UC DAVIS HEALTH | MEDICAL CENTER

Griffith UNIVERSITY
Queensland, Australia

The TIER EFFECT Project

A US Dept of Defense Implementation Science Research Project to facilitate the system-wide implementation of changes to burns first aid practices and guidelines

SACRAMENTO FIRE DEPT

U.S. Department of Defense

What is the new practice?

Apply 20 minutes of cool running water to the burn within three hours of injury

Collectively or consecutively
Ideally as close to the time of injury as possible

Evidence: systematic review & meta-analysis findings

7 studies
6 observational studies
6 Australian/NZ

11,383 patients

50.8% patients
20CRW <3/24

49.2% patients
***Other**

Outcomes for patients who received 20CRW

Full thickness burn
63% reduced odds

Skin grafting
46% reduced odds

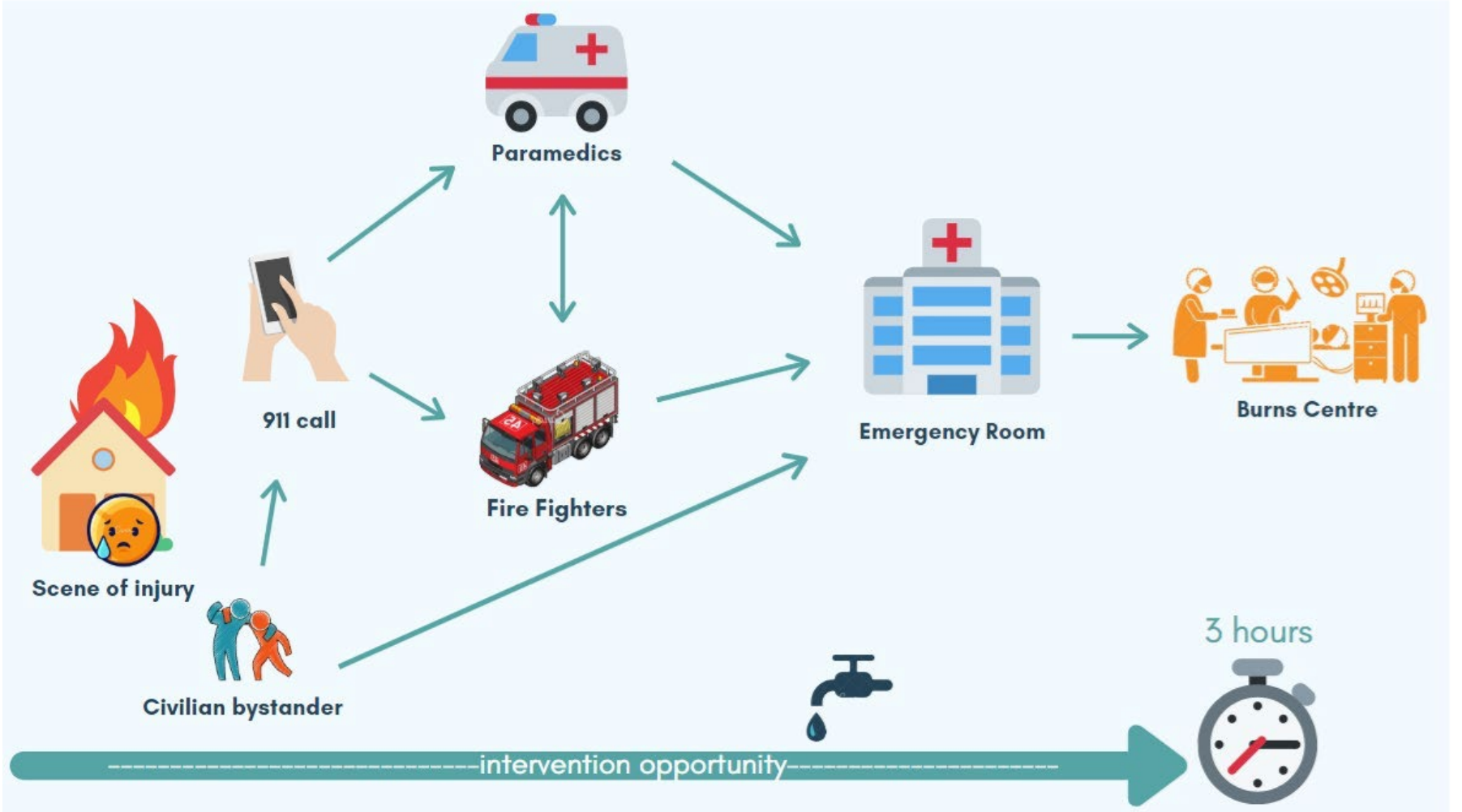
Wound healing
1-3 days earlier

Any surgery
36% reduced odds

Hospital admission
31% reduced odds

Mortality
No differences

System-wide multi-agency change to practices & guidelines



Benefits for patients

Full thickness burn
63% decreased odds

Wound healing
1-3 days earlier

Reduces scars & contractures

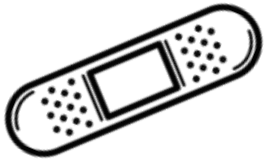
Less surgical risks

Less healthcare costs

Less separation from families

Benefits for hospitals

Wound healing
1-3 days earlier



Hospital admission
31% decreased odds

Skin grafting
46% decreased odds

Better patient outcomes

Reduces surgical demand

Reduced bed access pressure

Reduces hospital costs

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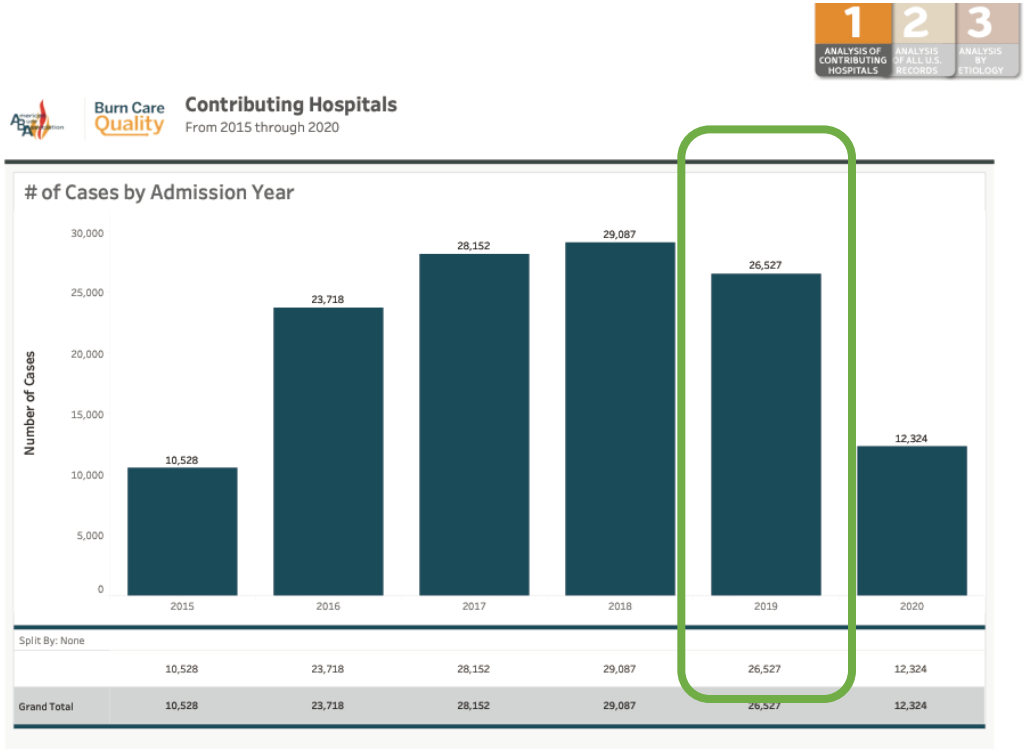
Potential burn centre admissions avoided
(based on ABA Burn registry data)

Hospital admission
31% decreased odds

ABA BCQP Report
2019: 26527 admissions

~ 8223 admissions potentially prevented



ABA BCQP data

What does evidence and data say about access to water?

Use of contaminated water for burn cooling documented in multiple publications regarding mass burn casualty situations

Bali Bombing 2002

Patients in swimming pools together whilst waiting transfer

Victorian Black Saturday fires 2009

Patients cooled themselves in dams that had livestock run-off

White Island Eruption 2020

Patients cooled with water stored on evacuation boats

Before EMS arrival*

What does evidence and data say about hypothermia and burns first aid?

Hypothermia in acutely presenting burn injuries to a regional burn service: incidence and impact on outcome
Lukusa M, Allorto N, Wall S. 2020

Hypothermia (T <36C)
103 (34%) patients

Predictors

Inhalation %TBSA

Age %TBSA

2016 – 2018
301 burn patients admitted to South African Burn unit

80% of burns in the US are <10%TBSA

These patients have a low risk of developing hypothermia


Thank You!

FIREGROUND RESUSCITATION

Robert B Dunne, MD FACEP, FAEMS

Medical Director

Detroit Fire Department

Detroit East Medical Control Authority

EAGLES 2023

QUESTIONS

- Why are fires killing people?
- Why is fireground resuscitation different?
- How can we save more people?
- How can we best protect our firefighters?

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EVOLUTION OF RESIDENTIAL FIRE DYNAMICS

Transition from legacy to modern materials changes fire dynamics and fire smoke[1]

Natural (legacy)

Synthetic (modern)

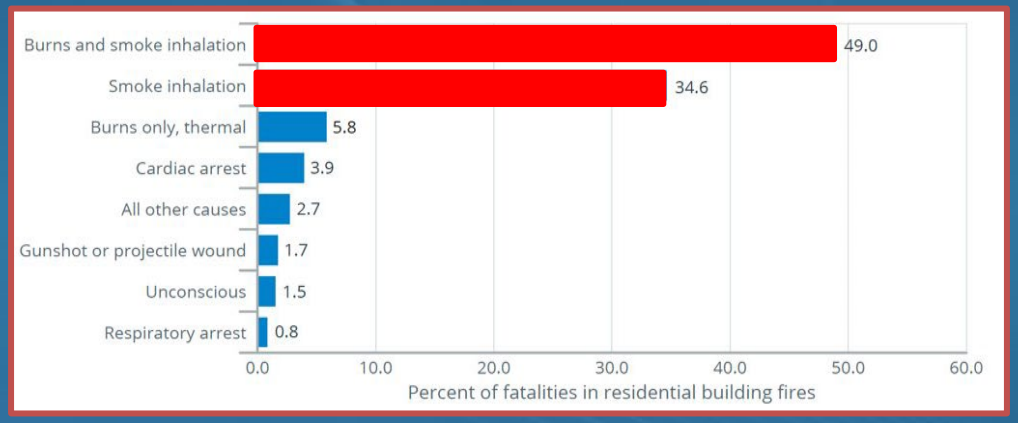
200x more smoke and 8x faster burning rate than 50 years ago[2]

Fire Department

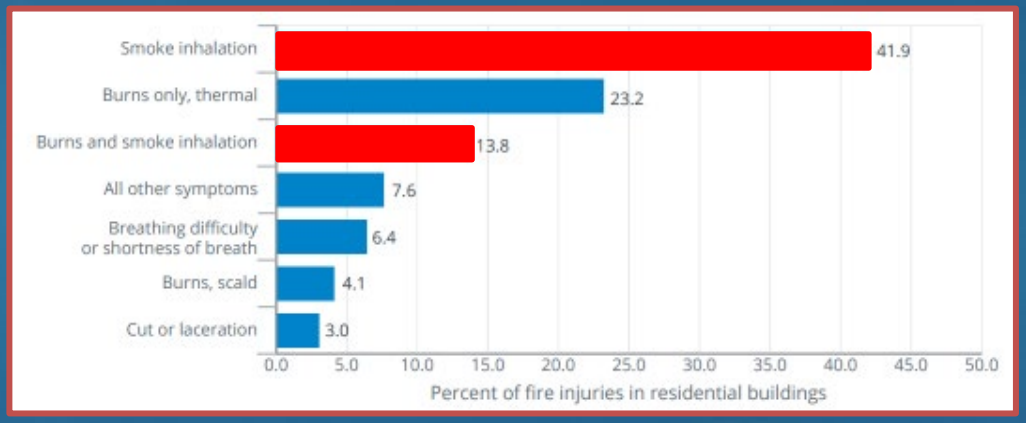
1. *New comparison of natural and synthetic home furnishings* (2020, September 30). UL's FSRI – Fire Safety Research Institute. https://fsri.org/n [illegible] home-furnishings. 2. *Modern homes burn 8 times faster than 50 years ago.* (2013, September 13). CBC. https://www.cbc.ca/news/canada/windsor/modern-ho[illegible]

CIVILIAN FIRE FATALITIES & INJURIES IN RESIDENTIAL BUILDINGS BY PRIMARY SYMPTOM (2017-2019)[1]

Fatalities



Injuries



The most common cause of death in fires is the *inhalation of noxious gases rather than thermal injury*[2]

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1. (n.d.). U.S. Fire Administration. https://www.usfa.fema.gov/downloads/pdf/statistics/v21i4.pdf 2. Jone… smoke inhalation: Cyanide poisoning in fire victims. *The American Journal of Emergency Medicine, 5*(4), 3…

HAZARDS (NO ANTIDOTE YET)

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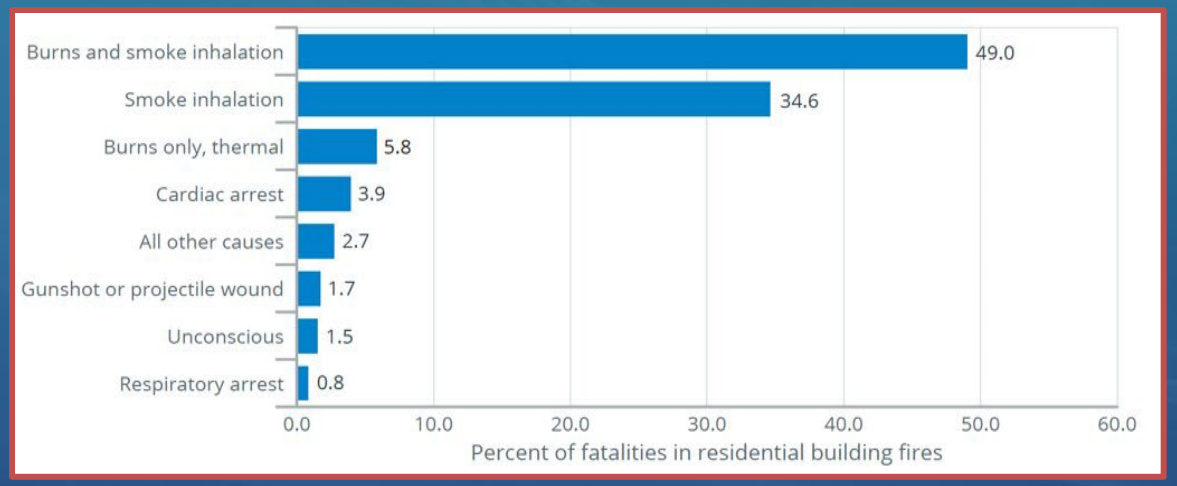
CITY OF DETROIT

HAZARDS – WHAT CAN WE DO TO IMPROVE OUTCOMES?

- Airway Burns
- Carbon Monoxide (CO)
- Cyanide (CN)



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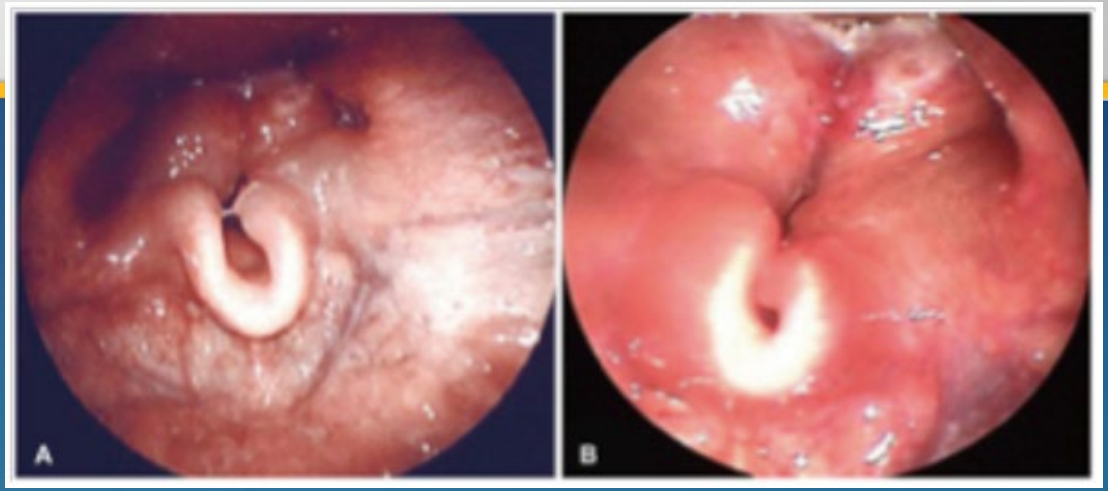
AIRWAY

- Expect difficulty
- Time is not your friend
- Bougie, Video if available, prep for surgical airway
- Goal is cuffed tube in Trachea



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CARBON MONOXIDE MONITORING

- In the studies conducted to submit the device for FDA clearance, the CO-oximeter has exhibited accurate readings for COHb values between 0 and 40%.

Cone DC, MacMillan DS, Van Gelder C, et al. Noninva ve fireground assessment of carboxyhemoglobin levels in firefigh ers. Prehosp Emerg Care. 2005;9:8—13.

THE TOXIC TWINS- PATHOPHYSIOLOGY

Smoke Inhalation

Produced from incomplete combustion of *nitrogen-containing materials*

Difficult to detect

Hydrogen Cyanide (CN)

Neurotoxicity

Inhibition of Cellular Respiration

Carbon Monoxide (CO)

Carboxyhemoglobin formation

Inhibition of Cellular Respiration

Produced from incomplete combustion of hydrocarbons or fuels

Easy to detect

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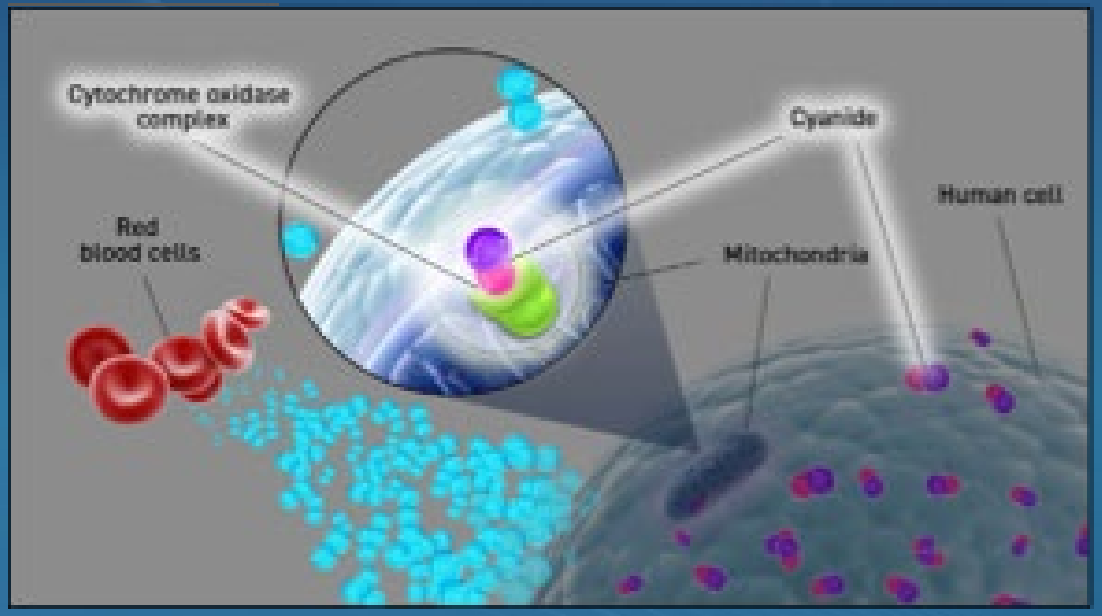
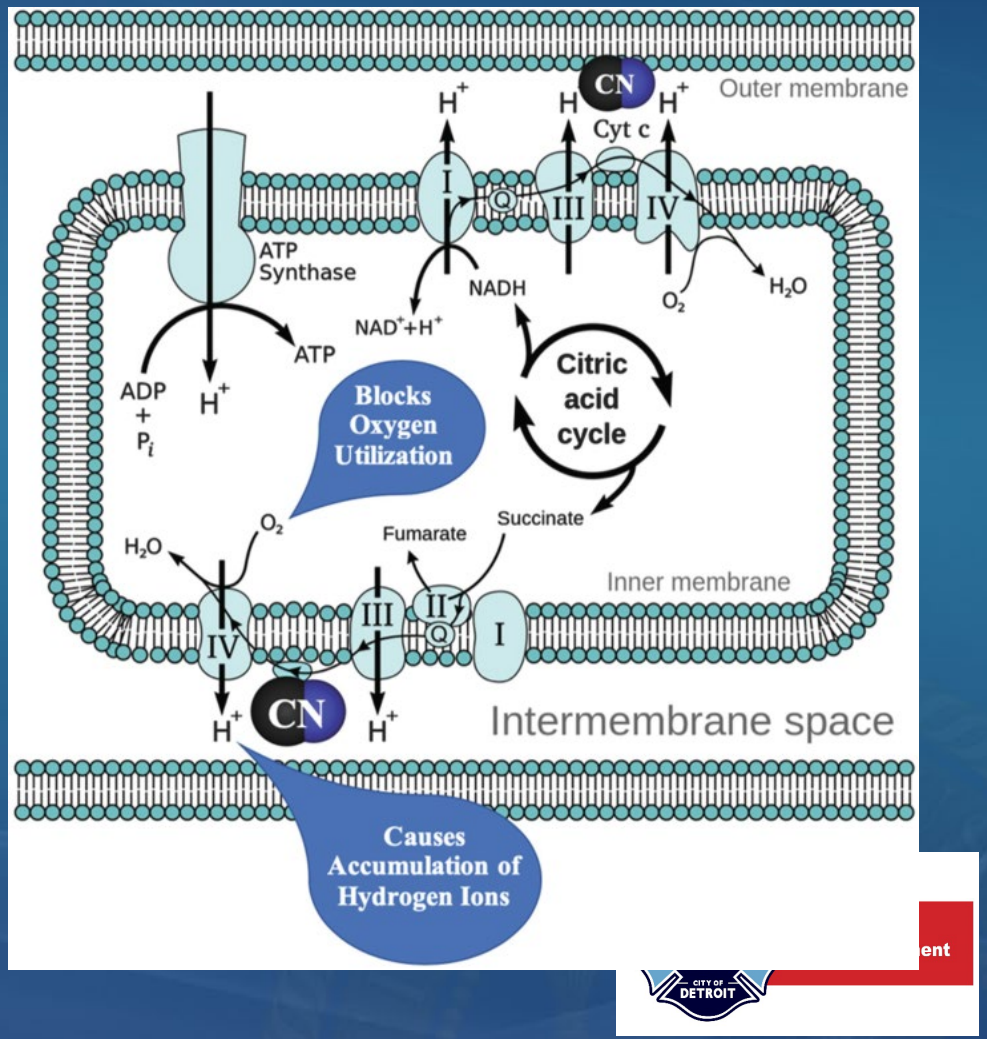
1. Hoffman, R. S., Nelson, L. S., Goldfrank, L. R., Howland, M. A., Lewin, N. A., & Smith, S. W. (2019). *Goldfrank's toxicologic emergencies* (11th ed.). McGraw [illegible] ang, L., & Gladwin, M. T. (2015). 2. Shining a light on carbon monoxide poisoning. *American Journal of Respiratory and Critical Care Medicine, 192*(10), 11[illegible] ed.

WHY IS CYANIDE BAD?





THE TOXIC TWINS- MANAGEMENT

Cyanide Poisoning by fire smoke inhalation: A European Expert Consensus

Cyanide Poisoning by Fire Smoke Inhalation Prehospital Algorithm

Severe Poisoning	Intermediate Poisoning	No neurological and/or hemodynamic symptoms
GCS ≤ 9	GCS 10-13 and/or abnormal ABC	GCS ≥ 14
Hydroxocobalamin 5g IV*	Hydroxocobalamin 5g IV	Monitoring

GCS= Glasgow Coma Scale, **ABC**= airway, breathing, circulation, **IV**= intravenous, **g**= gram, **O2**= oxygen

*If cardiac arrest, administer 10 grams hydroxocobalamin IV

Adapted from: Anseeuw, K., Delvau, N., Burillo-Putze, G., De Iaco, F., Geldner, G., Holmström, P. et al. (2013). Cyanide poisoning by fire smoke inhalation. *European Journal of Emergency Medicine, 20*(1), 2-5. http://doi.org/10.1097/MEJ.0b013e32835f170b

IDENTIFY, ANALYZE, DEVELOP, IMPLEMENT

- Cuffed Tube in Trachea (ASAP)
- Monitor CO
- 100% Oxygen
- CN Antidote (Hydroxocobalamin)
  - Need on Front line
  - Eagle Survey – Most large systems have
- Review your data

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