

# Burn Resuscitation and Management for Early Responders

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# Overview



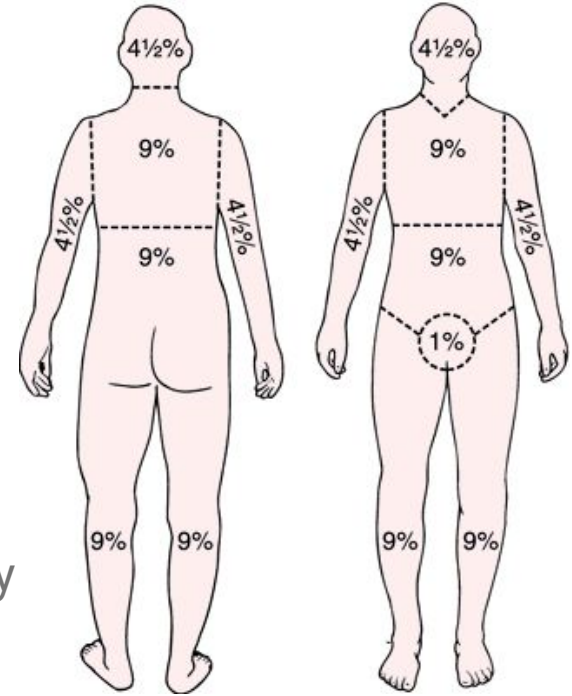
# VUMC Burn ICU

- Vanderbilt Burn ICU
  - Level 1 Burn Center
  - 630 new admissions per year
    - Majority transferred from E.R.
  - Primary Contact: Dr Avinash Kumar



# Problem Statement

- Current System: Wallace Rules of Nine
  - Adjust for age and BMI
- Problems:
  - Overestimation of burn percentage
  - Overburden Burn centers with patients
- Goal: Develop system to rapidly and accurately

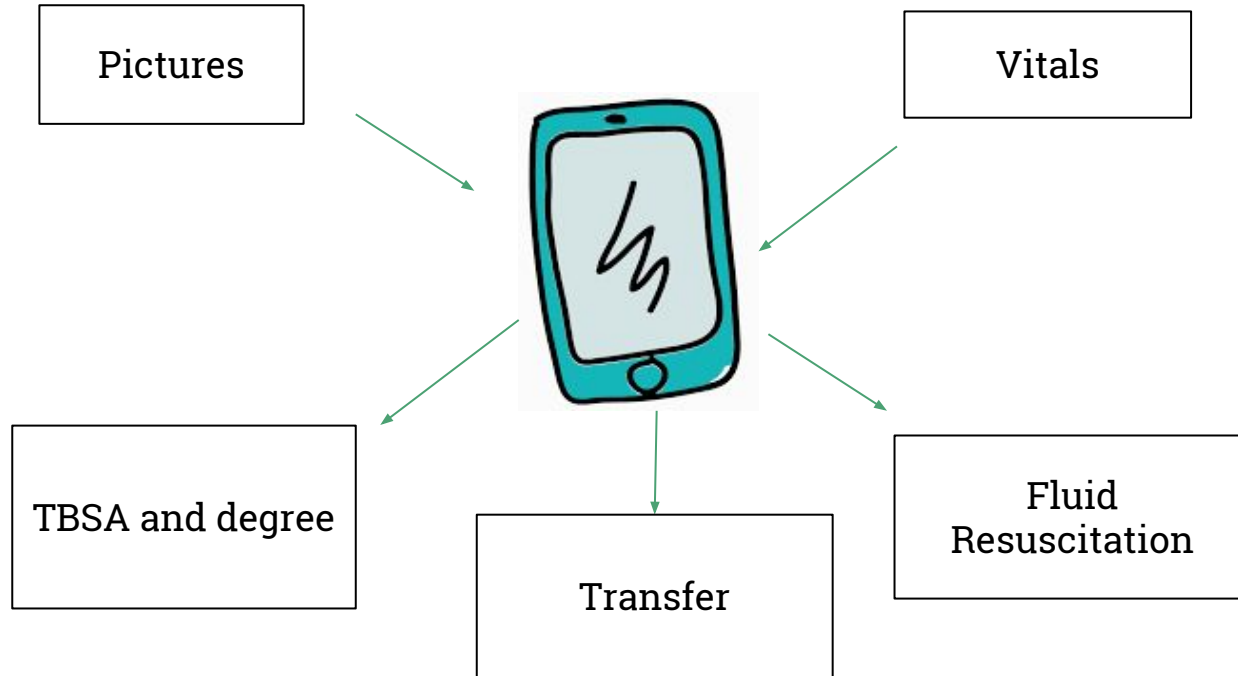


# Needs Assessment

1. Infrastructure compatibility
2. Safety
3. Patient Efficacy
4. Performance Capabilities
5. Cost Efficacy



# Our Solution



# Decision Flowchart



Courtesy of the  
**American Burn Association**  
**Advanced Burn Life Support (ABLS)**  
 Learn more about the ABA and ABLs at [www.ameriburn.org](http://www.ameriburn.org)

## Burn Center Referral Criteria

A burn center may treat adults, children, or both.

Burn injuries that should be referred to a burn center include:

1. Partial thickness burns greater than 10% total body surface area (TBSA).
2. Burns that involve the face, hands, feet, genitalia, perineum, or major joints.
3. Third degree burns in any age group.
4. Electrical burns, including lightning injury.
5. Chemical burns.
6. Inhalation injury.
7. Burn injury in patients with preexisting medical disorders that could complicate management, prolong recovery, or affect mortality.
8. Any patient with burns and concomitant trauma (such as fractures) in which the burn injury poses the greatest risk of morbidity or mortality. In such cases, if the trauma poses the greater immediate risk, the patient may be initially stabilized in a trauma center before being transferred to a burn unit. Physician judgment will be necessary in such situations and should be in concert with the regional medical control plan and triage protocols.
9. Burned children in hospitals without qualified personnel or equipment for the care of children.
10. Burn injury in patients who will require special social, emotional, or rehabilitative intervention.

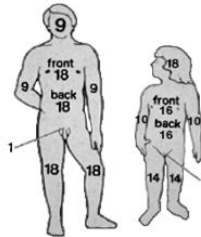
## Severity Determination

**First Degree (Partial Thickness)**  
 Superficial, red, sometimes painful.

**Second Degree (Partial Thickness)**  
 Skin may be red, blistered, swollen. Very painful.

**Third Degree (Full Thickness)**  
 Whitish, charred or translucent, no pin prick sensation in burned area.

## Percentage Total Body Surface Area (TBSA)



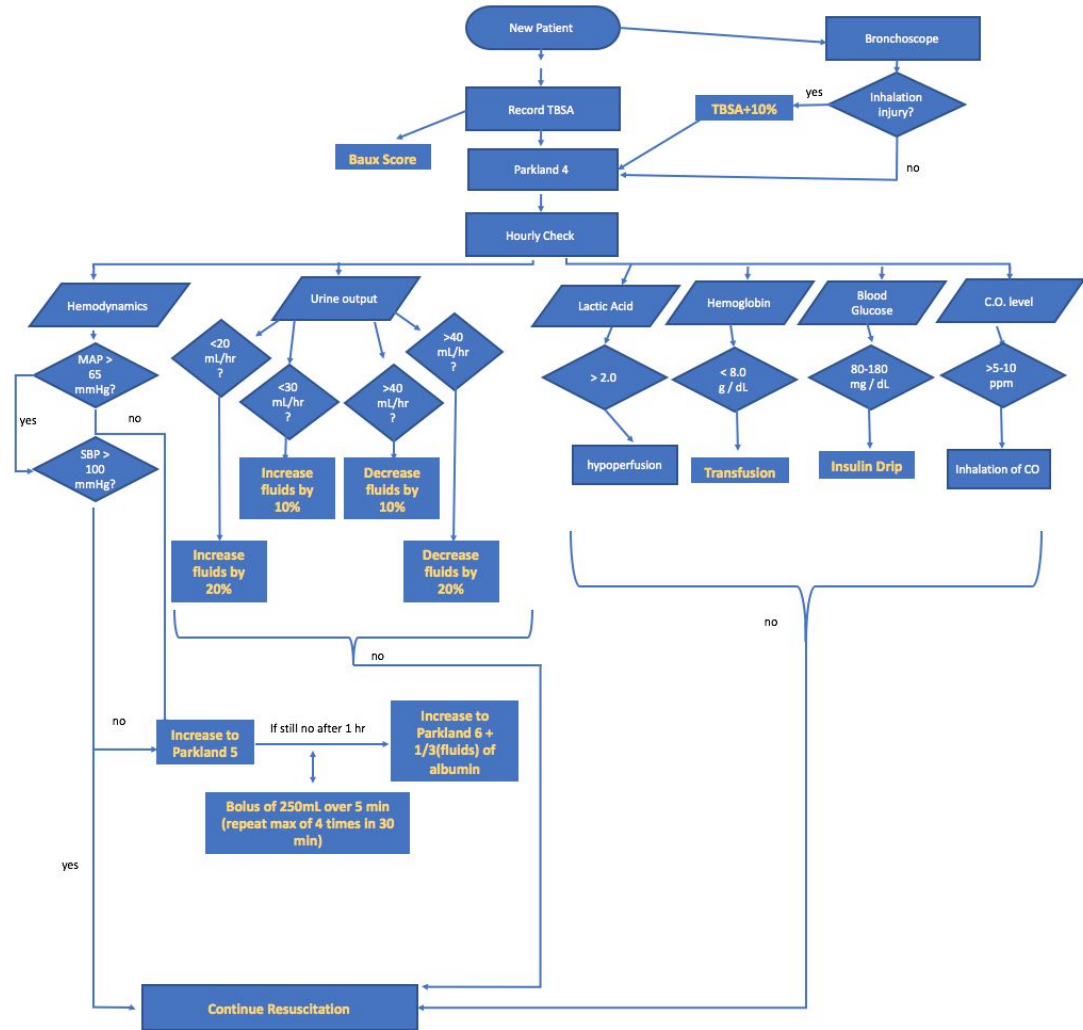
Excerpted from *Guidelines for the Operation of Burn Centers* (pp. 79-86), *Resources for Optimal Care of the Injured Patient 2006*, Committee on Trauma, American College of Surgeons



# Fluid Resuscitation Flowchart

## Parkland 4 Formula

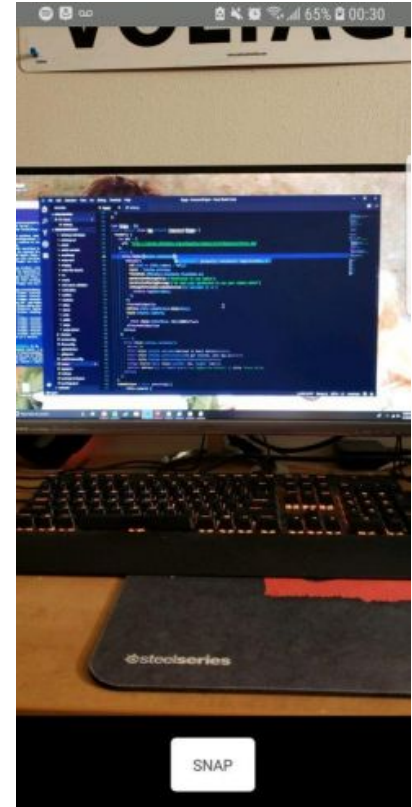
Volume of Lactated Ringers Solution =  $(4\text{mL}) * (\text{TBSA } \%) * (\text{weight kg})$





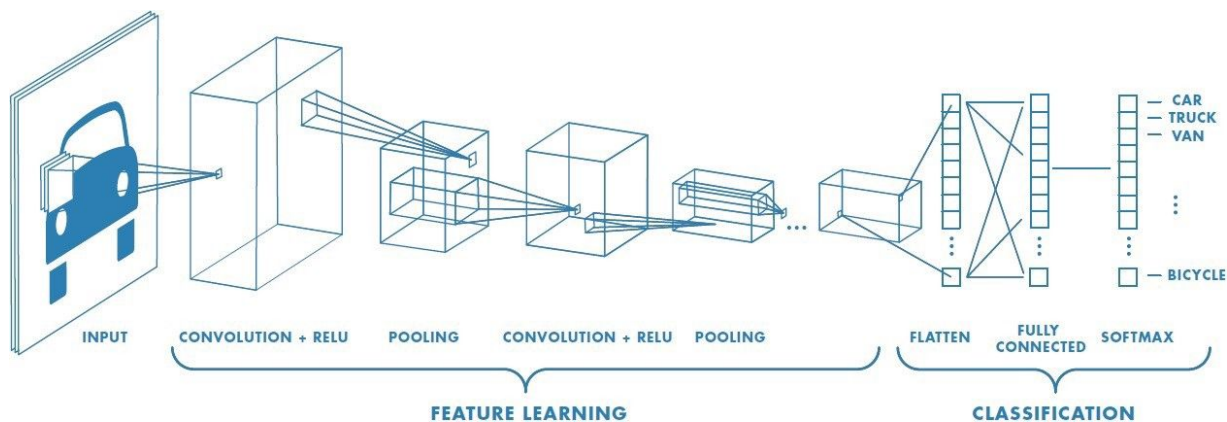
# Application Prototype

- Current Prototype uses React Native: Javascript, HTML, CSS
  - Efficient UI design
  - Has a large development community
    - React-native-tensorflow
    - React-native-camera
- Warning: Image of a burn on next slide



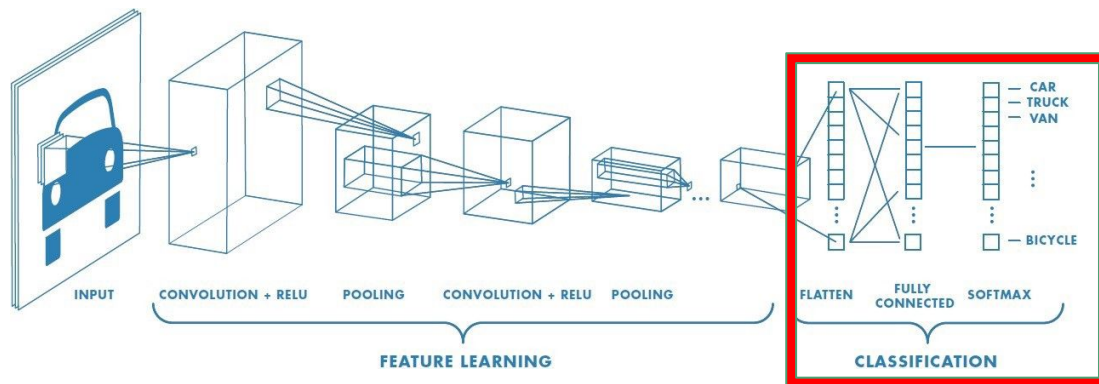
# Burn Degree Neural Network

- Convolutional Neural Network
  - Image classification neural network



# TBSA Neural Network

- Convolutional Convolutional Neural Network
  - Replaces dense layers with convolutional layers to contain computations to one run through
  - Classifies 50x50 pixel sections of larger images
  - Outputs segmented image based on 50x50 pixel classifications



# Data Security

- Must be HIPAA Compliant
  - Limit sharing of Protected Health Information (PHI)
  - Have agreements with business associates to ensure safety
  - Implement procedures that limit entities that can access PHI
- Safeguards
  - Administrative
    - Access control/training
  - Physical
    - Medical device/media control
  - Technical
    - Health data protection

# Sponsor Meeting 1/11/2019

- Review Flow Chart
- Determine Critical Resuscitation Points
- Limit Scope of Users
- Update Application Performance Requirements
- Increase Size of Data Set
- Discuss In-Clinic Testing