Minnesota Burn Surge Education

Minnesota Department *of* Health

Emergency Preparedness and Response

Version August 2016

Introduction

- **Module 1: Minnesota Statewide Burn Surge Planning**
- **Module 2: Introduction to Burn**
- **Module 3: Burn Treatment and Stabilization**
- **Module 4: Special Treatment Considerations**

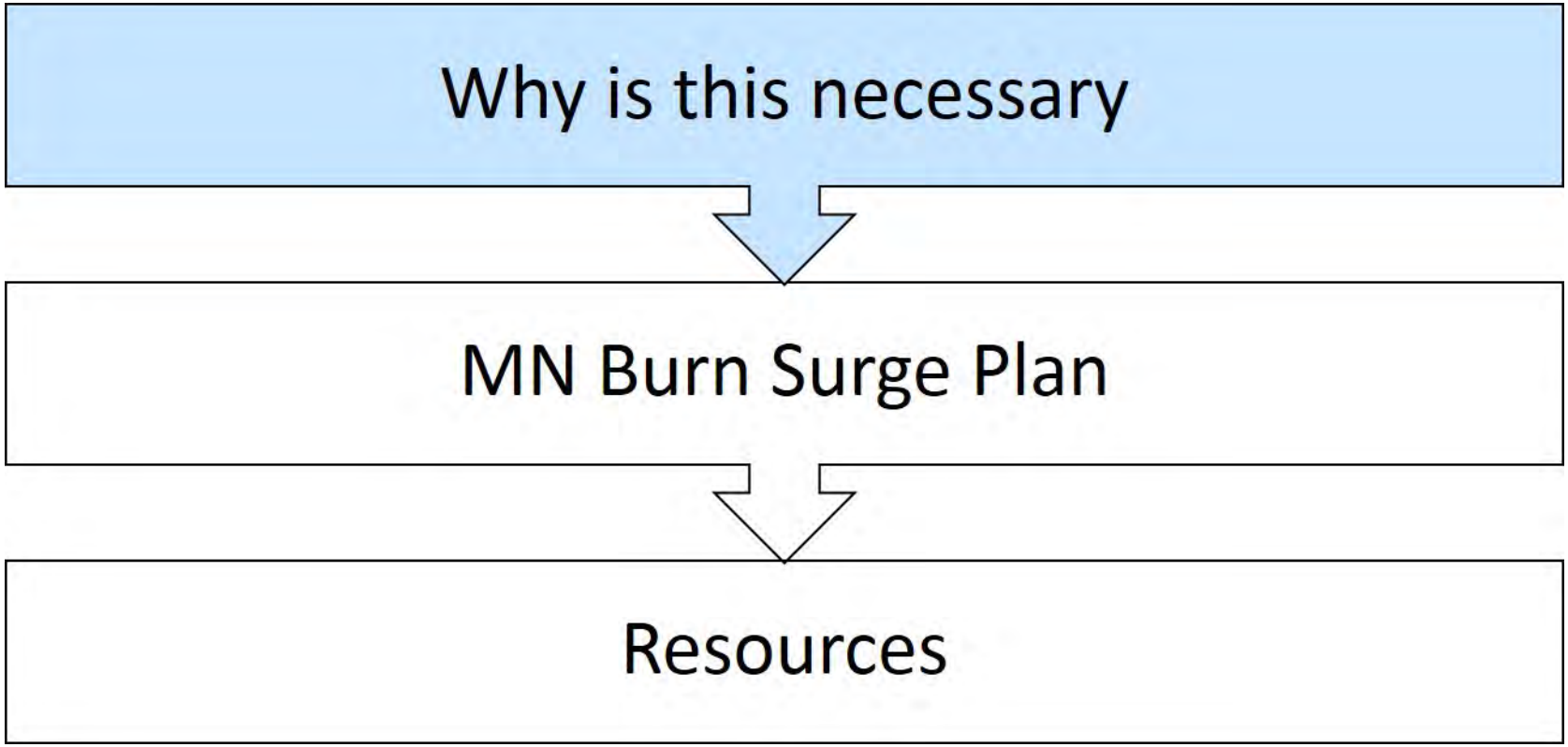
MDH

Module 1:

Minnesota Statewide Burn Surge Planning

Minnesota Department *of* Health

Objectives



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Why is this necessary

- Multiple Burn Causalities Incident can quickly overwhelm Burn Centers
- Limitations for capacity and burn trained personnel
- Burn Care is a specialized service

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Definition of a Burn Disaster

A burn disaster is defined by the American Burn Association (ABA) as any incident where capacity and capability is insufficient, patient care may be compromised, patient care is possible, and may require an individual Burn Center, state, regional, or federal disaster response.

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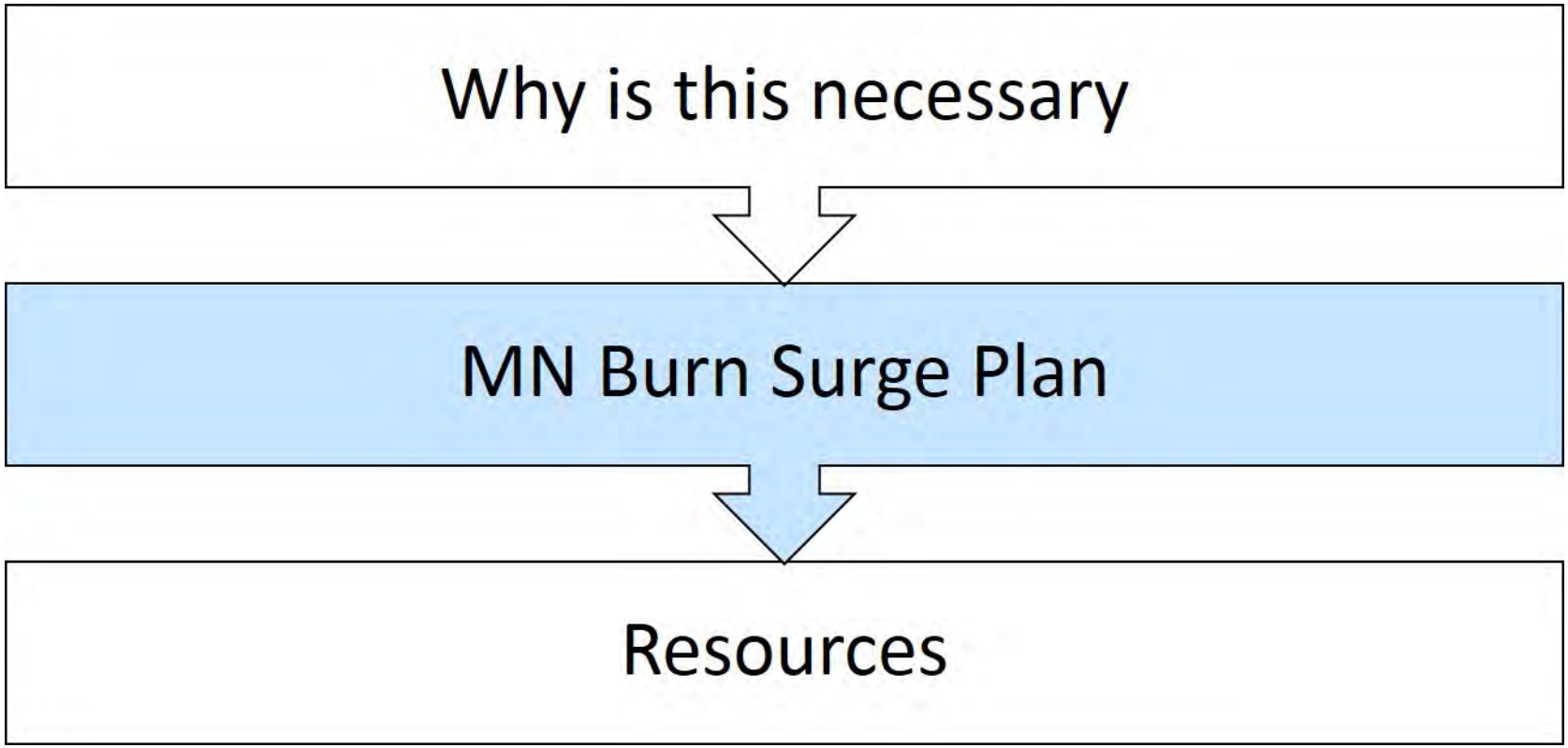
Objectives



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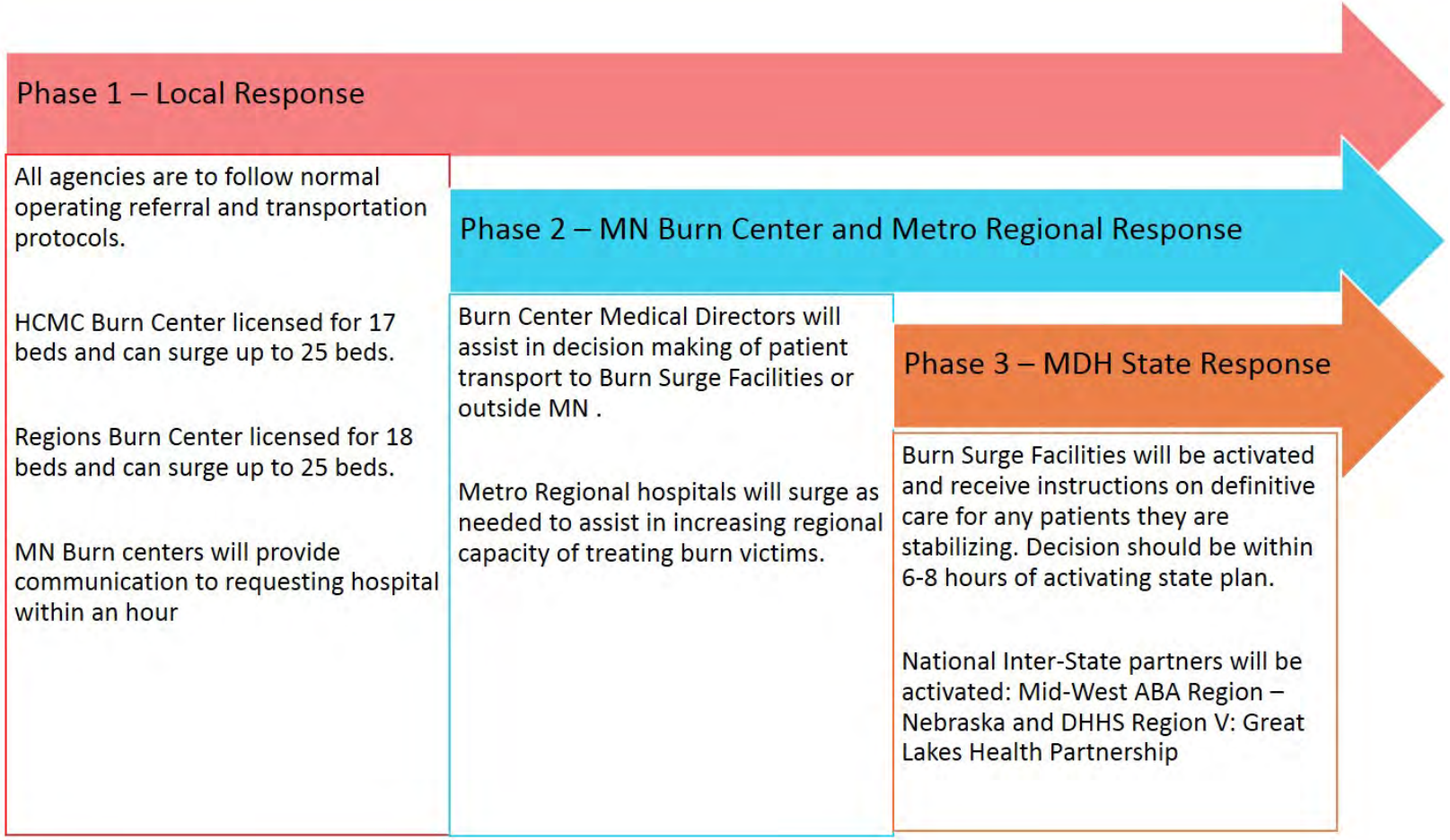
MN Burn Surge Plan: 3 Phases



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MN ABA verified Burn Centers

Hennepin County **Medical Center**

Regions Hospital

HealthPartners

National verification by the American Burn Association (ABA) & the American College of Surgeons - Committee on Trauma (ACS-CoT)

Integrated multidisciplinary teams - optimal functional & cosmetic outcome

Experienced care of burn injuries of any size or mechanism in all ages

- associated trauma
- multiple medical conditions
- physical, occupational & psychological care, rehabilitation and reintegration
- integrated regional mass casualty coordination

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Burn Surge Facilities

Burn Surge Facility	Regions
Mayo Clinic Hospital – Rochester	Facility will serve as point of referral for both SE and SC regions.
Sanford – Worthington	Facility will serve as point of referral for SW region.
St. Cloud Hospital	Facility will serve as point of referral for both Central and WC regions.
Altru – Grand Forks Sanford – Fargo Essentia Health – Fargo	Facility will serve as point of referral for both NW and WC regions.
Essentia Health – Duluth	Facility will serve as point of referral for NE region.
Abbott Northwestern Children's Hospitals & Clinics Mercy Hospital North Memorial UMMC – M Health	Facility will serve as point of referral for Metro region.

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Role of Burn Surge Facility

Severely burned patients require a dedicated burn facility for definitive care.

Note: Info recommended below is taken from MN Burn Surge Plan

Initial Assessment & Treatment

- Recognize and treat any associated trauma
- Diagnose burn size & initial depth
- Initial burn dressings/wound care
- Continue resuscitation

Stabilization (72H)

- Surgical/Critical Care Management
- Communication with Incident Command Center
- Supportive care: fluids, analgesia, ventilator support, nutrition
- Plan and coordinate transfer to Verified Burn Center for definitive management

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Objectives

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Resources

- **MDH Burn Surge website**
  http://www.health.state.mn.us/oep/healthcare/burn/
- **American Burn Association**
  http://ameriburn.org/
- **HCMC Burn Center**
  http://www.hcmc.org/clinics/burncenter/
- **Regions Hospital Burn Center**
  http://www.regionshospital.com/rh/specialties/burn-center/

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Module 2:

Introduction to Burn

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Objectives

Discuss the nature and epidemiology of burn injuries

Overview of skin and burn classifications

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Epidemiology

- **Incidence**
  - 1.25 Million injuries / year
  - 450,000 patients seek treatment per year
  - 40,000 patients hospitalized annually
  - 3,400 deaths from burn injuries
  - 96.1% overall survival rate

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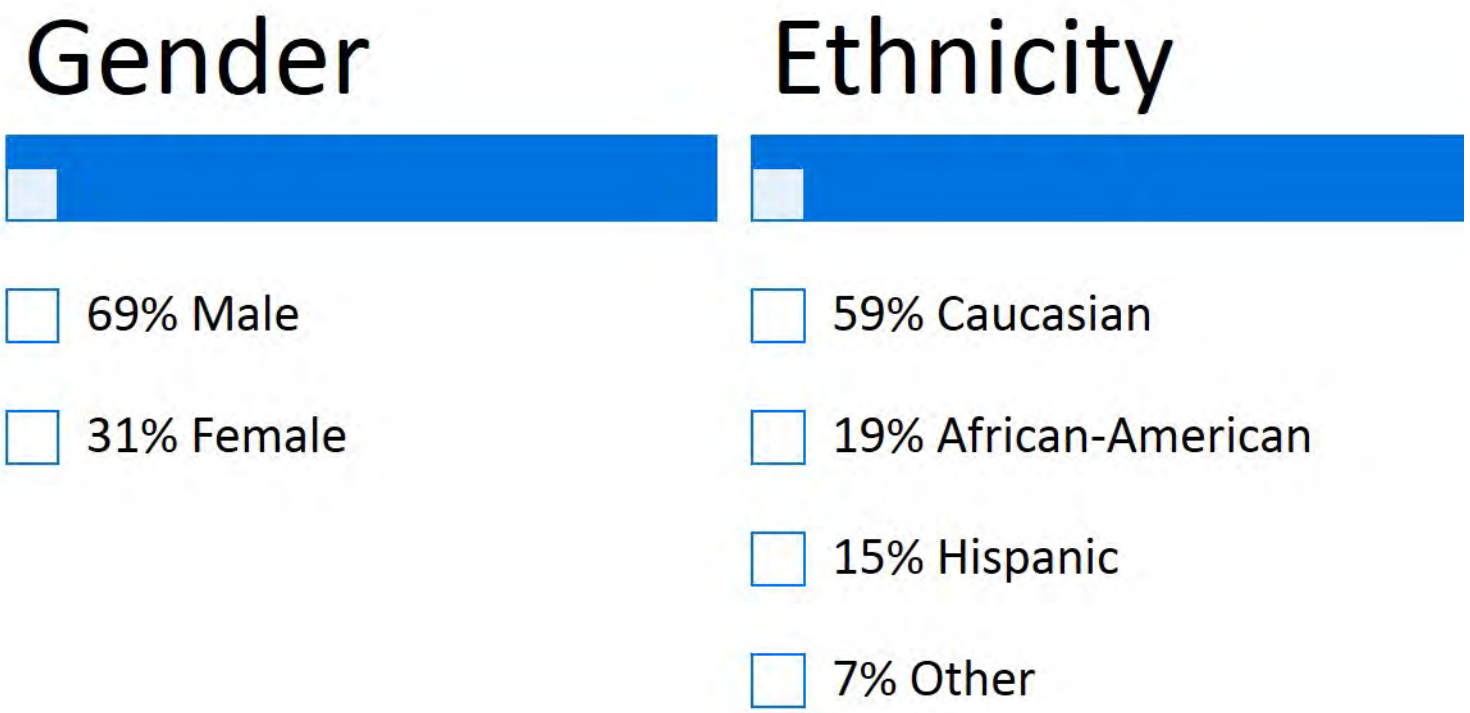
Epidemiology

Demographics



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Epidemiology

- **Injury Types**
  - 44% fire/flame
  - 33% scald
  - 9% contact
  - 4% electrical
  - 3% chemical
  - 7% other

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Epidemiology

- **Location**
  - 69% Home
    - Kitchen - scald
  - 9% Occupational
  - 7% Street/Hwy
  - 5% Recreational/Sport
  - 10% Other

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High Risk Groups

- **Children**
  - Scald injuries most common
- **Elderly**
  - Flame injuries most common
  - Pre-existing conditions

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High Risk Groups

- **Chemical intoxication**
  - Risk-taking behavior
  - Impaired responsiveness
  - 40% of house fire deaths are associated with substance abuse

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Objectives

Discuss the nature and epidemiology of burn injuries

Overview of skin and burn classifications

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Skin Function

- **Protects from infection and injury**
- **Regulates body temperature**
- **Prevents loss of body fluids**
- **Sensory contact with environment**

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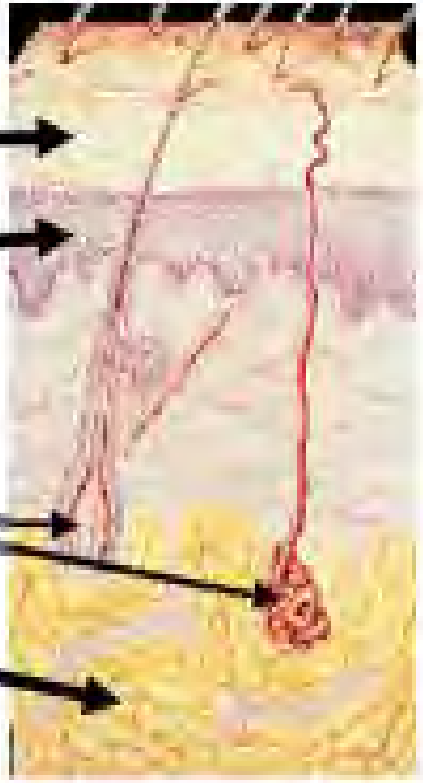
Skin Anatomy

- Epidermis
- Dermis
- Dermal Appendages
- Subcutaneous Tissue



Burn Definition

- **An injury to tissue usually caused by heat but also by abnormal cold, chemicals, poison gas, electricity, or lightning.**

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Burn Wound Zones

Zone of Coagulation

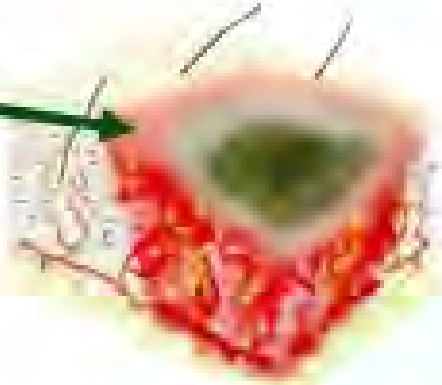
- Dead and stays dead regardless of Rx

Zone of Stasis

- Area of vessel contraction
- Inflamed
- Ischemic
- ± viable depending on care

Zone of Hyperemia

- Vessel dilatation
- Capillary permeability
- Viable with good care and no infection



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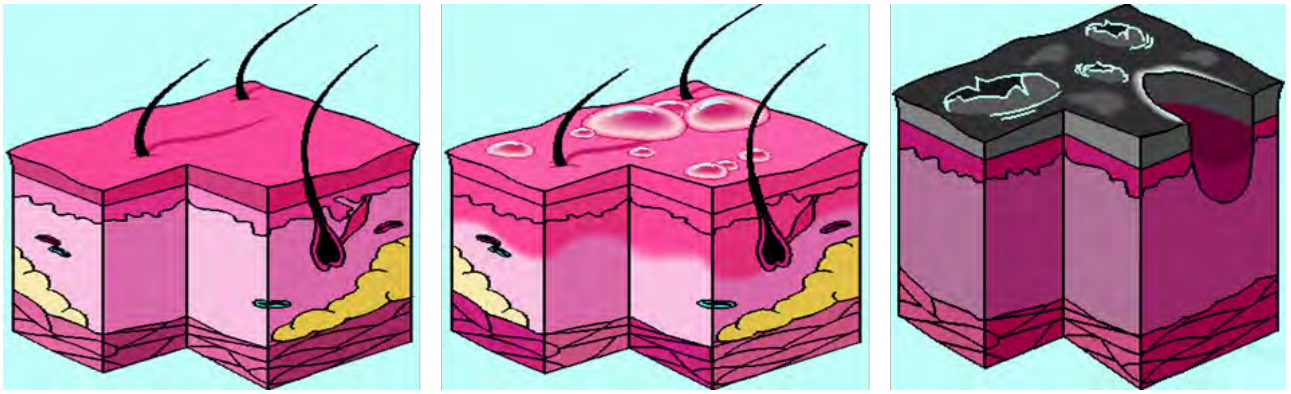
Images courtesy of Nicole S. Gibran, MD, FACS; Harborview Medical Center, Education Presentations

Burn Depth

- **Four categories**
  - First Degree
  - Second Degree
  - Third Degree
  - Fourth Degree



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First Degree Burn (Superficial)

- **“Sunburn” injury**
- **Epidermis only**
- **No scarring**
- **No disfigurement**

Note: First degree burns do NOT count toward calculation of TBSA burned

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Second Degree Burn (Partial-Thickness)

- **Entire epidermis and part of dermis**
- **Pink and blistered**
- **Most painful**
- **Heals in 2-3 weeks**
  - Via Dermal Appendages
- **Pigmentation changes**
- **Minimal scarring**
- **+/- skin grafting**

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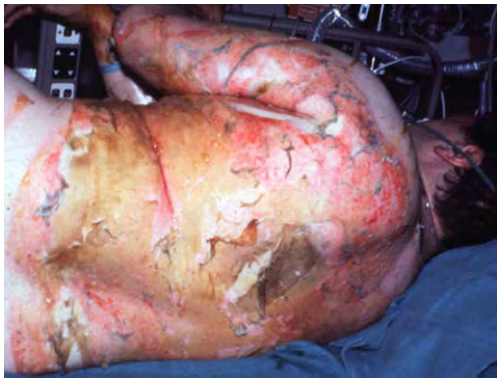
Third Degree Burn (Full-Thickness)

- **Entire dermis and epidermis**
- **White, dry appearance**
- **Coagulated vessels**
- **Scarring and disfigurement**
- **Heals by contracture**
- **Skin grafting indicated**



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Fourth Degree Burn (Deep Full-Thickness)

- **Burn into underlying structure**
- **Often charred**
- **Disfigurement**
- **Disability**

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Module 3:

Burn Treatment and Stabilization

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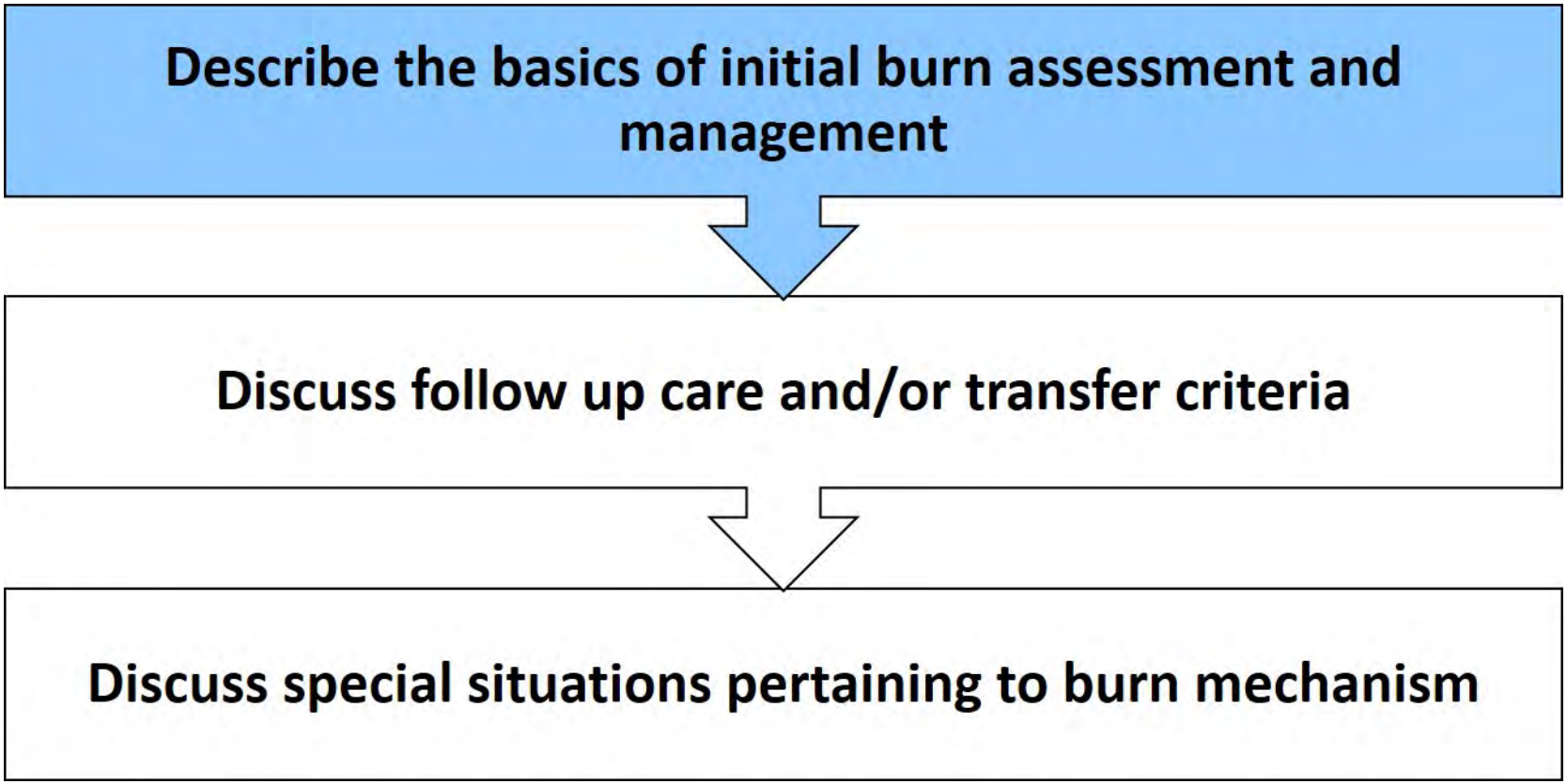

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Initial Care

- **Stop the burning process**
- **Initial resuscitation flows just like trauma**
  - Airway
  - Breathing
  - Circulation
  - Disability
  - Exposure
  - Fluids

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Airway/Breathing

Indications for Intubation

Hoarseness, voice change	Stridor	Large TBSA burn (>50%)	Extensive facial burns
Burns inside mouth	Significant burn edema	Signs of obstruction	Difficulty swallowing
Using accessory muscles	Inability to handle secretions	Respiratory fatigue	Poor oxygenation/ ventilation
	Very large doses of narcotics	Impaired level of consciousness, not protecting airway	

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Circulation

- Assess for pulses in extremities and hemodynamic stability
- If there is active hemorrhage control with direct pressure – if this fails, tourniquet and or surgical control may be used
- The burn will remain stable throughout hemorrhage stabilization
- Resuscitate with Crystalloid (LR) and blood products as needed to treat hypotension in addition to burn fluid resuscitation

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Burn Dressing Recommendations

Cool burn

Prevent hypothermia

Dry dressing

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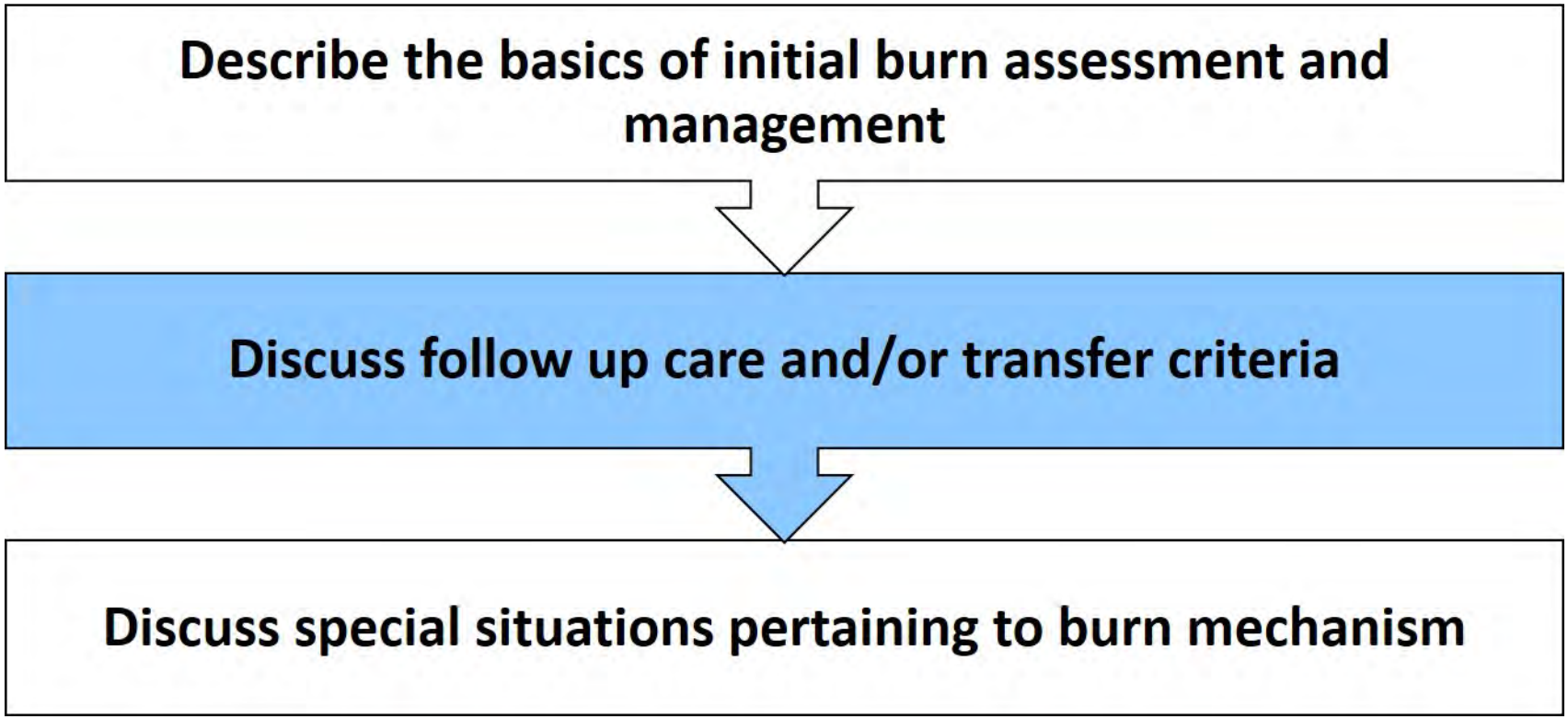
Objectives



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Referral Criteria for Burn Center

- > 10% TBSA
- Face, hands, feet, genitals, perineum, major joints
- Third degree
- Electrical, including lightning
- Chemical burns
- Inhalation injury
- Pre-existing conditions
- Associated trauma
- Pediatrics
- Special social, emotional, rehab needs

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Prep for Transfer

- SECURE all lines/tubes
- Dry sterile covering to wounds
- Don’t delay transfers for Imaging and labs
- Tetanus booster
- Continuous IV fluids – Parkland Formulas
- Air vs. ground
- Most admit directly to Burn Centers if able
- If unable to transfer to burn center with above criteria please refer to module 2

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Parkland Formula

- 2-4 mL/kg/%TBSA over 24 hours with the first half infused **in first 8 hours since time of initial burn**

Example: 30% TBSA in a 70kg patient

4mL*70*30 = 8400mL

4200mL in first 8 hours

Example: 60% TBSA in a 20kg child

2mL*20*60 = 2400mL

1200mL in the first 8 hours

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Estimating Percent TBSA

1% TBSA = size of patient hand
(whole palmer surface)

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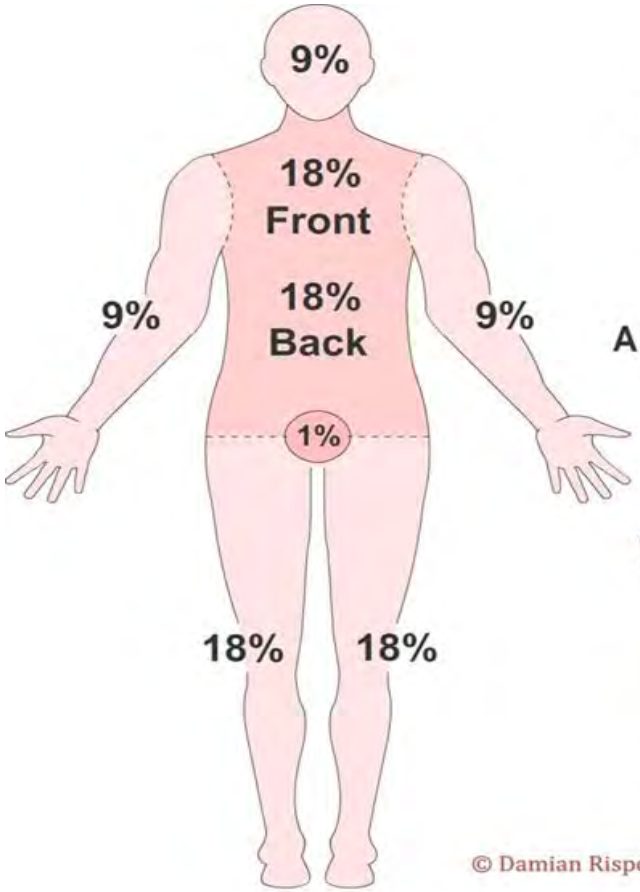
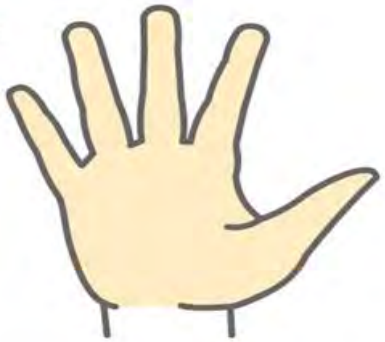
“Rule of Nines”



Rule of Nines

Measure 2nd and 3rd Degree Burns

A Patients hand ~ 1% of the total body surface area



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Guidelines for Safe Transport

- Keep Patient warm and dry, no wet dressings
- Secure airway if necessary *before* transport
- Initiate fluid resuscitation
- Foley catheter in place
- Tetanus prophylaxis
- Continue pain and sedation medications
- No Bolus therapy unless overtly hypotensive

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Transport issues (Ground and Rotary Transport service areas)

Air Service	Rotor Wing	Fixed Wing	IFR Rotor Capability	Dispatch	Bases	Hospital System
Avera Careflight	X	X	X	1-800-592-1889	SD	Avera
Life Link III	X	X		1-800-328-1377	MN, WI	Hospital Consortium
Mayo One	X	X	X	1-800-237-6822	MN, WI	Mayo Clinic
MedLink AIR	X		X	1-800-527-1200	WI	Gunderson Health System
Mercy Air Med	X			1-877-463-7291	IA	Mercy North Iowa
Ministry Spirit Air	X		X	1-888-411-1362	WI	Ministry Health Care
North Memorial Air Care	X		X	1-800-247-0229	MN, WI	North Memorial Medical Center
NorthStar Criticair	X			1-800-223-1596	ND	Trinity Health
Sanford Air Med	X	X	X	1-844-424-7633	MN, ND, SD	Sanford Health
Valley Med Flight	X	X		1-800-828-0168	MN, ND, MI	Independent

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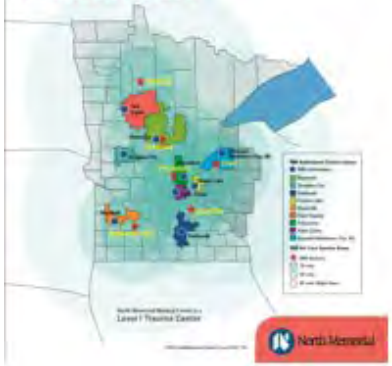
Transportation Services and their logos

AMRG
Air Medical Resource Group
SERVICE AREA MAP
AMRG Fixed & Rotor-wing Base
AMRG Rotor-wing Base
AMRG Fixed-wing Base

North Memorial
AIR CARE
24-Hour Dispatch Line
1-800-247-0229



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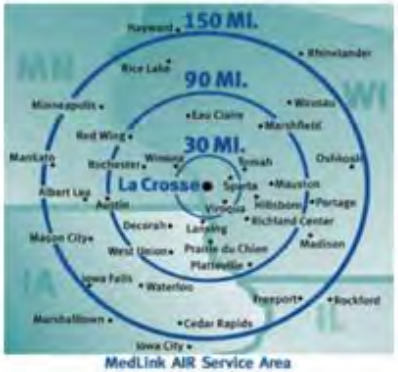

Criteria for Observation/Outpatient Care

<10% TBSA	1st and 2nd degree burns	Non-circumferential burns
Questionable inhalation exposure	Intractable pain patients	Need for IV hydration

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Prep for Outpatient Clinic

- **Bacitracin or Triple antibiotic/Adaptic (B&A) dressings**
  - Silvadene alters wound appearance
- **Supplies to change dressings daily**
- **Oral pain medication**
- **Tetanus booster**
- **Discharge Info to include contact information for follow up**

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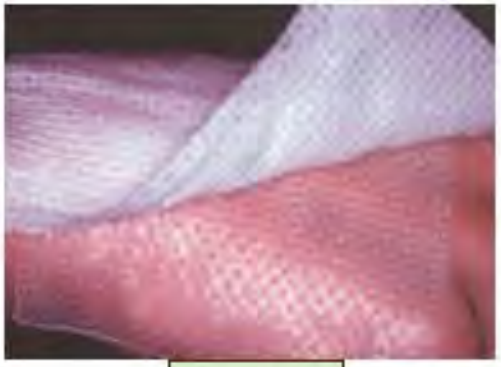
Options of Burn Dressings for Outpatient

Bacitracin

Adaptic



Mepitel

Kerlix Gauze

Stockinet

Coban

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Objectives

Describe the basics of initial burn assessment and management

Discuss follow up care and/or transfer criteria

Discuss Special Situations Pertaining to Mechanisms

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Special Circumstances

- **Electrical injuries**
- **Inhalation injuries**
- **Chemical burns**

- NOTE: Radiation injuries not included here as the burn component is a minor issue compared to the acute radiation exposure issues – Contact on call specialists at MN Regional Poison Center 800-222-1222 for chemical and radiation issues.

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Electrical injuries

- **Cardiac monitor and EKG required**
- **Monitor CK levels for rhabdomyolysis, treat with increased IVF and urine alkalization**
- **Injury is largely considered an inside-outside injury**
  - Meaning muscle and internal compartment damage may be major but the external signs are often minor
  - Continue to evaluate for compartment syndromes
- **Considered significant when involved Voltage > 1000 volts**
- **Consider labs for lactic acid**

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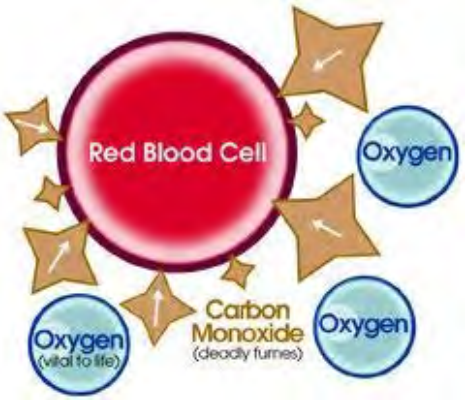
Inhalation Injury

- **Smoke inhalation is a 'toxic soup'**
  - Particles and chemicals
- **Carbon Monoxide (CO) poisoning**
  - 200x > affinity for Hgb than O_2
  - SpO_2 abnormally elevated (normal on monitor)
  - Half life
    - Room air: 250 mins
    - 100% FiO2: 40-60 mins
    - 3 atm HBO: 20 mins



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CO Poisoning

CO Hgb Saturation (%)	Symptoms
0-9%	None
10-20%	Headache, vasodilation
20-30%	Headache, pulsating temples
30-40%	Severe headache, nausea/vomiting, weakened sight, prostration
40-50%	As above, increased RR and HR, asphyxiation
50-60%	As above, coma, seizure, cheyne-Stoke breathing
> 60%	Coma, seizure, cardiopulmonary collapse, death

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Inhalation Injury

- **Cyanide (CN) poisoning**
  - Commonly produced by synthetic compounds (i.e. burning carpet, vinyl and household goods)
  - Binds to cytochrome oxidase
    - Blocks cellular respiration
    - Synergy with CO
  - Effects within seconds of inhalation
  - Persistent lactic acidosis resistant to resuscitation
  - ALWAYS consider with closed space smoke exposure
  - Lab: Consider cyanide and lactic acid levels

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Inhalation Injury

Treating CN Poisoning

"Old" Cyanide kit (Lilly Cyanide Antidote)

- Amyl nitrate, thiosulfate, sodium nitrite
- Methemoglobin generators

"New" Cyanide kit (Cyanokit)

- Hydroxycobalamine (Vit B12 precursor) 5 mg x1
- May repeat dose x1
- Side effects – flushing, HTN, lab interference

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Trauma Always Trumps Burn

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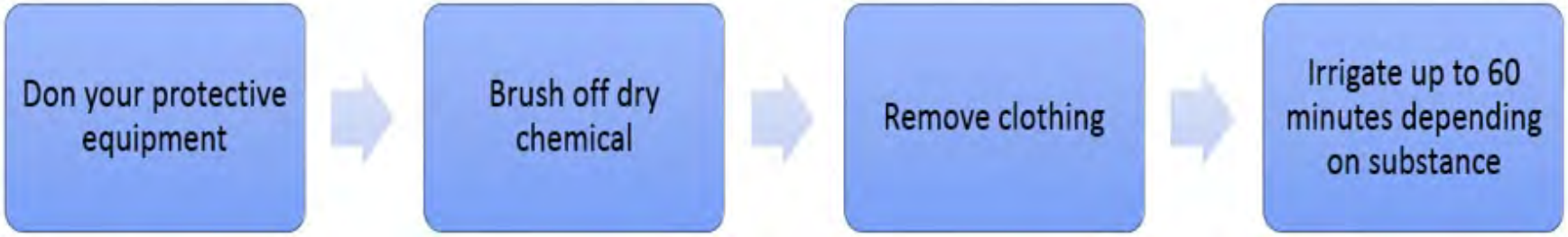
Chemical Burns

Initial treatment of Chemical Injuries



- Contact Poison Control for treatment recommendations – 800-222-1222
- No acid/base reversal, can monitor pH of skin while irrigating
- Alkali burns (base) are far more dangerous and may require long-term irrigation
- Place in saline dressing for 1st 24-48 hours as the petroleum's in topical creams can lock in the chemicals causing the burn

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POISON Help
1-800-222-1222

Module 4:

Special Treatment Considerations

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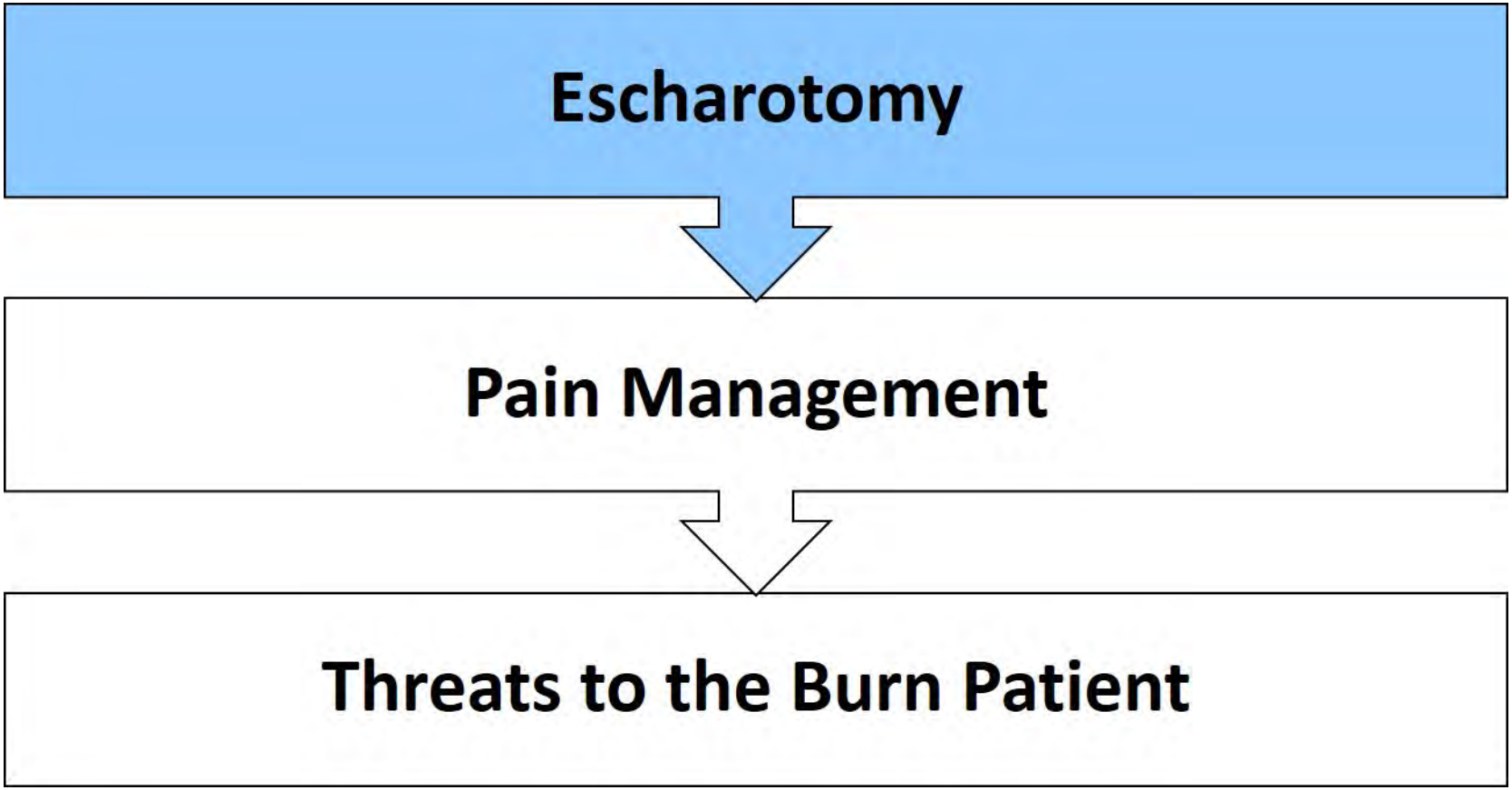

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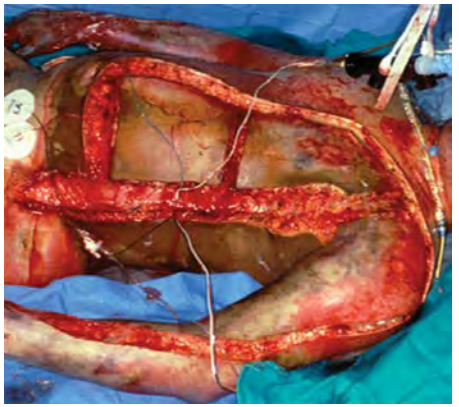
Escharotomy

- **Contact Burn Center or Burn Surge Facility for guidance**
- **Considerations:**
  - If unable to bag a patient
  - Generally circumferential chest full thickness burns



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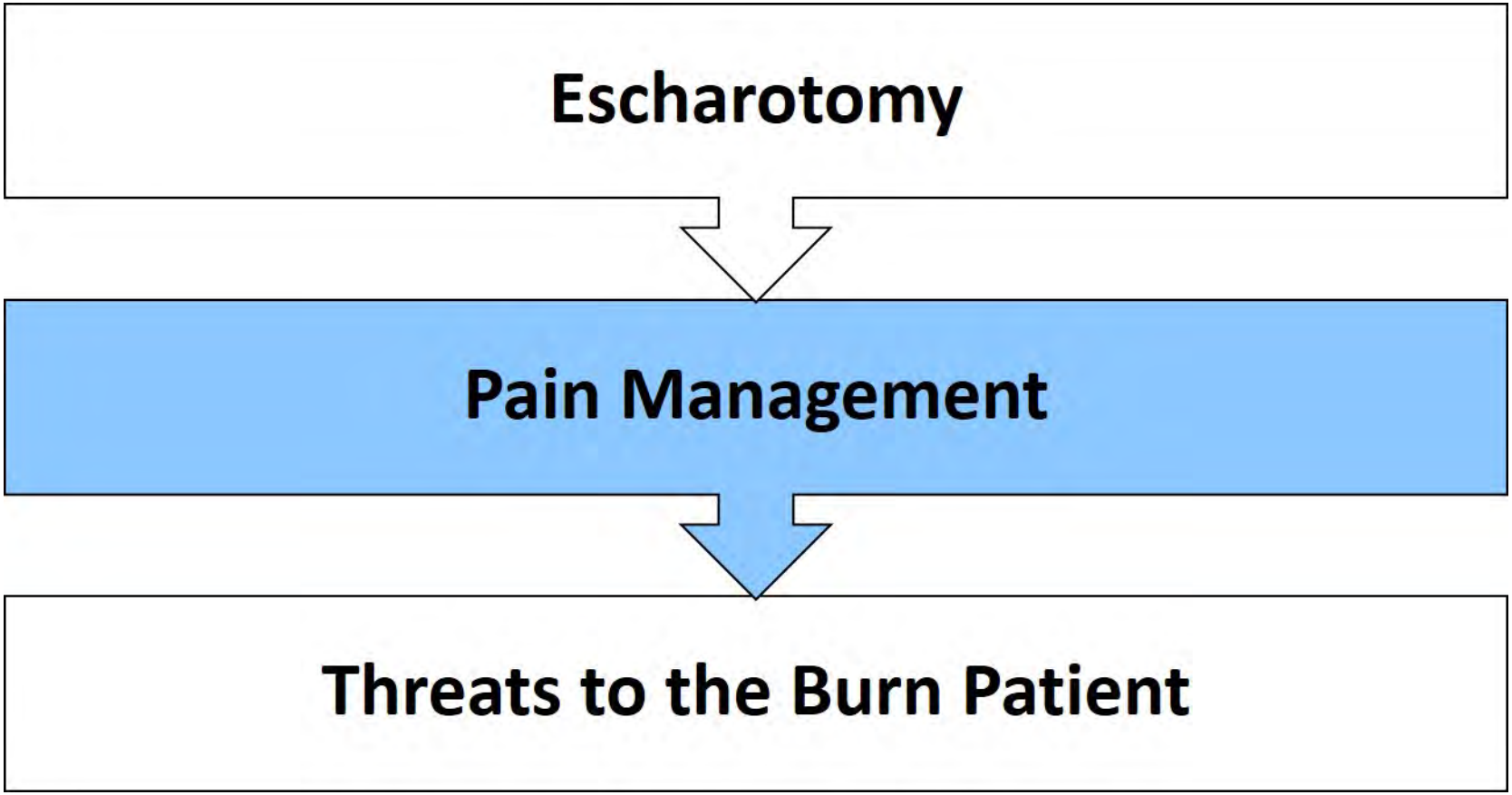

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Pain Management

- **Burn patients require large amounts of pain medication**

- Pain and analgesic treatment should be assessed hourly and adjusted to achieve adequate pain control

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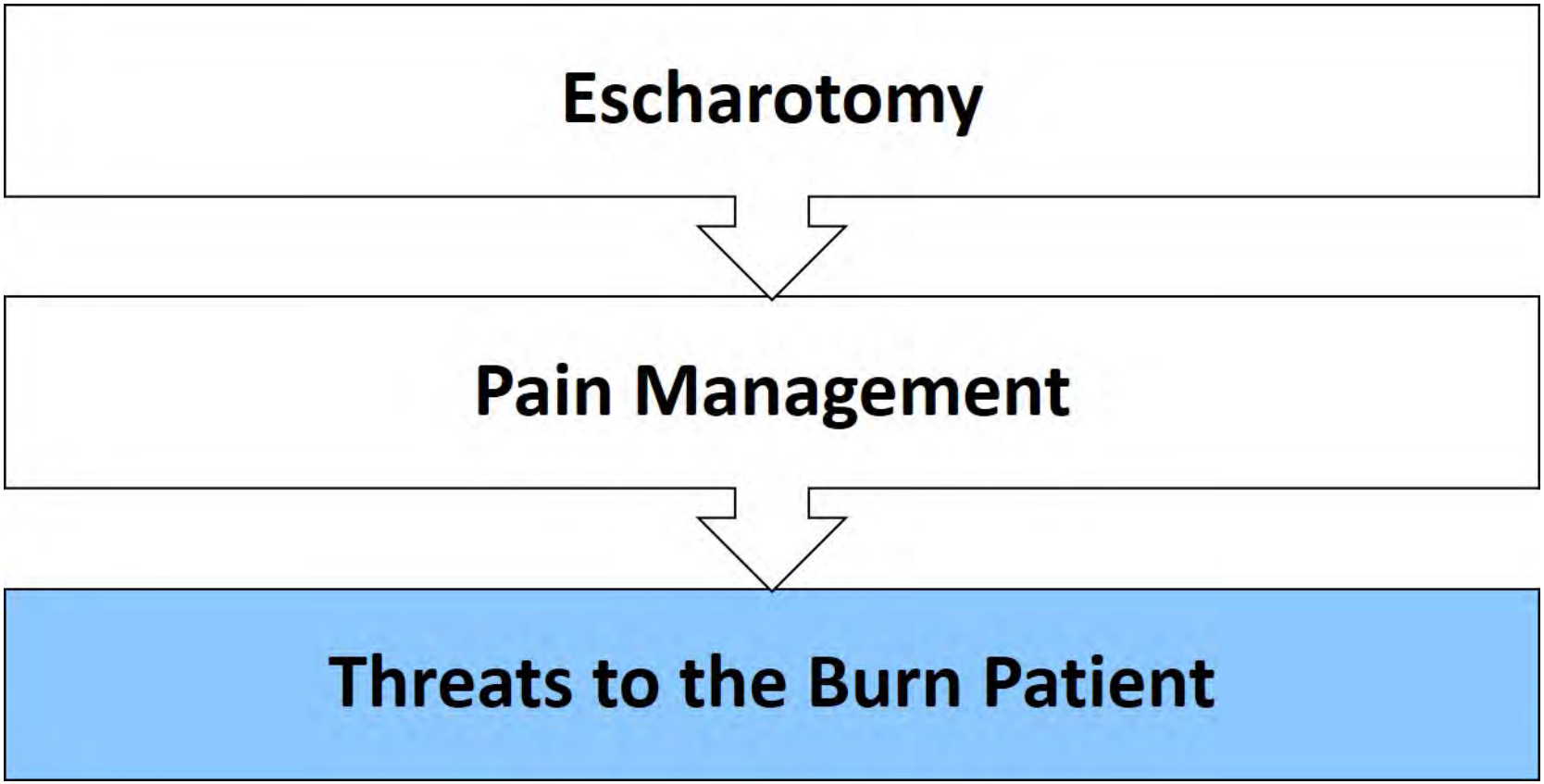
Objectives



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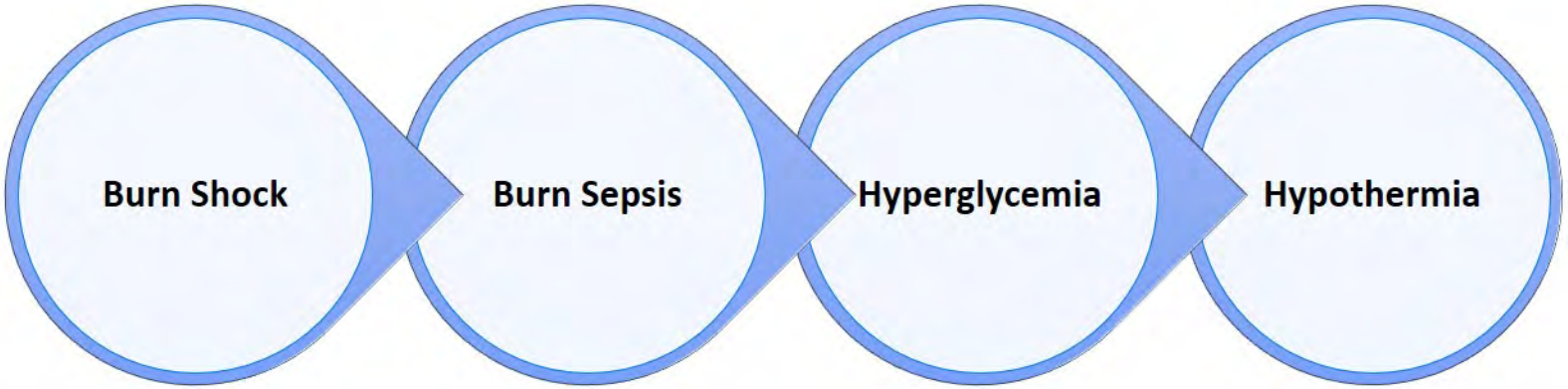
Specific Threats to Burn Patients



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Burn Shock

Burn Patients typically die from one of two causes

- "Burn shock" resulting in early deaths
- Multiple organ failure and sepsis leading to late deaths

Burn shock is multifactorial

- Hypovolemic distributive shock *plus*
- Mediator dependent reduction of cardiac output also contributes to the "burn shock" state, this is similar to a high output cardiogenic shock
  - This can be significant in patients with an underlying heart disease, such as congestive heart failure

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Burn Sepsis

Typically results in late burn deaths

"Burn sepsis" prevention is facilitated by the early removal of devitalized tissue (eschar)

- Typically try to have devitalized eschar removed within one week
- Removal of eschar relieves the patient of heavily colonized wounds that lead to recurrent episodes of bacteremia

Surface cultures can guide early antimicrobial therapy, however it is generally accepted to treat the septic burn patient with empiric broad spectrum antibiotics

Avoid the obvious critical care infections: line infections, VAE, etc…and identify and treat these infections early

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Hyperglycemia control

Considerations/Recommendations

- Stress hyperglycemia is common
- Treat with insulin drip or subcutaneous insulin as needed to achieve serum blood sugars of 100-180

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Hypothermia

Continuous monitor of patient temperature

Thermoregulatory control is dependent on inputs from the:

- Skin (the ultimate breathable insulating garment!)
- Central nervous system stimulation
- External interpretations of the environment by the brain

With large burns, the body is unable to use these thermoregulatory pathways resulting in hypothermia

Prevention is the best treatment

- Heat rooms to >80 degrees Fahrenheit
- Warm fluids
- Bair huggers, and external heating devices may be required to maintain normothermia

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Special Thanks to…

- **American Burn Association Advanced Burn Life Support Course 2016** for supplying images from the American Burn Association Advanced Burn Life Support Course 2016.
- **Regions Hospital Burn Center** for providing their expertise in the development of this education.
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THANK YOU

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