies, excess drug dosages based on renal function, adverse drug events, antimicrobial-susceptibility mismatches, antimicrobial costs, and length of hospital stay [142]. Implementation of a computer-assisted antibiotic-dose monitor throughout the same hospital over a 12-month period identified 1974 (44%) of 4483 patients receiving excessive antimicrobial dosages (based on renal function), leading to more-appropriate dosing and fewer adverse drug events [143]. Incorporation of practice guidelines into the system increased the percentage of surgical patients who received their preoperative prophylactic antimicrobials within 2 h of incision from 40% to 99.1% [144, 145].

In addition to improving antimicrobial use and care of the individual patient, their system has facilitated the electronic surveillance of hospital-acquired infections and adverse drug events. Computer surveillance identified 90% of confirmed nosocomial infections, compared with 76% of such infections identified by manual surveillance, allowing infection control practitioners to reduce the time required for such activities by 65% [146]. Automated surveillance of 36,653 patients over 18 months using defined triggers identified 731 adverse drug events, whereas only 9 were reported through traditional voluntary incident reports [147].

This computer decision-support system was adapted for use in pediatric patients by Mullett et al. [148], and its effect was evaluated in a quasi experimental study. Dosing guidelines were adjusted for pediatric and neonatal populations, to ensure that treatment recommendations were appropriate for infections common in the pediatric population (e.g., bacterial meningitis), local antimicrobial resistance patterns (e.g., the prevalence of *S. pneumoniae* with reduced susceptibility to penicillin), special populations (e.g., children with cystic fibrosis), and children with renal insufficiency. Comparing a 6-month period after implementation (intervention period) with the prior 6 months (baseline period), the decision-support system was associated with a 59% decrease in the rate of pharmacy interventions for erroneous drug doses and 36% and 28% decreases in the rates of subtherapeutic and excessive antimicrobial dosing days, respectively. There was a 9% decrease in the cost of antimicrobial agents during the intervention period. The frequency of adverse drug events and antimicrobial-bacterial susceptibility mismatches were not significantly different during the intervention period—a finding likely attributable to the low frequency of these events in the baseline period. Clinicians using the system reported that they felt that the program improved their selection of antimicrobial agents, increased their awareness of impairments in renal function that affected drug dosing, and reduced the likelihood of adverse drug events. The lead investigator has subsequently developed a separate decision-support system for treatment of bloodstream infection in hospitalized children, although the system has not yet been evaluated prospectively [149].

A randomized study incorporating guidelines for vancomycin use into a hospital's CPOE at the time of initial ordering and after 72 h of therapy led to 32% fewer vancomycin orders and a 36% reduction in the duration of vancomycin therapy. This resulted in a projected savings of $90,000 [150]. Simply adding antimicrobial cost information to antimicrobial susceptibility data resulted in decreased average monthly antimicrobial expenditures by $7636 (17%) in another hospital [151].

Despite these initial promising studies, matching the linear technology of CPOE with complex clinical management that can be subjective, interpretive, and reactive has been a challenge at other institutions [152]. Implementation of CPOE at a 750-bed teaching hospital to reduce medical errors was actually found to frequently facilitate medication errors [140]. Errors included inappropriate dose selection, double-dosing caused by separate order and discontinuation functions, and gaps in antimicrobial therapy resulting from automatic discontinuation orders. In large part, these errors reflected the difficulty of implementation rather than the concept of CPOE.

The Veterans Administration health care system has been a leader in the use of an electronic medical records and CPOE. Despite being a model for implementing CPOE, one Veterans Administration hospital found a continuing high rate of adverse drug events in the absence of decision support for drug selection, dosing, and monitoring [153]. Twenty-six percent of hospital admissions were associated with at least 1 adverse drug event, with medication errors contributing to 27% of these adverse events.

The lofty goal of merging the electronic records with CPOE and clinical decision support to optimize antimicrobial use is currently not attainable for most institutions on the basis of current technology. Depending on available resources, however, automated targeting of interventions to facilitate antimicrobial stewardship can be obtained through varying levels of complexity. Such targeting may include using pharmacy records to identify patients who are receiving broad-spectrum or expensive antimicrobials, use of simple computer programs that merge hospital pharmacy and microbiology databases, and use of more-complex, commercially available software to identify antimicrobial interventions.

Recommendations

- Health care information technology in the form of electronic medical records (A-III), CPOE (B-II), and clinical decision support (B-II) can improve antimicrobial decisions through the incorporation of data on patient-specific microbiology cultures and susceptibilities, hepatic and renal function, drug-drug interactions, allergies, and cost. However, im-

plementation of these features has been slow, and conformation of the technology to the clinical environment remains a challenge.

- Computer-based surveillance can facilitate good stewardship by more efficient targeting of antimicrobial interventions, tracking of antimicrobial resistance patterns, and identification of nosocomial infections and adverse drug events (B-II).

Microbiology Laboratory

The clinical microbiology laboratory plays a critical role in the timely identification of microbial pathogens and the performance of susceptibility testing [154, 155]. Susceptibility testing and reporting should be based on the guidelines developed by the Clinical and Laboratory Standards Institute (CLSI; formerly the NCCLS) [156]. Prioritization of tested antimicrobials and selective reporting of susceptibility profiles (e.g., not routinely reporting susceptibility of *S. aureus* to rifampin to prevent inadvertent monotherapy with rifampin) can aid in the prudent use of antimicrobials and direct appropriate therapy based on local guidelines. The advance of molecular diagnostics allows the identification of difficult-to-culture pathogens, potentially avoiding the need for extended courses of broad-spectrum empirical therapy.

In addition to routine susceptibility testing, the clinical microbiology laboratory should be actively involved in resistance surveillance. Local antibiograms with pathogen-specific susceptibility data should be updated at least annually, to optimize expert-based recommendations for empirical therapy [157]. Computerized surveillance can facilitate more-frequent monitoring of antimicrobial resistance trends, as well as provide ICU- or ward-specific data and inpatient versus outpatient data, recognizing that different parts of a health care institution can have very different patterns of antimicrobial use and resistance [157]. Besides qualitative determination of antimicrobial resistance or susceptibility, periodic review of MICs or zone diameters in disk-diffusion techniques can detect early trends of emerging resistance, even within the "susceptibility" cut-offs. Kirby-Bauer disk-diffusion methods can also be used to perform the D test for inducible clindamycin resistance for *S. aureus* [158], as well as provide quick screenings for extended-spectrum β-lactamase– and AmpC β-lactamase–containing organisms. Finally, the laboratory is an important partner with infection control in the identification and molecular epidemiologic investigation of local outbreaks of infection. The development of rapid resistance testing will facilitate the surveillance of organisms such as MRSA and VRE, allowing the more rapid implementation of infection control measures to prevent secondary spread [159, 160]. Clonal characterization of resistant strains through molecular typing can help focus appropriate interventions, leading to a reduction in nosocomial infections with associated cost savings [161]. If antimicrobial resistance is due to a clonal outbreak, antimicrobial interventions may be of limited value, compared with infection control interventions. If resistant strains are diverse, antimicrobial interventions may be required.

Recommendation

- The clinical microbiology laboratory plays a critical role in antimicrobial stewardship by providing patient-specific culture and susceptibility data to optimize individual antimicrobial management and by assisting infection control efforts in the surveillance of resistant organisms and in the molecular epidemiologic investigation of outbreaks (A-III).

Monitoring of Process and Outcome Measurements

In conjunction with developing local strategies for improving antimicrobial stewardship, programs must establish process and outcome measures to determine the impact of antimicrobial stewardship on antimicrobial use and resistance patterns. Furthermore, health care systems must invest in data systems to allow the evaluation of antimicrobial stewardship as a routine measure of quality improvement [162]. With antimicrobial stewardship, the "process goal" is often to change use of a specific antimicrobial or class of antimicrobials. The related "process measure" for this goal would determine the degree to which the intervention to change the use of an antimicrobial or class of antimicrobials has been successfully implemented, compared with baseline levels. The desired "outcome goal" of these process changes is to reduce or prevent resistance or other unintended consequences of antimicrobial use. "Outcome measurements" define the degree to which these outcomes are achieved, such as reduced antimicrobial resistance, adverse drug events, and cost, as well as unintended consequences, such as rates of *C. difficile* infection and the use of nontargeted antimicrobials as a result of the process change.

Antimicrobial use data based on pharmacy expenditure or dispensing reports often do not account for drug wastage, unused doses returned to pharmacy, or fluctuations in institutional price structures and discounts [163]. Drug use data can be standardized using the defined daily dose, calculated as the total number of grams of an antimicrobial agent used divided by the number of grams in an average adult daily dose of the agent [164]. The World Health Organization publishes defined daily dose values for nearly all antimicrobials (http://www.whocc.no/atcddd/). The use of defined daily doses is recommended so that hospitals may compare their antimicrobial use with that of other similar hospitals, recognizing the challenges of interhospital comparisons and the potential need for "risk adjustment." However, in populations with renal compromise (e.g., the elderly population) and for drugs that require

renal dose adjustment, the defined daily dose may be less accurate than measures of antimicrobial-days of therapy [165].

Recommendation

- Both process measures (did the intervention result in the desired change in antimicrobial use?) and outcome measures (did the process implemented reduce or prevent resistance or other unintended consequences of antimicrobial use?) are useful in determining the impact of antimicrobial stewardship on antimicrobial use and resistance patterns (B-III).

Comprehensive Multidisciplinary Antimicrobial Management Programs

Through the previous review of individual interventions directed at improving antimicrobial use, it is clear that effective antimicrobial stewardship requires a multidisciplinary team approach that incorporates many of these elements simultaneously. The core members of a comprehensive antimicrobial management program include an infectious diseases physician and a clinical pharmacist with infectious diseases training, with the inclusion of infection control professionals, the hospital epidemiologist, a clinical microbiologist, and an information system specialist, when possible [166–174]. The latter is critical for linking the patient's medical record to the pharmacy and microbiology databases, to identify interventions and to perform surveillance activities. Program personnel should be included as active members on the hospital infection control and pharmacy and therapeutics committees or their equivalents.

Central to an effective program is a proactive strategy incorporating prospective audit with direct intervention and feedback to the provider and/or preauthorization requirements for antimicrobial use. On the basis of an understanding of local antimicrobial use and resistance problems and of available resources that may differ depending on the size of the institution, the core active strategies may be supplemented by education, guidelines and clinical pathways, antimicrobial order forms, adequate empirical therapy followed by de-escalation based on culture results, dose optimization, and a systematic plan for conversion from parenteral to oral therapy. Consensus building with the support of administration and local providers is essential, with the focus on collaborating in the safety and care of their patients rather than a policing role. Although reports describing the clinical and economic impacts of multidisciplinary antimicrobial management programs are limited to single-center longitudinal studies, they consistently demonstrate a decrease in antimicrobial use (22%–36%) and annual savings of $200,000–$900,000, which more than pays for the program in both larger academic hospitals [2, 3, 5, 7, 8, 69] and smaller community hospitals [4, 6]. Quantifying a long-term impact on antimicrobial resistance has been more challenging, and further studies are needed to determine the optimal processes by which the goals of improved clinical outcomes and containment of antimicrobial resistance can be achieved. However, given the strong association between antimicrobial use and antimicrobial resistance (table 2), improving antimicrobial stewardship is an important first step.

RESEARCH PRIORITIES AND FUTURE DIRECTIONS

Because of the limited number of randomized clinical studies addressing antimicrobial stewardship strategies, many of the recommendations in this guideline are based on level III evidence. Further research and evaluation through appropriately conducted clinical trials are necessary to determine the best strategies for the prevention and containment of antimicrobial resistance. Recommended topics for investigation are as follows:

1. Antimicrobial cycling at the patient, unit, and institutional level to determine whether cycling is effective and, if so, the optimal antimicrobials to be cycled, the optimal duration of the cycles, and the preferred order in which agents should be cycled.
2. Clinical validation of mathematical models suggesting that heterogeneous antimicrobial use slows the spread of resistance.
3. The long-term impact of formulary restriction and preauthorization requirements on antimicrobial use and resistance.
4. Evaluation of "bundled" approaches that incorporate many or all of the most effective strategies.
5. Examination of the effectiveness of these strategies in more detail in subpopulations of hospitalized patients, including neonates, infants, and children; elderly patients; and severely immunocompromised patients.
6. The ability of antimicrobials to cause "collateral damage" or unintended ecological resistance, to focus interventions.
7. The incremental role of antimicrobial stewardship combined with infection control practices, such as hand hygiene and isolation, designed to prevent secondary spread of resistant organisms.
8. Understanding the resistance gene pool through molecular epidemiology, to determine the relative impact of antimicrobial stewardship and infection control practices on specific resistant bacteria, to tailor an approach to local resistance issues.
9. Development and validation of automated surveillance strategies for nosocomial infections and real-time monitoring of resistance trends.
10. Development of decision-support systems incorporating antimicrobial stewardship into CPOE.

11. Development and cost-effectiveness of more rapid and sensitive diagnostic tests, to identify patients with bacterial versus viral infections and to identify resistant bacterial organisms earlier.

12. Strategies to stimulate research and development of novel antimicrobials as outlined in the IDSA "Bad Bugs, No Drugs" campaign.

13. Education and training of infectious diseases fellows and pharmacists in the area of antimicrobial stewardship, including program implementation and management.

14. The influence of pharmaceutical industry and representatives on antimicrobial prescribing within the health care setting and effective strategies to counteract inappropriate detailing.

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Antimicrobial Stewardship: What it is and why it's important

Edwin Pereira, MD
Infectious Diseases Fellow – U of M
May 10, 2011

Why Are We Here?

- What is antimicrobial stewardship?
- Why is it important?
- Outcomes

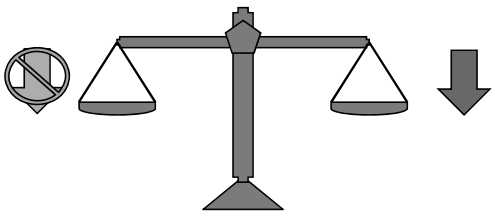
Previous Names

- Terminology:
  - Antibiotic Control
  - Antimicrobial Management
  - Antimicrobial Stewardship

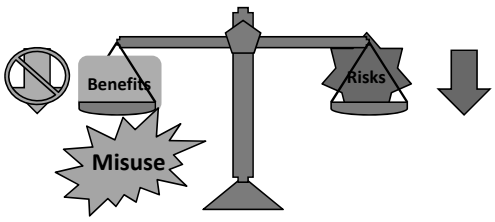
Definition

- Processes designed to measure and optimize the **appropriate** use of antimicrobials
- Achieved by selecting the appropriate agent, dose, duration of therapy and route of administration

What is Appropriate?



What is Appropriate?



Reasons for Antimicrobial Stewardship (1)

- Ensure the proper use of antimicrobials
  - To optimize clinical outcomes
  - Decrease the risk of adverse effects
  - Reduce or stabilize resistance

Reasons for Antimicrobial Stewardship (2)

- Reduce excessive costs attributable to:
  - Inappropriate/unnecessary therapy
  - Suboptimal outcomes
  - Toxicity and other adverse events
  - Antimicrobial resistance

Is This Significant?

- 200-300 million antimicrobials are prescribed annually
  - 45% for outpatient use
- 25-40% of hospitalized patients receive antimicrobials
  - At least 30% are unnecessary or sub-optimal
  - 5% of hospitalized patients experience an adverse reaction
- >$1.1 billion spent annually on unnecessary adult antimicrobial prescriptions for URI
  - 50-80% of outpatient antimicrobial use is inappropriate
- Antimicrobials are unlike any other drug: use of the agent in one patient can compromise efficacy in another

Anti-infective Use in US Hospitals

Table 2.
Top 10 Therapeutic Classes by Expenditures for Nonfederal Hospitals[1]

Drug Class	2008 Total Expenditure ($ Thousands)	Percent Change From 2007	2009 Expenditure ($ Thousands) (% Total)[2]	Percent Change[2]
Antineoplastic agents	3,344,742	5.0	2,758,485 (13.3)	10.3
Hemostatic modifiers	3,459,080	6.6	2,732,285 (13.1)	5.4
Antiinfectives, systemic	3,188,596	7.3	2,396,384 (11.5)	–0.1
Blood growth factors	2,106,040	9.6	1,546,527 (7.4)	7.0
Hospital solutions	1,697,024	17.5	1,351,909 (6.5)	5.1
Diagnostic aids	1,451,388	–1.0	1,084,089 (5.2)	–0.2
Gastrointestinal	1,138,236	10.4	902,450 (4.3)	5.9
Psychotherapeutics	1,116,037	3.1	810,178 (3.9)	–5.3
Respiratory therapy	992,315	5.0	782,175 (3.8)	4.7
Biologicals	1,041,297	–30.7	699,832 (3.4)	–16.0
Total	26,915,577	2.1	20,803,931 (100.0)	3.0

[1]Through September 2009.
[2]Year-to-date 2009 versus year-to-date 2008.

Hoffman, et al. Am J Health-Syst Pharm. 2010;67:919-28

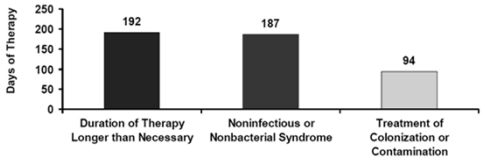
Misuse

- Contributes to rising cost of medical care
- Increased adverse drug effects/reactions
  - 5% of hospitalized patients who receive antimicrobials experience an adverse reaction
  - 20% of patients who require medical care have a history of an adverse drug effect
- Emergence of resistance

Unnecessary Use of Antimicrobials in Hospitalized Patients

- Prospective observational study in ICU
- 576 (30%) of 1941 antimicrobial days of therapy deemed unnecessary

Most Common Reasons for Unnecessary Days of Therapy



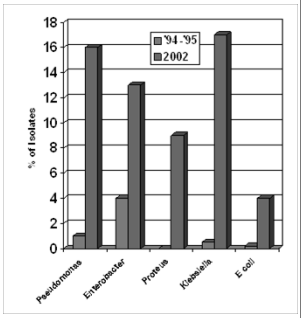
Hecker MT et al. *Arch Intern Med*. 2003;163:972-978.

Antimicrobial Resistance

- Antimicrobial resistance parallels the introduction of new antimicrobials
  - Selective pressure
  - Emergence of multidrug resistance
- Leads to lack of therapies
  - Untreatable infections
  - Increasing mortality from drug resistant infections

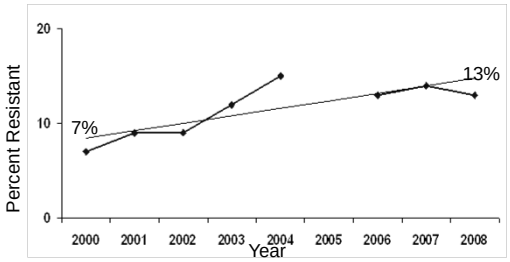
Increasing Rates of Resistance

- D'Agata reviewed resistant gram-negatives over a 9-year period
  - 430-bed, tertiary care hospital
  - Resistance to ≥3 antimicrobial classes
  - Rates increased among all organisms studied (p≤.05)



D'Agata. Infect Control Hosp Epidemiol 2004;25:842-846

Percent *E. coli* and *K. pneumonia* in ICUs that are Multidrug-resistant, NNIS and NHSN, 2000-2008*



Includes ICUs only (MICU, SICU, MSICU) and device-related infections only (CLABSI, CAUTI, VAP)

Kallen, CDC data

Increasing Healthcare Costs

- Increased length of stay
- Increase in use of personal protective equipment
- More costly antimicrobials and longer duration of treatment

The Bottom Line

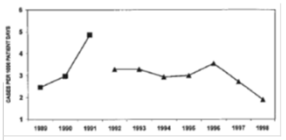
- Antimicrobial resistance is a critical patient safety issue
- Antimicrobial resistance is a public health threat
- Antimicrobials should be viewed as a limited resource
- **Antimicrobial stewardship** provides the **infrastructure** to preserve antimicrobials

Successful Stewardship Programs

- Can decrease antimicrobial use and costs
  - 22-36% decrease in antimicrobial use
  - Annual savings between $200,000 and $900,000 in large academic hospitals and smaller community hospitals
- Carling et al. ICHE 2003;24:699-706.
  - Multidisciplinary antimicrobial management program
  - Prospective study evaluating the incidence of *C. difficile* and resistant Enterobacteriaceae infections

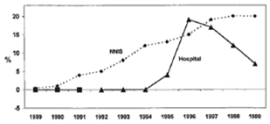
Stewardship Decreases Resistance

Rate of Resistant Enterobacteriaceae Infections



Antimicrobial Use and Cost

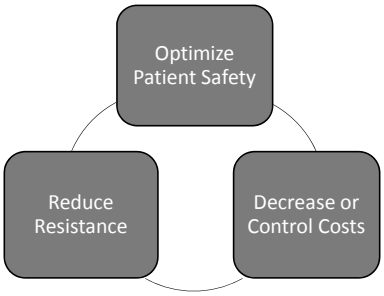
Rate of VRE



MRSA rates stayed the same

Carling P et al. Infect Control Hosp Epidemiol. 2003;24:699.

Goals of Antimicrobial Stewardship



Summary

- Antimicrobials play a significant role in healthcare
  - Patient care
  - Healthcare costs
- Inappropriate use reduces antimicrobial effectiveness and leads to rising healthcare costs
- Antimicrobial stewardship is a means to encourage appropriate antimicrobial use

Additional Resources

- SHEA
  - http://www.shea-online.org/GuidelinesResources/FeaturedTopicsinHAIPrevention/AntimicrobialStewardship.aspx
- IDSA – Bad Bugs, No Drugs
  - http://idsociety.org/10x20.htm

Antibiotic Overview

Antibiotics by Mechanism

I. Cell-wall Antibiotics

A. Penicillins

1) Mechanism of action
   (a) Beta-lactam ring
   (b) Inhibit bacterial cell wall synthesis by binding to PBP
   (c) Bactericidal
   (d) Time dependent killing
2) Examples
   (a) Penicillin
   (b) Anti-staph Penicillin: nafcillin, dicloxacillin
   (c) Ampicillin, amoxicillin
   (d) Antipseudomonal penicillins: piperacillin, ticarcillin
3) Some can be used with beta-lactamase inhibitors
   (a) Clavulanic acid + amoxicillin = Augmentin
   (b) Clavulanic acid + ticarcillin = Timentin
   (c) Tazobactam + piperacillin = Zosyn
   (d) Sulbactam + ampicillin = Unasyn

B. Cephalosporins

1) Same mechanisms as Penicillins (beta-lactam)
2) <5% allergy cross-reactivity
3) First, second, third, and forth generation
   (a) 1st generation has best gram-positive coverage: cefazolin, cephalexin
   (b) Later generations have better gram-negative coverage; worse gram-positive coverage
   (c) Ceftazidime (3rd generation) and Cefepime (4th generation) good pseudomonas coverage
   (d) New antibiotics: Ceftobiprole and Ceftaroline
      (i) Not in common usage yet
      (ii) IV only
      (iii) Anti-MRSA activity

C. Carbapenems

1) Also a beta-lactam, with same mechanism of action
2) Excellent beta-lactamase stability
3) Similar allergy cross-reactivity
4) Imipenem, meropenem, ertapenem, doripenem
5) Most broad-spectrum activity of all the beta-lactams

D. Monobactam – Aztreonam

1) Aerobic gram-negative activity
2) Virtually no allergy cross-reactivity with other beta-lactams

E. Other non-beta-lactam cell wall antibiotics

1) Glycopeptides (**Vancomycin**)
   (a) Large molecule that disrupts cell wall synthesis in dividing bacteria
   (b) Weak bactericidal activity
   (c) Broad spectrum gram-positive coverage
   (d) Common anti-MRSA antibiotic
   (e) Mainly IV, but oral form for *C. difficile* infection
2) Polymixins (Polymixin B, colistin)
   (a) Detergent-like activity with lipophilic and lipophobic groups that disrupt membranes
   (b) Old antibiotic with recent resurgence due to activity against resistant gram-negatives
3) Daptomycin
   (a) Mechanism unclear; binds to the cell membrane and creates channels, disrupting the cell membrane potential
   (b) Gram-positive coverage
   (c) Can cause muscle toxicity
   (d) Inactivated by surfactant in the lungs

II. Protein Synthesis or Ribosomal Antibiotics

A. Macrolides (Erythromycin, Azithromycin, Clarythromycin)

1) Bind to the 50S ribosome and inhibit RNA-dependent protein synthesis
2) Gram-positive and Gram-negative coverage
3) Activity against intracellular and "atypical" organisms: Salmonella, Legionella, Chlamydia, Mycoplasma

B. Lincosamide (Clindamycin)

1) 50S Ribosome
2) Good bioavailability
3) Anaerobic activity (above the diaphragm)
4) Anti-toxin activity (Toxic shock syndrome)

C. Oxazolidinones (linezolid)

1) Inhibit protein synthesis by binding to 50S ribosome, preventing binding to 30S subunit
2) Bacteriostatic
3) Gram-positive coverage
4) Excellent bioavailability
5) Bone marrow suppression with extended use
6) Possible toxin inhibition (same as clindamycin)?

D. Tetracyclines (tetracycline, doxycycline, minocycline)

1) Binds to 30S ribosome and inhibits protein synthesis
2) Gram-positive and gram-negative activity, plus atypicals
3) Tigecycline
   (a) Derivative of minocycline
   (b) Broad coverage with gram-positive, gram-negative, and anaerobes

E. Aminoglycosides (gentamicin, tobramycin, amikacin, etc.)

1) Binds to 30S ribosome
2) Concentration dependent killing, post-antibiotic effect, synergistic
3) Activity against aerobic bacteria only
4) Nephrotoxicity and ototoxicity

III. Other Antibiotics

A. Fluoroquinolones (ciprofloxacin, levofloxacin, moxifloxacin, etc.)

1) Blocks DNA synthesis by inhibiting DNA gyrase and topoisomerase IV
2) Concentration dependent killing
3) Excellent bioavailability
4) Broad spectrum activity, including atypicals
5) Strep and Mycobacterial coverage?

B. Trimethoprim-Sulfamethoxazole (Tmp-Smx)

1) Inhibit bacterial growth by interfering with folic acid synthesis, needed for DNA synthesis
2) Gram-positive and gram-negative coverage, including MRSA, but not Streptococcus

C. Metronidazole

1) Bactericidal for anaerobic infections (below the diaphragm)
2) Effect is via free radicals
3) Good GI absorption

Antibiotics by Usage

I. Broad Spectrum, Empiric Coverage

A. Gram-positive coverage, including MRSA – Vancomycin

B. Gram-negative coverage

1) 3rd or 4th generation cephalosporins (may not cover pseudomonas and anaerobes)
2) Pipercillin-Tazobactam and Carbapenems (covers pseudomonas, anaerobes, gram-positives [not MRSA])
3) Fluoroquinolones (does not cover anaerobes)

II. *Staphylococcus aureus*

A. MSSA

1) Treatment (s*ee MRSA treatments for others*)
    (i) Nafcillin/dicloxacillin
    (ii) 1st gen cephalosporins
    (iii) 4th gen cephalosporins
    (iv) (2nd > 3rd gen) cephalosporins
    (v) Carbapenems
    (vi) Beta-lactams + Beta-lactamase inhibitors
    (vii) Macrolides
    (viii) Clindamycin

B. MRSA

1) Treatment
   (a) Vancomycin
   (b) New generation cephalosporins
   (c) Linezolid
   (d) Tmp-Smx
   (e) Doxycycline
   (f) Tigecycline
   (g) Synercid
   (h) Daptomycin
   (i) Others
      (i) Gentamicin only as synergy
      (ii) FQs and rifampin never used as a sole agent
      (iii) Fusidic acid
      (iv) Nitrofurantoin
      (v) Clindamycin

III. Pneumonia

A. Community-Acquired

1) Macrolide alone, or plus 3rd generation cephalosporin
2) Fluoroquinolone (respiratory)
3) Doxycycline

B. Pseudomonal coverage

1) Anti-pseudomonal penicillins (piperacillin-tazobactam)
2) Cephalosporins (cefepime, ceftazidime)
3) Aminoglycosides
4) Carbapenems
5) Fluoroquinolones

C. MRSA

1) Vancomycin
2) Linezolid
3) See above for alternatives
4) Cannot use daptomycin

D. Aspiration (anaerobic infections)

1) Clindamycin
2) Pipercillin-Tazobactam

IV. Skin infections

A. Typically gram-positive organism – staph and strep
B. See above for MRSA options
C. Tmp-Smx will not cover strep infections
D. Tmp-Smx, Doxycycline, Clindamycin, and linezolid are oral options

V. Meningitis

A. Empiric therapy

1) Ceftriaxone for *Neisseria meningitidis*
2) Vancomycin for penicillin-resistant *S. pneumoniae*
3) Ampicillin for *Listeria monocytogenes* (infant and elderly)

Antimicrobial Stewardship Tool Kit for targeting *Clostridium difficile* infection prevention

The primary goal of antimicrobial stewardship is to optimize clinical outcomes while minimizing unintended consequences of antimicrobial use. Review and utilize guidance in, "Antimicrobial Stewardship Guidelines"- Infectious disease Society of America and the Society for Healthcare Epidemiology of America in Clinical Infectious Diseases[1] in developing an antimicrobial stewardship program.

Not All Antimicrobials are Alike

All antibiotic classes have been associated with CDI through disruption of the normal colonic flora. Antimicrobial Stewardship programs developed for the goal of reducing CDI should focus on limiting/restricting the use of all antimicrobials, with an emphasis on those agents frequently associated with CDI in your facility or locally.

Specific Strategies to Reduce Antimicrobial Use on an Individual or Programmatic Basis

Antimicrobial stewardship strategies that can be employed either individually or as part of a facility-wide program include the following[7].

1. Shorten duration of antibiotics for a given condition (see examples below)
    a. Prospective monitoring of length of therapy by pharmacist
    b. Create and implement a system to stop or reassess the need for antimicrobial therapy with the initial order
2. De-escalate antibiotic therapy from empiric broad spectrum coverage to targeted narrow spectrum coverage[1]. (see examples below)
    a. When clinically appropriate, limit the unnecessary use of agents with broad anaerobic coverage (Clindamycin), third generation cephalosporins, and more recently, fluoroquinolones[3,4,5,6].
3. Stop antibiotics when assessment indicates that bacterial infection is no longer considered likely, or when no clear indication for antibiotic therapy exists.
4. In an outbreak or cluster situation, consider restriction of certain antibiotics[3,4, 5,6] (e.g . clindamycin, extended spectrum cephalosporins, fluoroquinolones.

<u>Examples of shortened duration of antimicrobial therapy for known or established conditions:</u>

1. Ventilator-associated pneumonia (VAP) and healthcare-associated pneumonia
    a. If patients receive an initially appropriate antibiotic regimen, shorten the duration of therapy to 7 days provided that the etiologic pathogen is not *P. aeruginosa*, and that the patient has a good clinical response with resolution of clinical features of infection[8].
2. Community-acquired Pneumonia (CAP):
    a. Patients should be treated for a minimum of 5 days, be afebrile for 48 hours prior to the end of therapy and should have no more than 1 CAP associated sign of clinical instability[9].

3. Catheter-associated Urinary tract Infection (CA-UTI)
    a. Seven days is the recommended duration of antimicrobial treatment for patients with who have prompt resolution of symptoms, and 10–14 days of treatment is recommended for those with a delayed response, regardless of whether the patient remains catheterized or not[10].
    b. A 5-day regimen of levofloxacin may be considered in patients with CA-UTI who are not severely ill. Data are insufficient to make such a recommendation about other fluoroquinolones[10].
    c. A 3-day antimicrobial regimen may be considered for women aged 65 years who develop CA-UTI without upper urinary tract symptoms after an indwelling catheter has been removed[10].
4. Uncomplicated acute bacterial cystitis and pyelonephritis in women
    a. Cystitis should be treated with 3 days of trimethoprim/sulfamethoxazole, or 7days of a beta-lactam antibiotic.
    b. Pyelonephritis may be adequately treated with a 14 day course of antibiotic therapy, assuming a prompt clinical response to the antimicrobial in use[11].

<u>Example of de-escalating antibiotic therapy from empiric broad spectrum coverage to targeted narrow spectrum coverage</u>

1. Review microbiologic and clinical data on patients admitted and treated for sepsis syndrome (e.g. positive blood culture results revealing *Staphylococcus aureus* may allow de-escalation of therapy from vancomycin IV + Zosyn to Cefazolin or vancomycin IV alone).

<u>Examples of avoiding or discontinuing antibiotic therapy because bacterial infection deemed unlikely</u>

1. Asymptomatic bacteruria associated with pyuria[12].
2. Prophylactic antibiotics for patients with severe necrotizing pancreatitis prior to the diagnosis of infection[13].
3. Certain serious intra-abdominal infections in which source control can be quickly attained may require only 24 hours of antibiotic therapy:
    a. Acute appendicitis without rupture, abscess or local peritonitis
    b. Stomach/proximal jejuna injuries in the absence of malignancy or acid reduction therapy and which achieve source control within 24 hours
    c. Blunt/traumatic/iatrogenic bowel injuries which are repaired within 12 hours[13].
4. Discontinue empiric coverage with IV vancomycin after 48 hours of therapy based upon microbiologic data and clinical status.
5. Discontinue "double coverage" for a suspected or known pathogen (i.e. *Pseudomonas aeruginosa* infection susceptible to both agents being prescribed). This assessment may occur at 48-72 hours of therapy or when microbiologic data dictates.
6. Skin abscesses which undergo incision and drainage and are clinically NOT associated with significant surrounding cellulitis[14].

References for Antimicrobial Stewardship Programs:

1. Timothy Dellit, Robert Owens, and John McGowan et al. "Infectious Disease Society of America and the Society for Healthcare Epidemiology of America Guidelines for Developing an Institutional Program to Enhance Antimicrobial Stewardship" CID 2007;44:159-177.
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3. Pepin J, et al. Clin Infect Dis 2005;41:1254-1260. (fluorquinolones restricted)
4. Carling P, et al Infect Control Hosp Epidemiol. 2003;24:699-706. (third generation cephalosporins restricted)
5. Climo MW, et al Ann Intern Med 1998;128(12 Pt 1):989-995. (Clindamycin restricted)
6. Pear SM, et al. "Decrease in Nosocomial *Clostridium difficile*-associated Diarrhea by Restricting Clindamycin Use" Ann Intern Med 1994; 120:272-277. (Clindamycin restricted)
7. Paterson, David. "Collateral Damage' from Cephaolsporin or Quinolone Antibiotic Therapy" CID 2004;38(Suppl 4):S341-345.
8. Guidelines for the Management of Hospital Acquired, Ventilator Associated and Health Care Associated Pneumonia in Adults. Am J Respir Crit Care Med Vol 171. pp 388–416, 2005
9. IDSA/ATS Consensus Guidelines on the Management of Community Acquired Pneumonia in Adults, CID 2007:44 (Suppl 2) • Mandell et al.
10. Diagnosis, Prevention and Treatment of Catheter Associated Urinary Tract Infections in Adults: 2009 International Clinical Practice Guidelines from the Infectious Disease Society of America, CID 2010:50 (1 March) • Hooton et al
11. Guidelines for Antimicrobial Treatment of Uncomplicated Acute Bacterial Cystitis and Pyelonephritis in Women. Clinical Infectious Diseases 1999;29:745–58
12. Infectious Disease Society of America Guidelines for the Diagnosis and Treatment of Asymptomatic Bacteruria. Clinical Infectious Diseases 2005; 40:643–54
13. Diagnosis and Management of Complicated Intra-abdominal Infections in Adults and Children: Guidelines by the Surgical Infection Society and the Infectious Disease Society of America. Clinical Infectious Diseases 2010; 50:133–64
14. Duong M., et al. "Randomized, controlled trial of antibiotics in the management of community-acquired skin abscesses in the pediatric patient." Annals of Emergency Medicine 2010 May; 55(5): 401-407.

Antibiotics frequently, occasionally and rarely associated with *Clostridium difficile* infection (CDI):

Antibiotics Frequently Associated with CDI:

- Fluoroquinolones
- Clindamycin
- Broad spectrum cephalosporins
- Broad spectrum penicillins

Antibiotics Occasionally Associated with CDI:

- Macrolides
- Trimethoprim
- Sulfonamides

Antibiotics Rarely Associated with CDI:

- Tetracyclines
- Aminoglycosides
- Chloramphenicol
- Metronidazole
- Vancomycin

Get smart...

- Antibiotics are strong medicines, but they don't cure everything.
- When not used correctly, antibiotics can be harmful to your health.
- Antibiotics can cure most bacterial infections. Antibiotics cannot cure viral illnesses.
- Antibiotics kill bacteria – not viruses.
- When you are sick, antibiotics are not always the answer.

Use antibiotics wisely

Talk with your healthcare provider about the right medicines for your health.

Get Smart about Antibiotics

Adapted from the Centers for Disease Control and Prevention's "Get Smart: Know When Antibiotics Work." Visit www.cdc.gov/getsmart for more information.

This isn't just about health care.
This is about you.

Park Nicollet

Park Nicollet

20105 (5/11)

When you—or your family members—are sick, our goal is to help you feel better fast. You may think antibiotic medications are the answer for every illness. But they're not. The following information can help you know when antibiotics work and when they won't.

Antibiotics aren't always the answer

Most illnesses are caused by 2 kinds of germs: bacteria or viruses.

Bacteria cause strep throat, some pneumonia and sinus infections. *Antibiotics can cure most bacterial infections.*

Viruses cause the common cold, most coughs and the flu. *Antibiotics won't cure viral infections.* They won't help you feel better and they won't keep other people from catching your illness.

What's the harm in taking antibiotics when they're not needed?

- Using antibiotics when they are not needed causes some bacteria to become resistant to the antibiotic.
- These resistant bacteria are stronger and harder to kill. They can stay in your body and can cause serious illnesses, such as antibiotic resistant infections and severe diarrhea caused by *Clostridium difficile* (C. diff.) bacteria. Resistant bacteria may require stronger treatment – and possibly a stay in the hospital.
- To help keep antibiotic-resistant infections from developing, don't take antibiotics to treat viruses, such as the common cold or the flu.

What should I do when I get sick?

- Take antibiotics only if they're prescribed to treat a bacterial infection, such as strep throat.
- If antibiotics are prescribed, be sure to take all the antibiotic medicine as directed. If you use only part of the prescription, you've treated only part of the infection. Not finishing the medicine can cause resistant bacteria to develop.

How do I know if I have a viral or bacterial infection?

- Ask your clinician.
- If you have a virus, check with your clinician about what other treatments are available to treat your symptoms.

Won't an antibiotic help me feel better quicker so I can get back to work when I get *a cold or the flu*?

No. Antibiotics do nothing to help a viral illness. They will not help you feel better sooner.

Do I need an antibiotic if mucus from my nose changes from clear to yellow or green?

No. Yellow or green mucus doesn't mean that you have a bacterial infection. It's normal for mucus to get thick and change color during a viral cold.

Reportable Diseases, MN Rule 4605.7040

Report Immediately by Telephone

Anthrax (*Bacillus anthracis*) a
Botulism (*Clostridium botulinum*)
Brucellosis (*Brucella* spp.) a
Cholera (*Vibrio cholerae*) a
Diphtheria (*Corynebacterium diphtheriae*) a
Hemolytic uremic syndrome a
Measles (rubeola) a
Meningococcal disease (*Neisseria meningitidis*)
(all invasive disease) a, b
Orthopox virus a
Plague (*Yersinia pestis*) a
Poliomyelitis a
Q fever (*Coxiella burnetii*) a
Rabies (animal and human cases and suspected cases)
Rubella and congenital rubella syndrome a
Severe Acute Respiratory Syndrome (SARS)
(1. Suspect and probable cases of SARS. 2. Cases of health care workers hospitalized for pneumonia or acute respiratory distress syndrome.) a
Smallpox (variola) a
Tularemia (*Francisella tularensis*) a
Unusual or increased case incidence of any suspect infectious illness a

a Submission of clinical materials required. If a rapid, non-culture assay is used for diagnosis, we request that positives be cultured, and isolates submitted. If this is not possible, send specimens, enrichment broth, or other appropriate material. Call the MDH Public Health Laboratory at 651-201-4953 for instructions.

b Isolates are considered to be from invasive disease if they are isolated from a normally sterile site, e.g., blood, CSF, joint fluid, etc.

c Report on separate Sexually Transmitted Disease Report Card.

d Report on separate HIV Report Card.

e For criteria for reporting laboratory confirmed cases of influenza, see www.health.state.mn.us/divs/idepc/dtopics/reportable/index.html.

Report Within One Working Day

Amebiasis (*Entamoeba histolytica/dispar*)
Anaplasmosis (*Anaplasma phagocytophilum*)
Arboviral disease (including, but not limited to, LaCrosse encephalitis, eastern equine encephalitis, western equine encephalitis, St. Louis encephalitis, and West Nile virus)
Babesiosis (*Babesia* spp.)
Blastomycosis (*Blastomyces dermatitidis*)
Campylobacteriosis (*Campylobacter* spp.) a
Cat scratch disease (infection caused by *Bartonella* spp.)
Chancroid (*Haemophilus ducreyi*) c
Chlamydia trachomatis infection c
Coccidioidomycosis
Cronobacter (Enterobacter) sakazakii (infants under 1 year of age) a
Cryptosporidiosis (*Cryptosporidium* spp.) a
Cyclosporiasis (*Cyclospora* spp.) a
Dengue virus infection
Diphyllobothrium latum infection
Ehrlichiosis (*Ehrlichia* spp.)
Encephalitis (caused by viral agents)
Enteric *E. coli* infection
(*E. coli* O157:H7, other enterohemorrhagic [Shiga toxin-producing] *E. coli*, enteropathogenic *E. coli*, enteroinvasive *E. coli*, enterotoxigenic *E. coli*) a
Giardiasis (*Giardia lamblia*)
Gonorrhea (*Neisseria gonorrhoeae*) c
Guillain-Barre´ syndrome
Haemophilus influenzae disease
(all invasive disease) a
Hantavirus infection
Hepatitis (all primary viral types including A, B, C, D, and E)
Histoplasmosis (*Histoplasma capsulatum*)
Human immunodeficiency virus (HIV) infection, including Acquired Immunodeficiency Syndrome (AIDS) a, d
Influenza
(unusual case incidence, critical illness, or laboratory confirmed cases) a, e
Kawasaki disease
Kingella spp. (invasive only) a, b
Legionellosis (*Legionella* spp.) a
Leprosy (Hansen's disease) (*Mycobacterium leprae*)
Leptospirosis (*Leptospira interrogans*)
Listeriosis (*Listeria monocytogenes*) a
Lyme disease (*Borrelia burgdorferi*)
Malaria (*Plasmodium* spp.)
Meningitis (caused by viral agents)
Mumps
Neonatal sepsis, less than 7 days after birth (bacteria isolated from a sterile site, excluding coagulase-negative *Staphylococcus*) a, b
Pertussis (*Bordetella pertussis*) a
Psittacosis (*Chlamydophila psittaci*)
Retrovirus infection
Reye syndrome
Rheumatic fever (cases meeting the Jones Criteria only)
Rocky Mountain spotted fever (*Rickettsia rickettsii, R. canada*)
Salmonellosis, including typhoid (*Salmonella* spp.) a
Shigellosis (*Shigella* spp.) a
Staphylococcus aureus (vancomycin-intermediate *S. aureus* [VISA], vancomycin-resistant *S. aureus* [VRSA], and death or critical illness due to community-associated *S. aureus* in a previously healthy individual) a
Streptococcal disease (all invasive disease caused by Groups A and B streptococci and *S. pneumoniae*) a, b
Syphilis (*Treponema pallidum*) c
Tetanus (*Clostridium tetani*)
Toxic shock syndrome a
Toxoplasmosis (*Toxoplasma gondii*)
Transmissible spongiform encephalopathy
Trichinosis (*Trichinella spiralis*)
Tuberculosis (*Mycobacterium tuberculosis* complex) (Pulmonary or extrapulmonary sites of disease, including laboratory confirmed or clinically diagnosed disease, are reportable. Latent tuberculosis infection is not reportable.) a
Typhus (*Rickettsia* spp.)
Unexplained deaths and unexplained critical illness (possibly due to infectious cause) a
Varicella-zoster disease (1. Primary [chickenpox]: unusual case incidence, critical illness, or laboratory-confirmed cases. 2. Recurrent [shingles]: unusual case incidence or critical illness.) a
Vibrio spp. a
Yellow fever
Yersiniosis, enteric (*Yersinia* spp.) a

Sentinel Surveillance (at sites designated by the Commissioner)

Methicillin-resistant *Staphylococcus aureus* (invasive only) a, b
Clostridium difficile a
Carbapenem-resistant *Enterobacteriaceae* spp. (CRE) and carbapenem-resistant *Acinetobacter* spp. a

Antimicrobial Susceptibilities of Selected Pathogens, 2010

MINNESOTA MDH DEPARTMENT OF HEALTH

Minnesota Department of Health
625 North Robert Street
PO Box 64975
St. Paul, MN 55164-0975
www.health.state.mn.us

To Report a Case:
Fill out a Minnesota Department of Health case report form and mail to the above address. For diseases that require immediate reporting, or for questions about reporting, call the Acute Disease Investigation and Control Section at: 651-201-5414 or 1-877-676-5414 or fax form to 651-201-5743.

To Send an Isolate to MDH:
If you are sending an isolate by U.S. mail, use regulatory compliant transport packaging and send to: PO Box 64899, St. Paul, MN 55164. If you are using a courier, use transport packaging appropriate for the specific courier and send to: 601 North Robert Street, St. Paul, MN 55155. To request pre-paid transport labels (both mail and courier) and packaging, or for other assistance, call the Public Health Laboratory Specimen Handling Unit at: 651-201-4953.

The MDH Antibiogram is available on the MDH web site (http://www.health.state.mn.us). Laminated copies can be ordered from: Antibiogram, Minnesota Department of Health, Acute Disease Investigation and Control Section, 625 North Robert Street, PO Box 64975, St. Paul, MN 55164-0975.

Antimicrobial Susceptibilities of Selected Pathogens, 2010

MINNESOTA DEPARTMENT OF HEALTH

Sampling Methodology
† all isolates tested
‡ ~10% sample of statewide isolates received at MDH
§ isolates from a normally sterile site

		Campylobacter spp. [1‡]	*Salmonella* Typhimurium [2†]	Other *Salmonella* serotypes (non-typhoidal) [2‡]	*Shigella* spp. [‡]	*Neisseria gonorrhoeae* [3]	*Neisseria meningitidis* [4†§]	Group A *Streptococcus* [5†§]	Group B *Streptococcus* [6†§]	*Streptococcus pneumoniae* [7†§]	*Mycobacterium tuberculosis* [8†]
Number of Isolates Tested		90	100	55	6	71	9	142	385	625	109
		% Susceptible									
ß-lactam antibiotics	amoxicillin									90	
	ampicillin		77	93	67		89	100	100		
	penicillin					77	89	100	100	77	
	cefixime					100					
	cefuroxime sodium									86	
	cefotaxime							100	100	88	
	ceftriaxone		95	96	100	100	100			88	
	meropenem						100			87	
Other antibiotics	ciprofloxacin	76	100	100	83	76	100				
	levofloxacin						100	100	99	99	
	azithromycin	99				97	100				
	erythromycin	97						85	57	73	
	clindamycin							97/89[5]	77/68[6]	88	
	chloramphenicol		74	95	83					99	
	gentamicin	98									
	spectinomycin					100					
	tetracycline	47				23		87		87	
	trimethoprim/sulfamethoxazole		95	100	83		67			78	
	vancomycin							100	100	100	
TB antibiotics	ethambutol										100
	isoniazid										95
	pyrazinamide										94
	rifampin						100				99

Trends, Comments, and Other Pathogens

[1] *Campylobacter* spp.	Ciprofloxacin susceptibility was determined for all isolates (n=906). Only 32% of isolates from patients returning from foreign travel were susceptible to quinolones. Most susceptiblities were determined using 2009 CLSI breakpoints for *Campylobacter*. Susceptibilities for gentamicin were based on an MIC ≤ 4µg/ml and azithromycin were based on an MIC ≤ 2µg/ml.
[2] *Salmonella enterica* (non-typhoidal)	Antimicrobial treatment for enteric salmonellosis generally is not recommended.
[3] *Neisseria gonorrhoeae*	Routine resistance testing for *Neisseria gonorrhoeae* by MDH PHL was discontinued in 2008. Susceptibility results were obtained from the CDC Regional Laboratory in Cleveland, Ohio, and are for isolates obtained through the Gonococcal Isolate Surveillance Program. Isolates (n = 71) were received from the Red Door Clinic in Minneapolis. Numbers do not include two samples missing susceptibility results. Resistance criteria for cefixime, ceftriaxone, cefpodoxime, and azithromycin have not been established; data reflect reduced susceptibility using provisional breakpoints (minimum inhibitory concentration ≥ 0.5 µg/ml, ≥ 0.5 µg/ml and ≥ 2.0 µg/ml, respectively). Also, the number of gonorrhea isolates submitted for testing decreased from 128 in 2009 to 73 in 2010.
[4] *Neisseria meningitidis*	In 2010, 1 case-isolate demonstrated intermediate susceptibility to penicillin and ampicillin. Three cases demonstrated resistance to trimethoprim/sulfamethoxazole. There were no 2010 case-isolates with ciprofloxacin resistance. In 2008, 2 isolates obtained from cases occuring in northwestern Minnesota had nalidixic acid MICs > 8 µg/ml and ciprofloxacin MICs of 0.25 µg/ml, indicative of resistance.
[5] Group A *Streptococcus*	The 142 isolates tested represent 90% of 158 total cases. Among 18 erythromycin-resistant, clindamycin-susceptible isolates, 12 (67%) had inducible resistance to clindamycin by D-test for a total of 89% that were susceptible to clindamycin and D-test negative (where applicable).
[6] Group B *Streptococcus*	100% (31/31) of early-onset infant, 100% (14/14) of late-onset infant, 43% (3/7) of maternal, and 85% (337/396) of other invasive GBS cases were tested. Among 78 erythromycin-resistant, clindamycin-susceptible isolates, 37 (47%) had inducible resistance to clindamycin by D-test. Overall, 68% (260/385) were susceptible to clindamycin and were D-test negative (where applicable). 71% (34/48) of infant and maternal cases were susceptible to clindamycin and were D-test negative (where applicable).
[7] *Streptococcus pneumoniae*	The 625 isolates tested represent 96% of 649 total cases. Reported above are the proportions of case-isolates susceptible by meningitis breakpoints for cefotaxime, ceftriaxone (intermediate = 1.0 µg/ml, resistant ≥ 2.0 µg/ml) and penicillin (resistant ≥ 0.12 µg/ml). By nonmeningitis breakpoints (intermediate = 2.0 µg/ml, resistant ≥ 4.0 µg/ml), 92% (573/625) of isolates were susceptible to cefotaxime and ceftriaxone. By nonmeningitis breakpoints (intermediate = 4.0 µg/ml, resistant ≥ 8.0 µg/ml), 90% (565/625) of isolates were susceptible to penicillin. Isolates were screened for high-level resistance to rifampin at a single MIC; all were ≤ 2 µg/ml. Using meningitis breakpoints, 20% (125/625) of isolates were resistant to two or more antibiotic classes and 15% (96/625) were resistant to three or more antibiotic classes. (CLSI also has breakpoints for oral penicillin V; refer to the most recent CLSI recommendations for information).
[8] *Mycobacterium tuberculosis* (TB)	National guidelines recommend initial four-drug therapy for TB disease, at least until first-line drug susceptibility results are known. Of the 12 drug-resistant TB cases reported in 2010, 10 (83%) were in foreign-born persons. There were no multidrug-resistant (MDR-TB) cases (i.e., resistant to at least isoniazid and rifampin) reported in 2010. There were no cases of extensively drug-resistant TB (XDR-TB) (i.e., resistance to at least INH, rifampin, any fluoroquinolone, and at least one second-line injectable drug) reported in 2010.
Invasive methicillin-resistant *Staphylococcus aureus* (MRSA)	232 cases of invasive MRSA infection were reported in 2010 in Ramsey and Hennepin Counties, of which 158 (68%) were from blood. 79% (183/232) had an isolate submitted and antimicrobial susceptibility testing conducted. Of cases with an isolate, 89% (163/183) were epidemiologically classified as healthcare-associated. Susceptibilities were as follows: 100% to linezolid, minocycline, and vancomycin; 99% to gentamicin, daptomycin, doxycycline, trimethoprim/sulfamethoxazole; 98% to tetracycline; 95% to rifampin; 94% to mupirocin (MIC ≤ 4 ug/mL); 13% to levofloxacin; 8% to erythromycin. 33% were susceptible to clindamycin by broth microdilution; however, an additional 17 isolates (10%) exhibited inducible clindamycin resistance (23% susceptible and negative for inducible clindamycin resistance). For community-associated (CA) cases (76% of 25 cases had isolates submitted), susceptibilities were as follows: 100% to daptomycin, doxycycline, gentamicin, linezolid, minocycline, rifampin, tetracycline, trimethoprim/sulfamethoxazole, vancomycin; 95% to mupirocin (MIC ≤ 4 ug/mL); 40% to levofloxacin; 20% to erythromycin. 63% were susceptible to clindamycin by broth microdilution; however, 1 additional isolate (5%) exhibited inducible clindamycin resistance (58% susceptible and negative for inducible clindamycin resistance). In addition to invasive MRSA surveillance, MDH received 2 reports of isolates (1 MRSA and 1 MSSA) with intermediate resistance to vancomycin (MIC 4-8 µg/ml).
Carbapenem-resistant *Enterobacteriaceae* (CRE)	Of *Enterobacteriaceae* submitted to the MDH Public Health Laboratory because of an elevated MIC to at least one carbapenem, 18 tested positive for bla_{KPC} by PCR.
Escherichia coli O157:H7	Antimicrobial treatment for *E. coli* O157:H7 infection is not recommended.