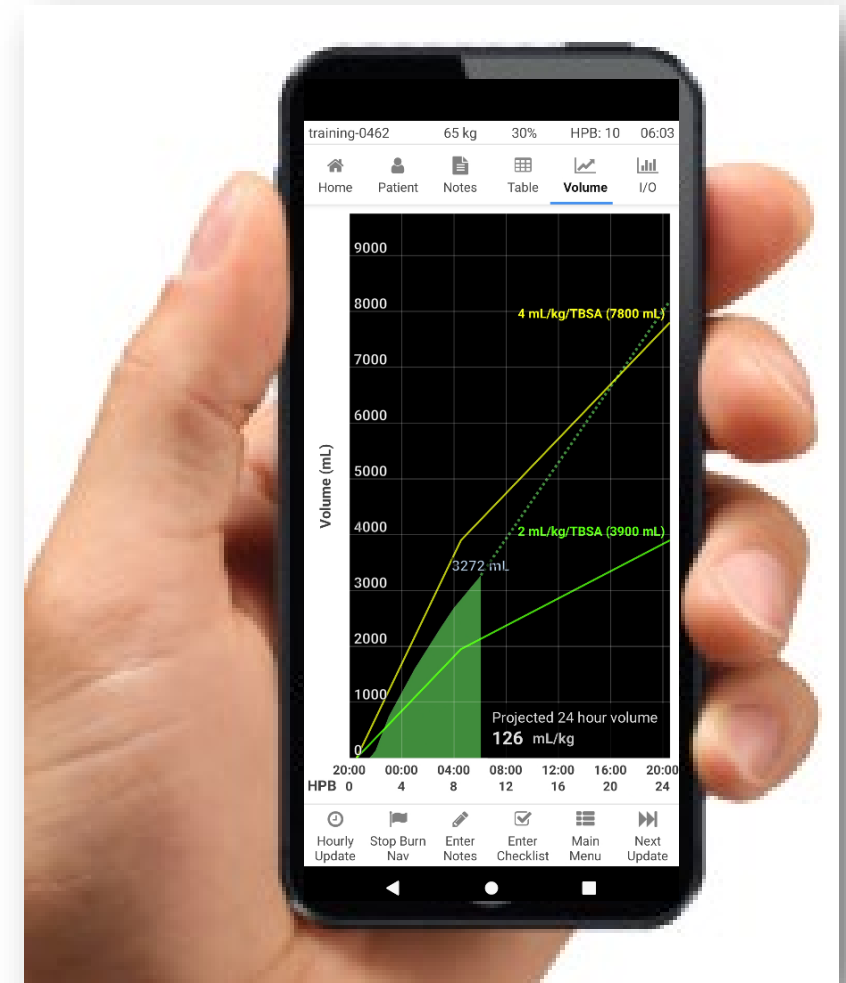


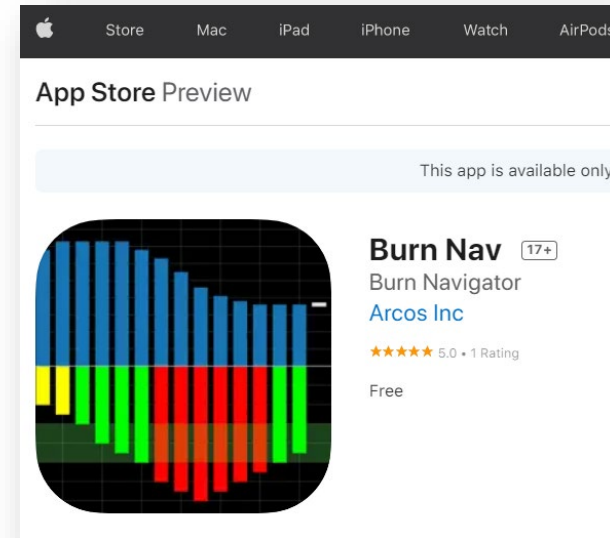
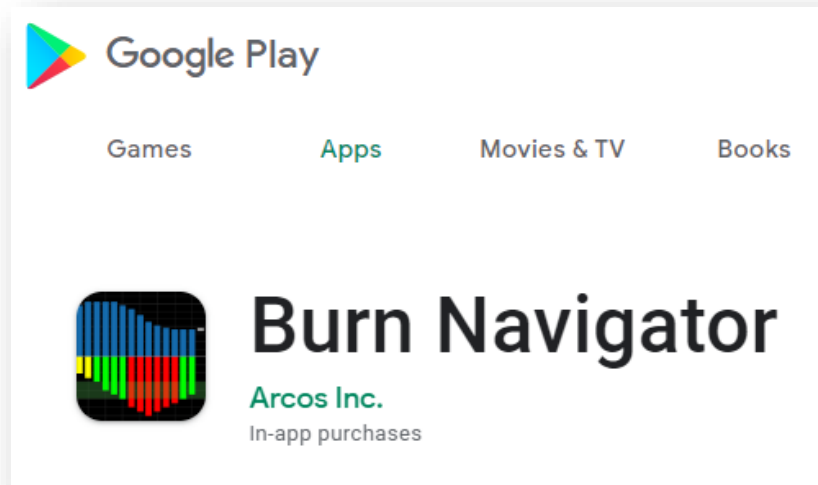


# Burn Navigator® Phone App Education

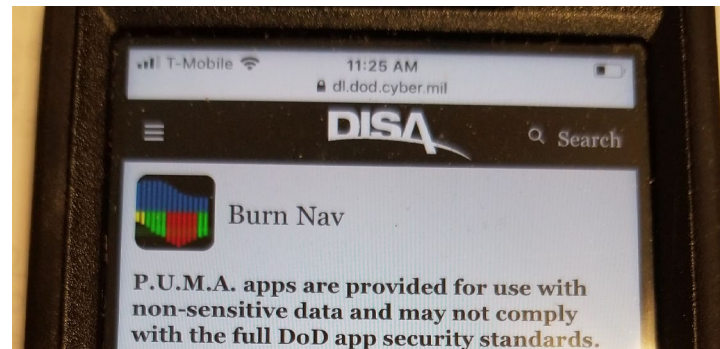
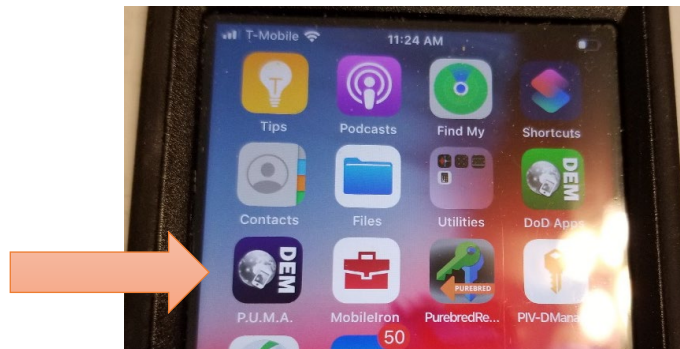
Mar 2023



# Download on Android Phones or iPhones



Also available on DISA P.U.M.A. app store



- Free for training, license/in-app purchase for clinical use

# Part 1: Clinical Background

# Clinical Goal of Burn Fluid Resuscitation

- Maintain adequate tissue perfusion at the least physiological cost of fluid<sup>1</sup>
  - Over-resuscitation complications
    - edema, increased risk of compartment syndromes, ARDS, mortality
  - Under-resuscitation complications
    - acute kidney injury, burn shock, organ failure, mortality

<sup>1</sup> Rizzo, J., et al. "The Battle of the Titans—Comparing Resuscitation Between Five Major Burn Centers Using the Burn Navigator." Journal of Burn Care & Research (2022) <https://doi.org/10.1093/jbcr/irac095>

# Clinical Goal of Burn Fluid Resuscitation

- Urine output is a good, but sometimes flawed, surrogate of tissue perfusion
  - If UO is high, reduce IV fluid rate
  - If UO is low, increase IV fluid rate
- UO may be flawed or skewed due to ESRD, renal insult, ethanol/alcohol abuse, meth/narcotic use, baseline diuretic, ...
- Consider Hb/Hct, lactate, base excess, HR, BP, SVV in addition to UO

# Burn Navigator

- implements your UO-based protocol for burn fluid resuscitations
- provides graphs to visualize resuscitations
- facilitates team communication
- provides fluid projections, patient safety alerts and prompts to escalate to senior providers
- provides reports for M&M, QI and CSV files for research

training-6528 83 kg 53% HPB: 8 11:01

< Fluid Update

From: 09:59 To: 11:00 61 minutes

Fluids In/Out

Urine Output 5 mL

☐ UO Unknown 0.1 mL/kg/hr

Primary Fluid was Lactated Ringer's

Infusion rate 560 mL/hr

Infusion volume 569 mL

Additional Fluids In

Total additional fluids 0 mL

Select fluid...

Recommendation

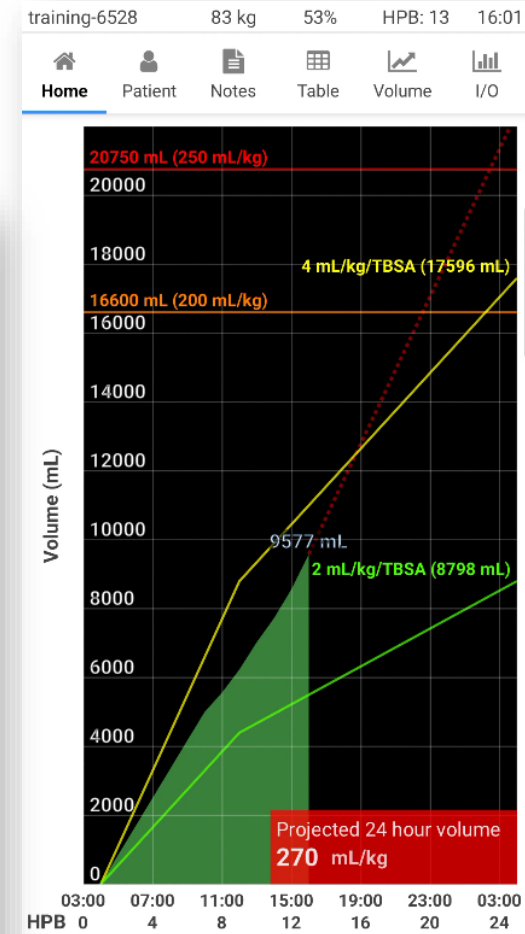
Primary fluid Lactated Ringer's

Previous rate 560 mL/hr

Recommended rate ↑ 20% 670 mL/hr

Enter new rate: ↑ 20% 670 mL/hr

Submit Update



## Alert!

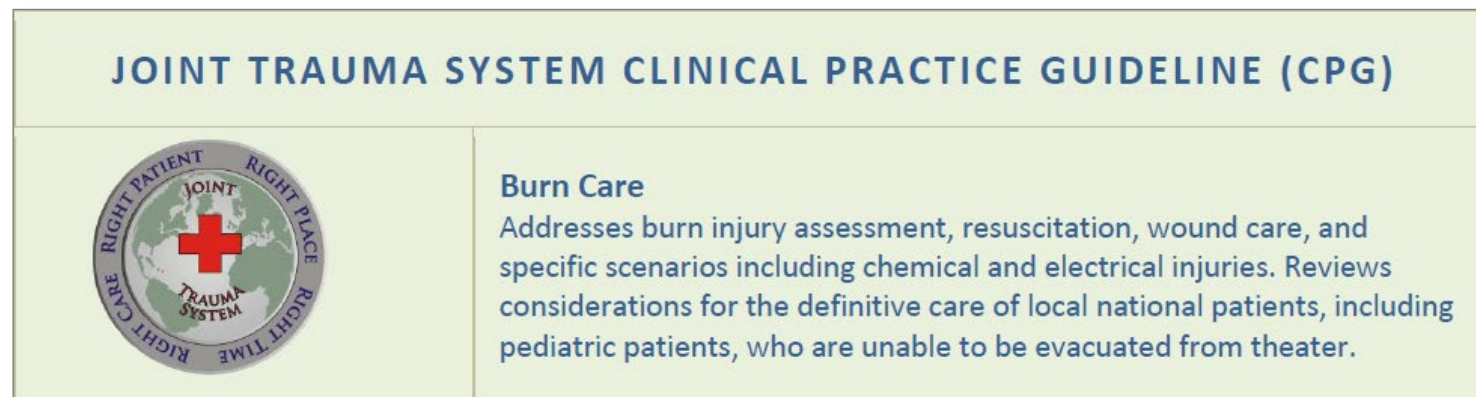
24 hour projection is 211 ml/kg.  
Review the Volume and I/O graphs.  
Consult with attending physician.

Consider albumin or other intervention.

OK

# Burn Navigator

- Was invented at the U.S. Army Institute of Surgical Research (USAISR)
- First prototype was used clinically at USAISR in 2007
- Has been used with [over a thousand severe burn patients](#) at USAISR, Parkland, Arizona Burn Center, Harborview Medical Center (Seattle), UTMB-Galveston, Vanderbilt, University of Alabama Birmingham and international locations
- Is recommended by the U.S. Department of Defense Joint Trauma System CPG for Burn Care since 2016



# Multi-Center Observational Data<sup>1</sup>

- 5 U.S. Burn Centers, 285 patients
- “Followed Burn Navigator” (FBN) if 83%+ of recommendations accepted
- FBN: average 4.07 mL/kg/TBSA and 151.48 mL/kg of primary fluids given in first 24 hours
- FBN: significant decrease in incidence of burn shock
- Early initiation of BN resulted in lower overall fluid volumes

<sup>1</sup> Rizzo JA, Liu NT, Coates EC et al. Initial results of the American Burn Association Observational Multicenter Evaluation on the Effectiveness of the Burn Navigator. *J Burn Care Res.* 43(3) May/June 2022, p 728-734.

<https://doi.org/10.1093/jbcr/irab182>



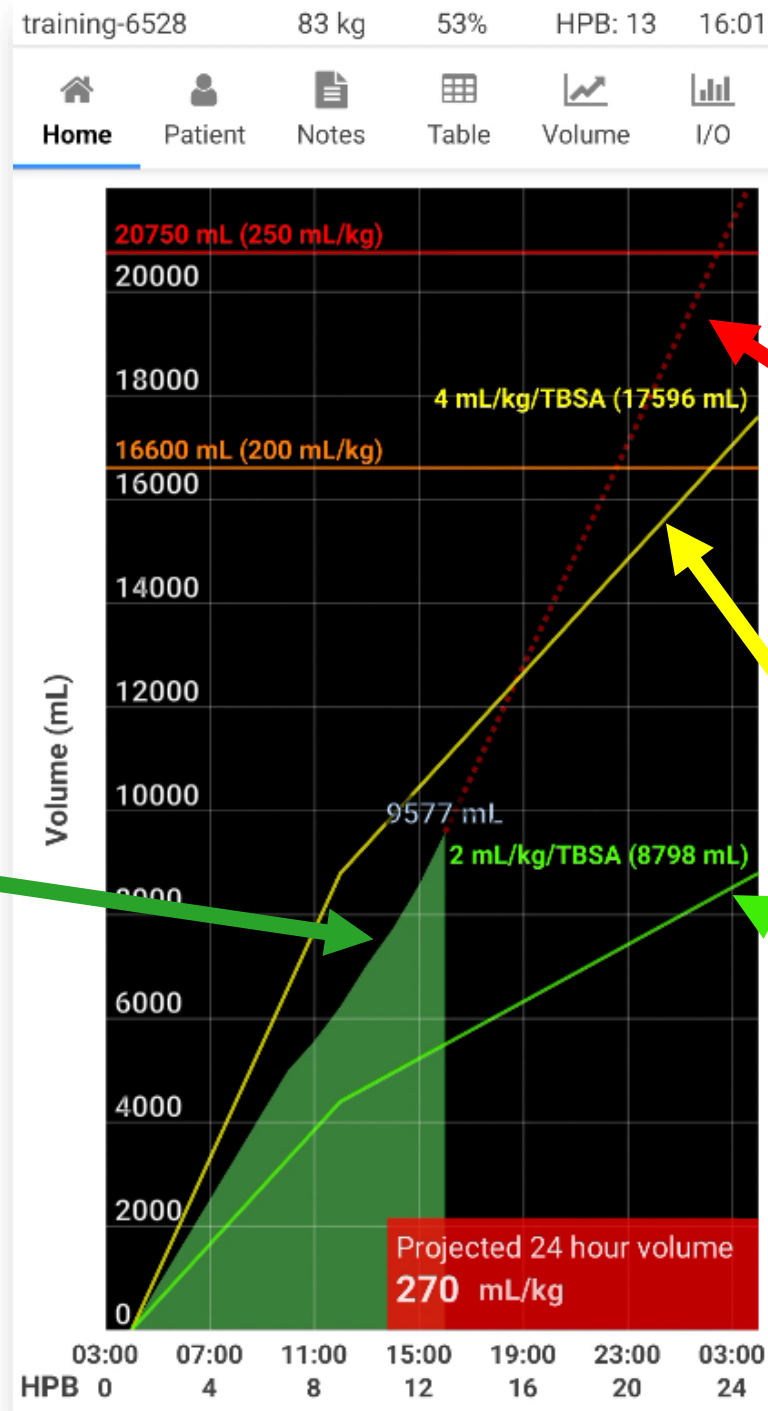
## Indications For Use

- Burn Navigator is indicated for use in the care of
  - adult patients with **20% or more** Total Body Surface Area (TBSA) burned, or
  - pediatric patients, **24 months old or older**, weighing at least 10 kg with **15% or more TBSA** burned,
  - as a fluid resuscitation monitor and calculator for hourly fluid recommendations.
- Burn Navigator is intended to be used for burn patients of all ages, weights and co-morbidities as a **fluid resuscitation monitor**.
- Burn Navigator is intended to be initiated within 24 hours of the burn incident and to be used no longer than 72 hours post burn.

# Volume Graph

**Green Mountain**  
Cumulative resuscitation fluids

Current cumulative volume is labeled at the “peak” (9577 mL in this example)



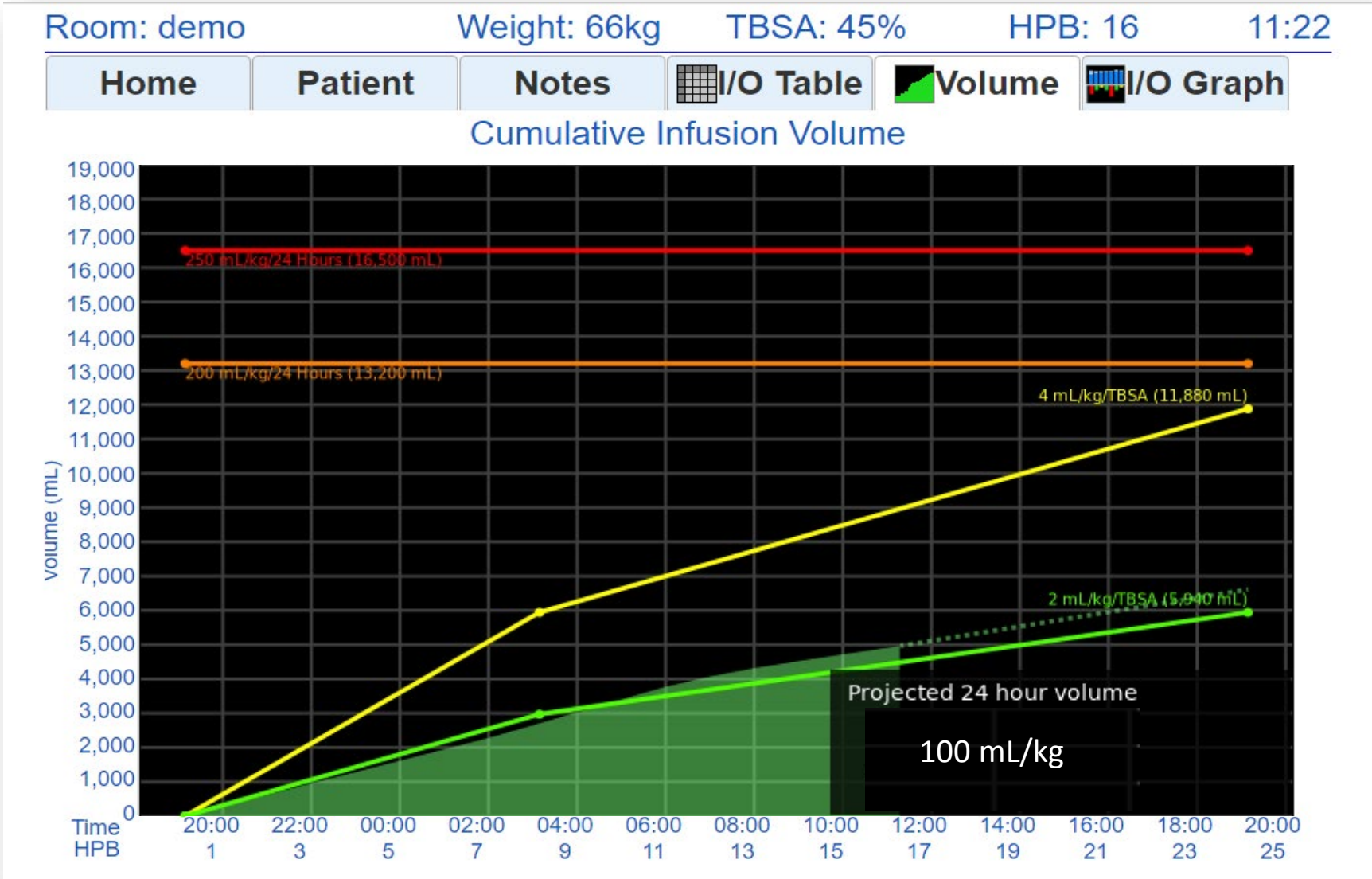
**Ivy Index**  
Higher risk of ACS & mortality

**Projection Line**  
Where fluids will be at 24 hours with current rate (see also bottom right box)

**Guidelines**  
Parkland 4mL/kg/TBSA (Yellow)  
Modified Brooke (Green)

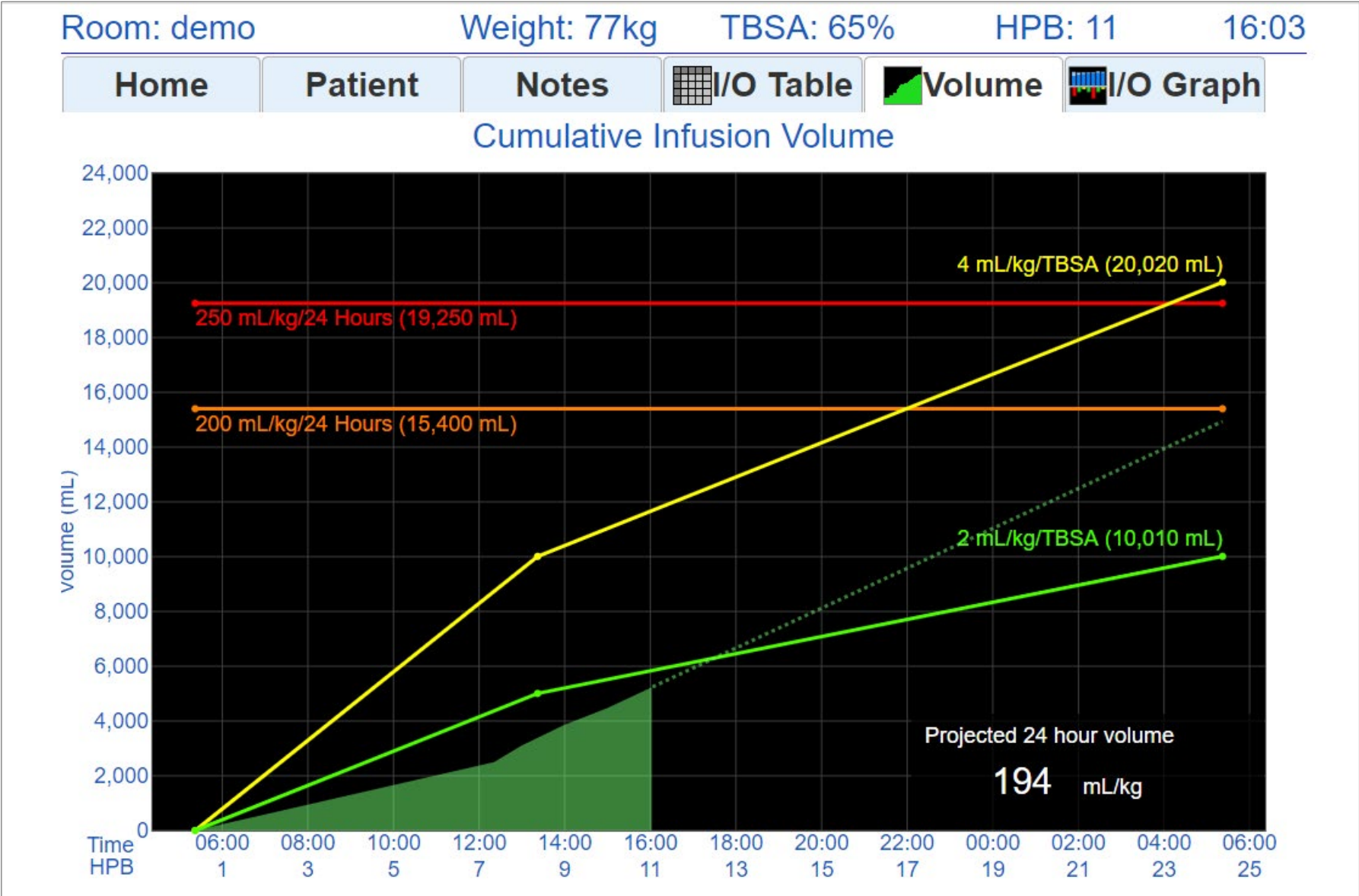
# Resuscitation Example

If UO/tissue perfusion is adequate, this volume of fluids is sufficient



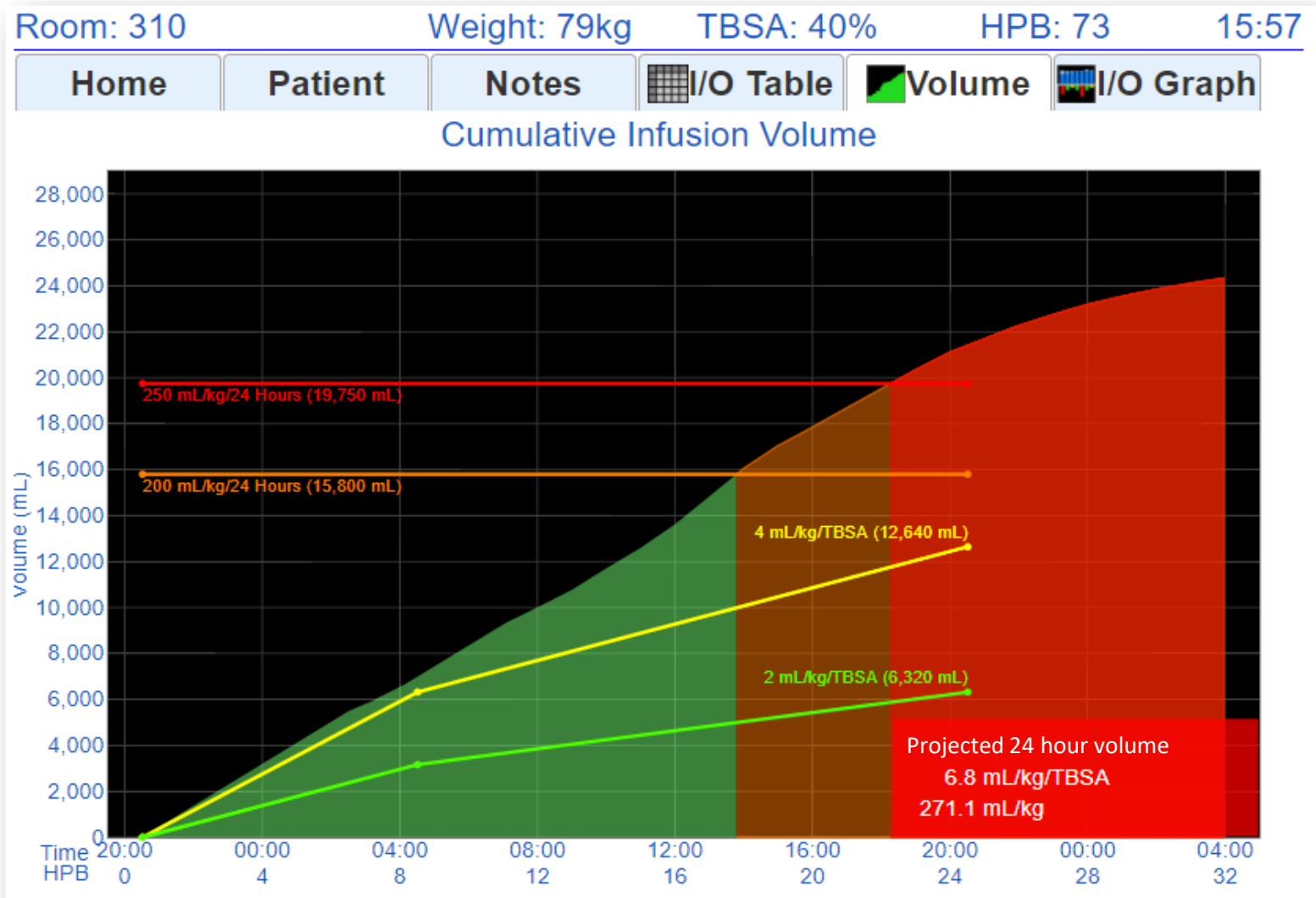
# Resuscitation Example

Likely under-resuscitated pre-hospital  
Resuscitation more on track now



Resuscitation Example (Likely) Over-resuscitated

*UO did not respond to increasing IV fluid rates, IV fluid was not turned down soon enough*

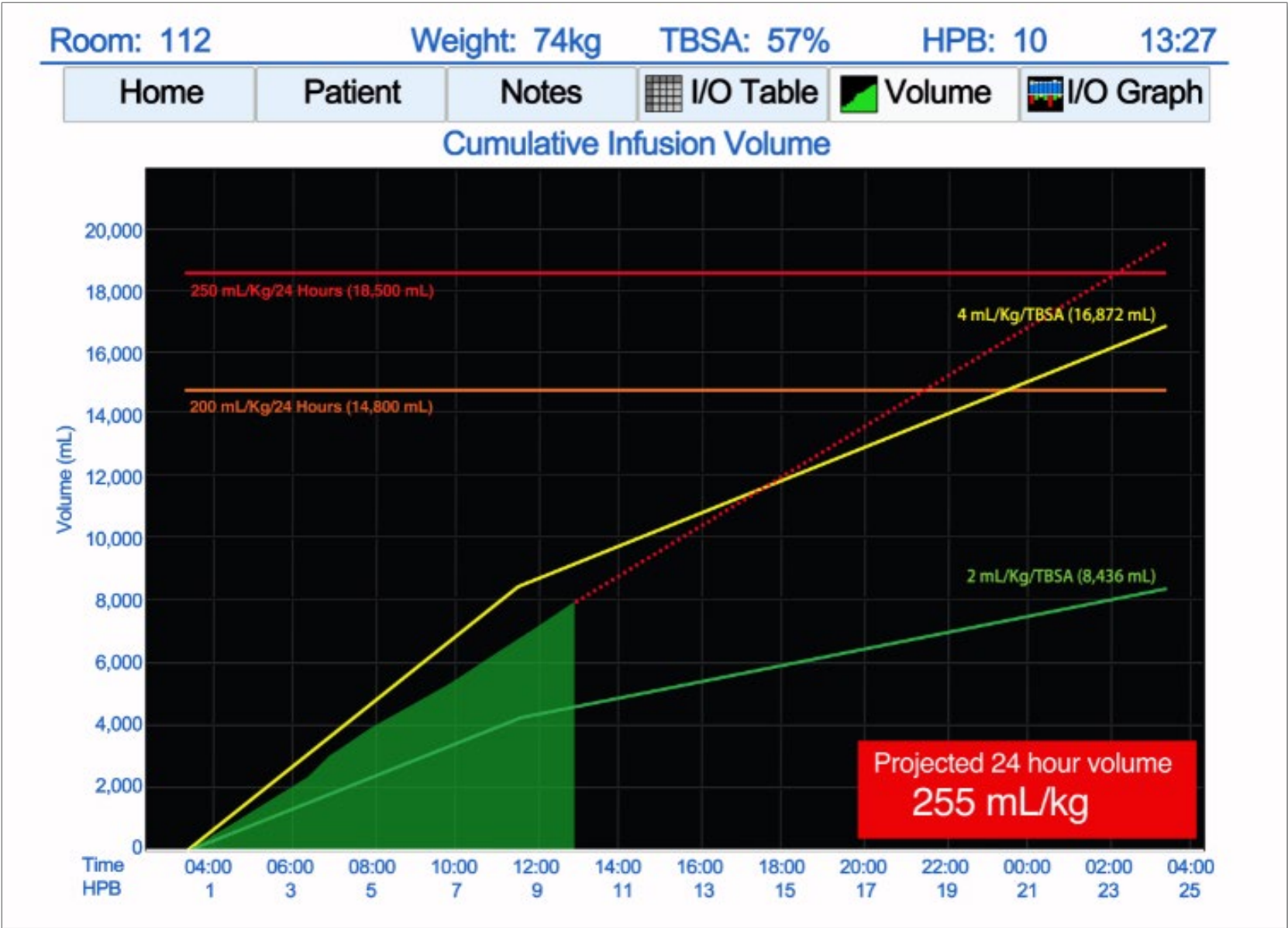


# Resuscitation Example

Resuscitation going well so far, but projection exceeds Ivy Index

Projection shows by HPB 10

- Consult attending physician if projection exceeds Ivy Index (250mL/kg)

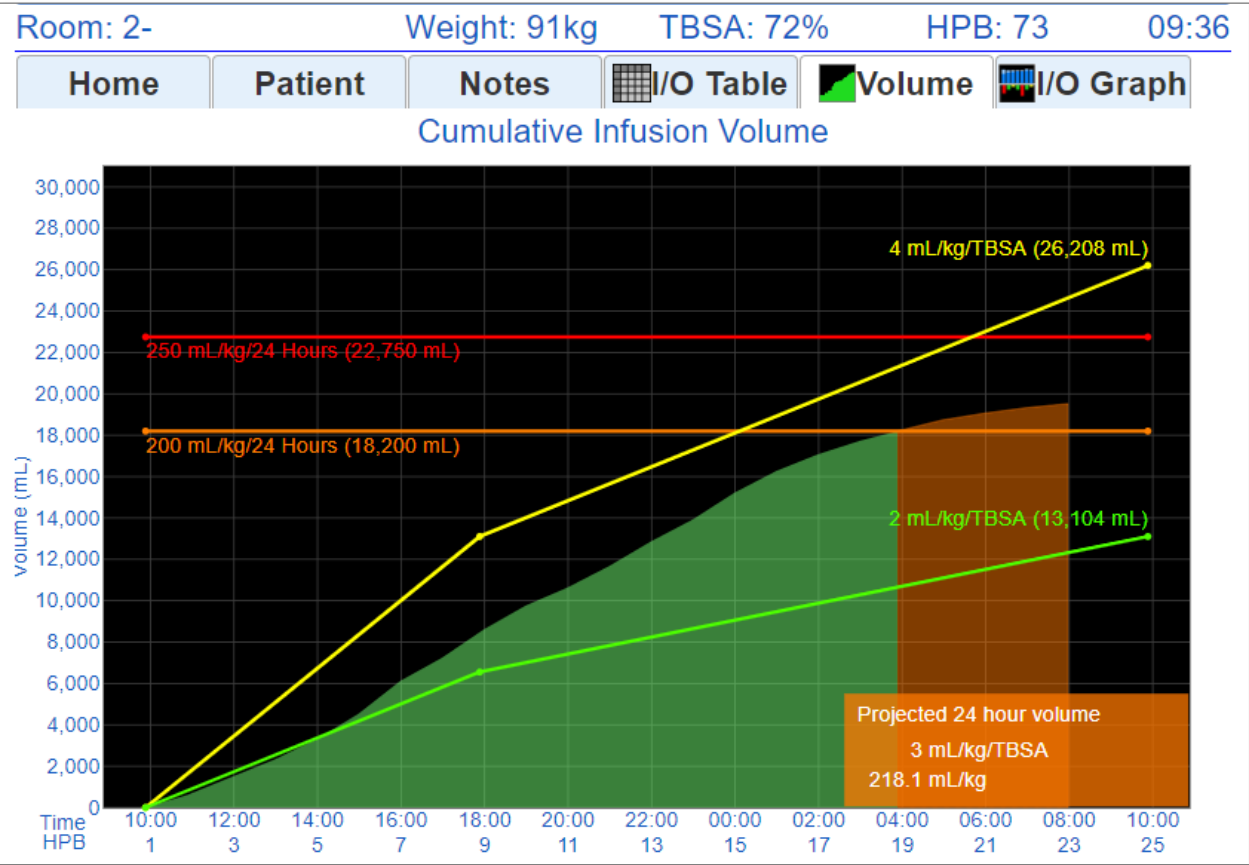
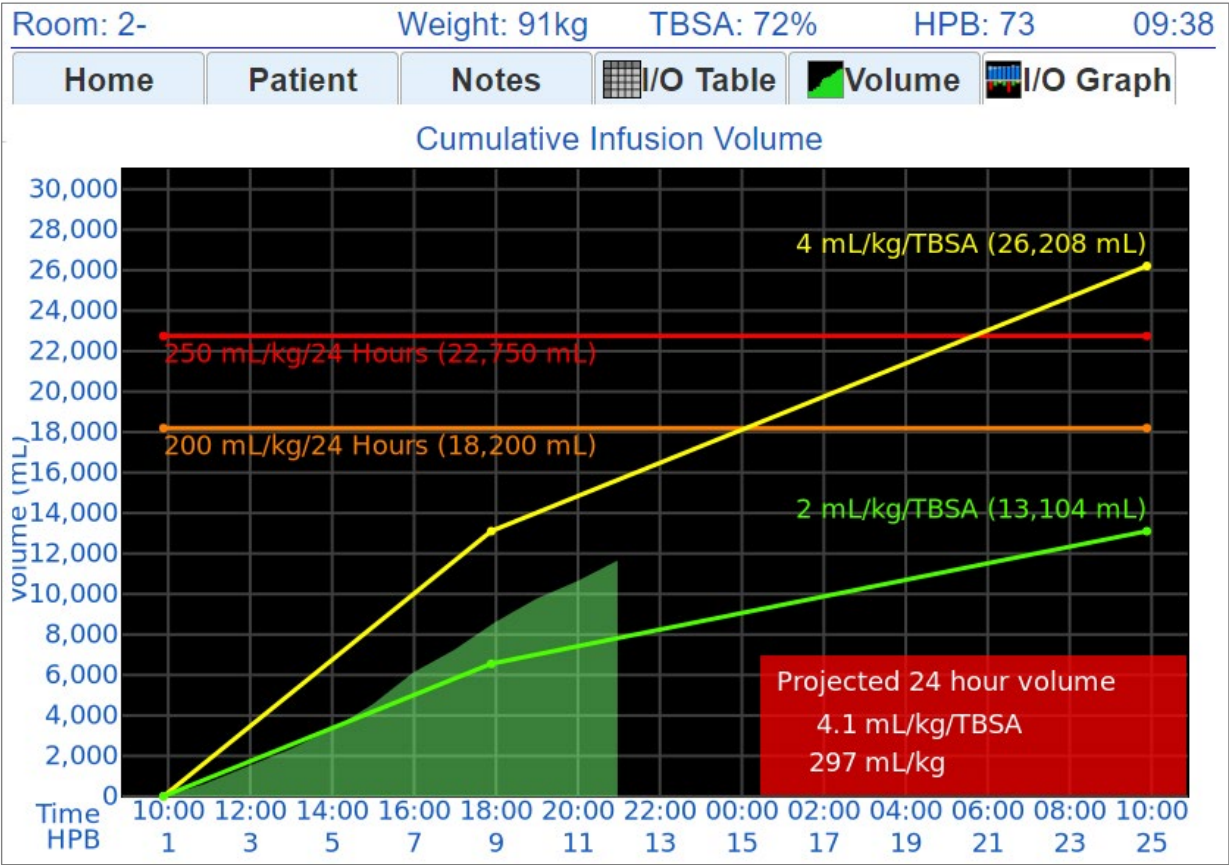




# Resuscitation

## Example

Timely interventions can result in good resuscitations, even for large (70%+ TBSA) burns

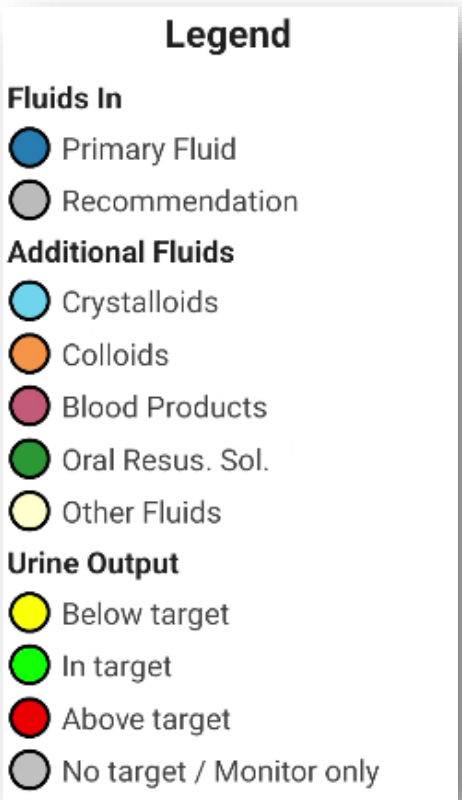
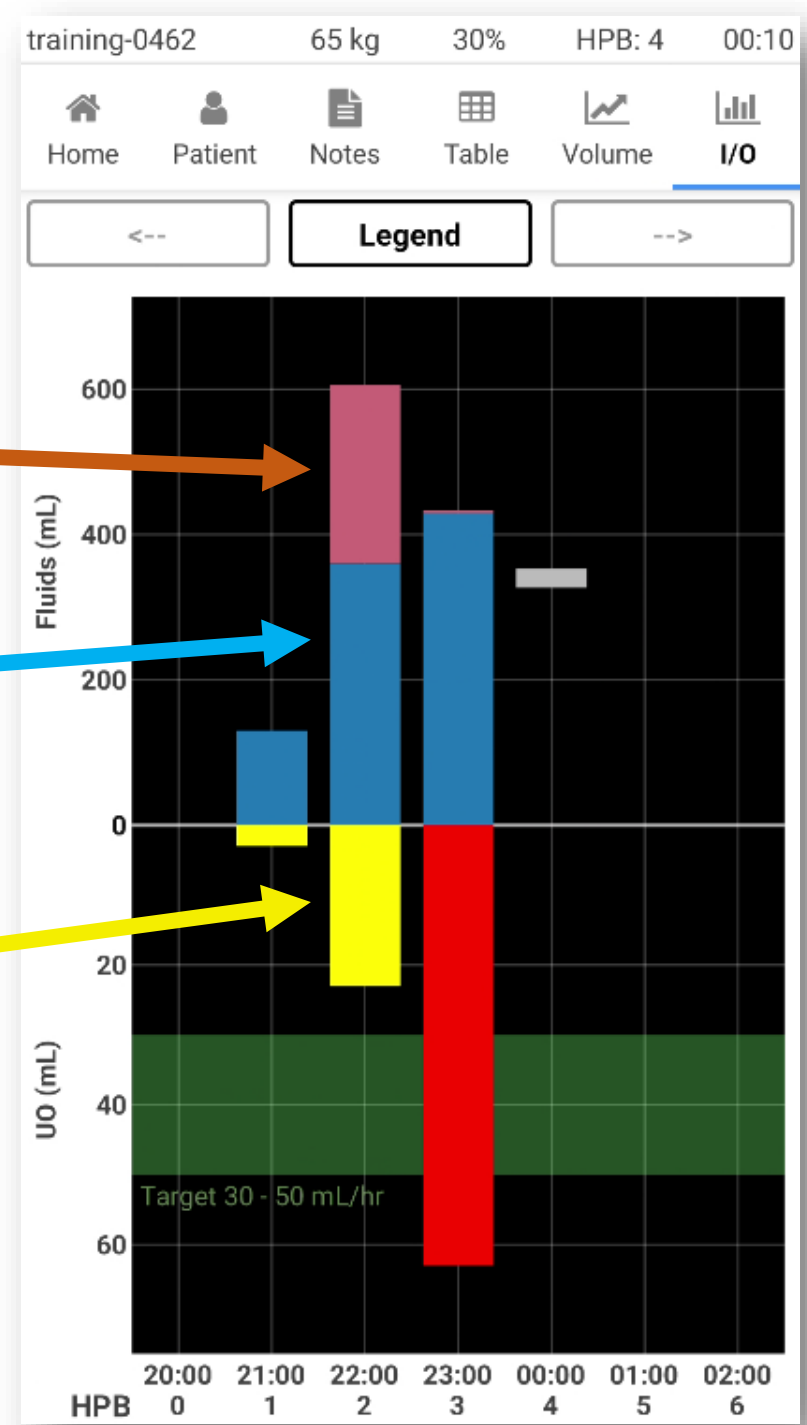


# I/O Graph

**Additional Fluids**  
E.g. albumin, FFP, ...  
(colored by category)

**Primary Resus Fluid**  
Fluids titrated hourly  
(dark blue bars)

**Urine Output**  
Green: In Target  
Yellow: Below Target  
Red: Above Target



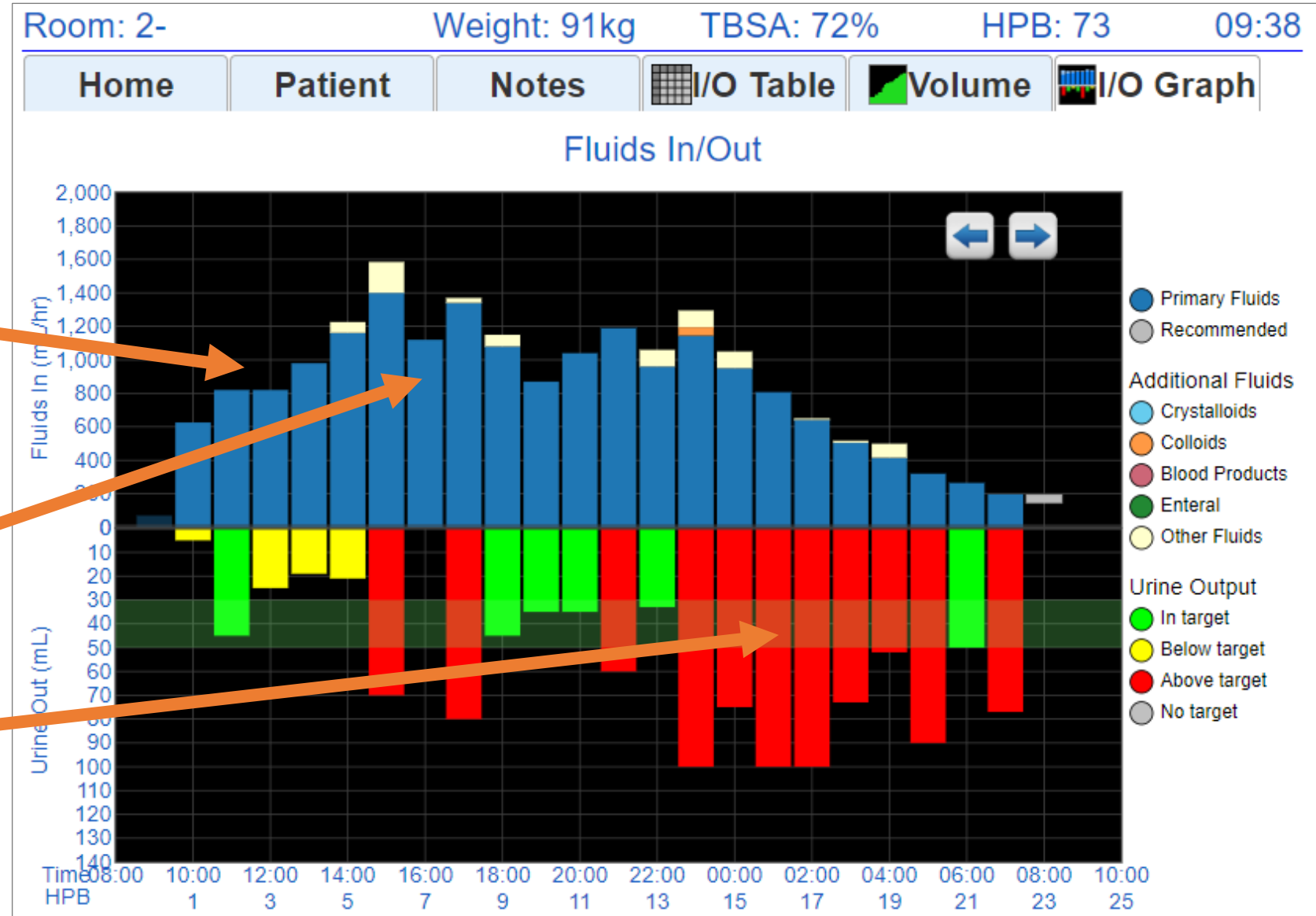


# Resuscitation

## Example

A good resuscitation (72% TBSA):

1. Early hours IVF increasing due to capillary leakage, low UOP
2. IVF plateaus around HPB 8-9
3. Several hours of high UO prompting quick, smooth de-escalation of IVF, precede end of resuscitation



## Part 2: Phone App Walkthrough

## Burn Navigator

Burn Navigator is a Clinical Decision Support app that helps clinicians manage fluid therapy for severe burn patients. [More info](#)

[HIPAA Compliance Information \(US\)](#)

### Developer

[Arcos, Inc.](#)

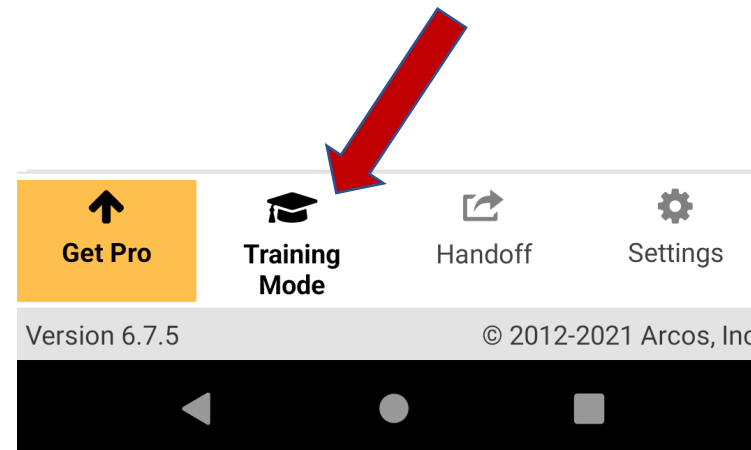
4714 Riverstone Blvd Ste 200  
Missouri City, TX 77459  
+1 877 542 8025  
support@arcosmedical.com

Burn Navigator Android App  
Product# 2107  
Version 6.7.2

OK

# New Patient Setup

- Start by pressing “Training Mode” at the bottom of the screen (allows fast-forwarding time)





## Patient Setup

### Basic Information

#### Patient identification

training-6935

Weight

65

kg

143

lbs

Height (opt.)

cm

in

Body surface area:

### Confounders

Does the patient have...

Yes

No

?

Myoglobinuria?



Hyperglycemia?



High blood alcohol?



End-stage renal disease?



Congestive heart failure?




### Protocol

Protocol

Adult Predictive



training-6849    65 kg    30%    HPB: 1    21:12

 Patient Setup

End-stage renal disease?    ☐    ☒    ☐

Congestive heart failure?    ☐    ☒    ☐

---

Protocol

Protocol    Adult Predictive ▾

Uses [Salinas algorithm](#) developed at U.S. Army Burn Center.

Targets 30-50 mL/hr urine output.

Recommendation changes up to 20% each hour.

Recommended for most adults without gross myoglobinuria.

---

Burn

Burned area (TBSA)\*     %    Guide

Time elapsed since burn      hrs     mins

Time of burn (clock time)    **20:11**

\*Only include 2nd and 3rd degree burns for TBSA.

---

Fluids So Far

Fluids given (optional)     mL

Urine output (optional)     mL

---

Initial Recommendation



## Protocols:

### 1. Adult Predictive

- Targets 30-50 mL/hr UO
- Uses UO trend and a predictive algorithm for recommendations
- The size of recommended IV fluid rate changes may vary

### 2. Custom

- You can choose the UO target range in mL or mL/kg
- IV fluid rate recommendations will be +/- 10% or no change (unless a safety rule applies)

### 3. Monitor Only

- Will not provide IV fluid rate recommendations
- Will provide graphs and safety alerts

training-6849 65 kg 30% HPB: 1 21:12

**Patient Setup**

End-stage renal disease? ☐ ☒ ☐

Congestive heart failure? ☐ ☒ ☐

**Protocol**

Protocol Adult Predictive ▾

Uses [Salinas algorithm](#) developed at U.S. Army Burn Center.

Targets 30-50 mL/hr urine output.

Recommendation changes up to 20% each hour.

Recommended for most adults without gross myoglobinuria.

**Burn**

Burned area (TBSA)\* 30 % Guide

Time elapsed since burn 0 1 2 hrs 00 mins

Time of burn (clock time) **20:11**

\*Only include 2nd and 3rd degree burns for TBSA.

**Fluids So Far**

Fluids given (optional)  mL

Urine output (optional)  mL

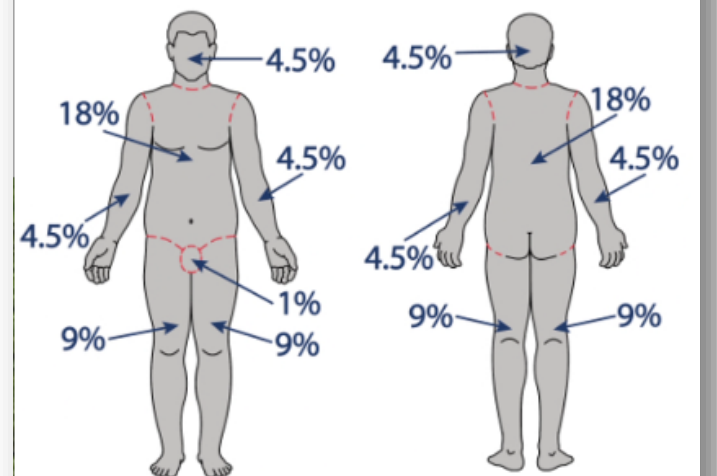
**Initial Recommendation**

training-6849 65 kg 30% HPB: -- 21:10

**TBSA Guide**

☐ < 1 year ☐ 1 - 4 years ☐ 5 - 9 years

☐ 10 - 14 years ☐ 15 - 17 years ☒ 18+ years



The diagram shows a human body with TBSA percentages for different body parts. The percentages are: Head 4.5%, Neck 4.5%, Face 4.5%, Chest 18%, Back 18%, Arms 4.5% each, Legs 9% each, and Groin 1%.

training-6849 65 kg 30% HPB: 1 21:14

← Patient Setup

Recommendation changes up to 20% each hour.  
Recommended for most adults without gross myoglobinuria.

Burn

Burned area (TBSA)\*  % Guide

Time elapsed since burn  hrs  mins

Time of burn (clock time) **20:11**

\*Only include 2nd and 3rd degree burns for TBSA.

Fluids So Far

Fluids given (optional)  mL

Urine output (optional)  mL

Initial Recommendation

Primary fluid

Initial rate formula

Recommended rate 300 mL/hr

Enter new rate:  mL/hr

Start Resuscitation

You can add fluids in/out so far here.  
These are not used for recommendations but will be graphed.

You can choose different formulas (e.g., higher for electrical or inhalation injuries)

Select Initial Formula ×

4 mL/kg/TBSA (Parkland)

3 mL/kg/TBSA

2 mL/kg/TBSA

☒ Rule of Ten

Galveston Pediatric

Start Resuscitation

training-6849 65 kg 30% HPB: 1 21:14

**Patient Setup**

Recommendation changes up to 20% each hour.

Recommended for most adults without gross myoglobinuria.

---

**Burn**

Burned area (TBSA)\*  % **Guide**

Time elapsed since burn  hrs  mins

Time of burn (clock time) **20:11**

\*Only include 2nd and 3rd degree burns for TBSA.

---

**Fluids So Far**

Fluids given (optional)  mL

Urine output (optional)  mL

---

**Initial Recommendation**

Primary fluid  ▼

Initial rate formula  ▼

Recommended rate 300 mL/hr

Enter new rate:  mL/hr

**Start Resuscitation**

You can always choose a different rate than the one recommended

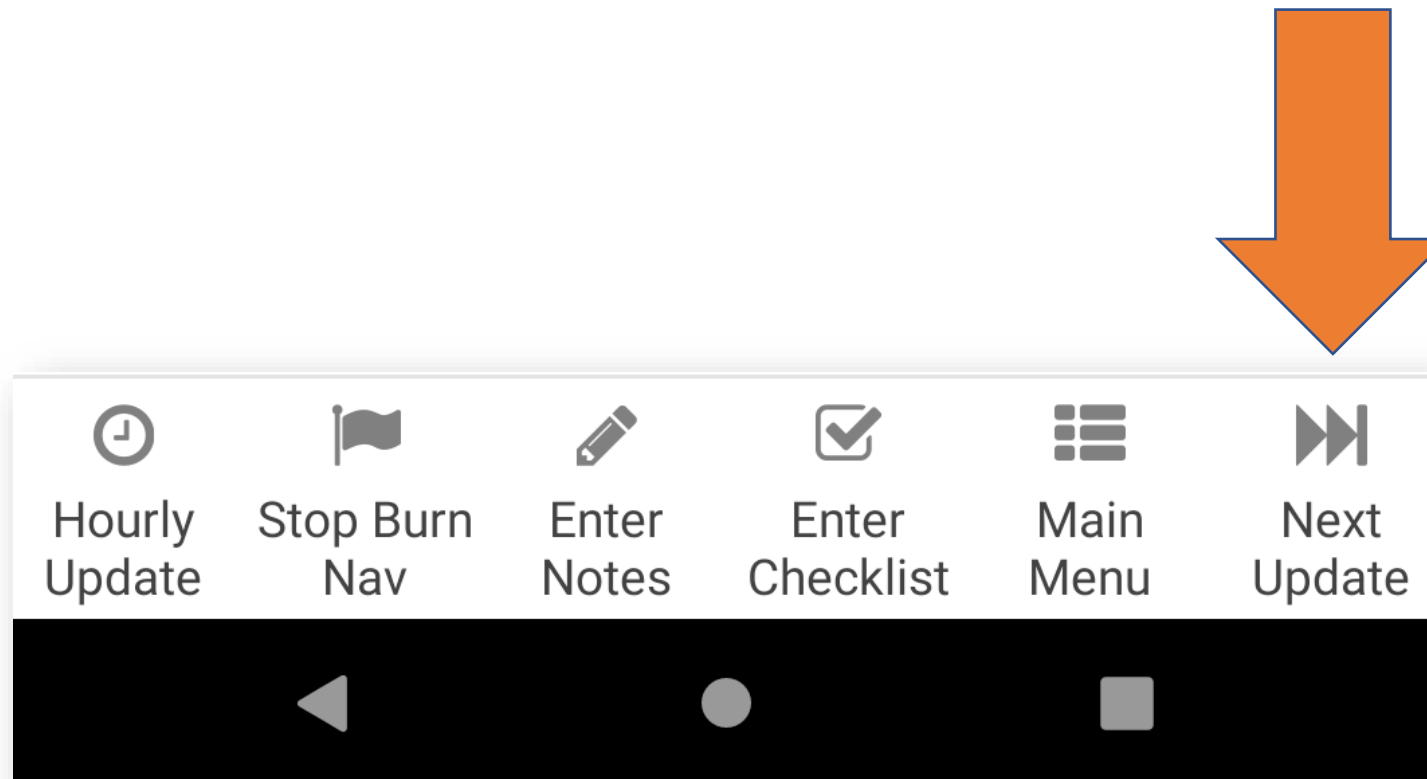
Press "Start Resuscitation" when ready!



# Fluid Updates

- **Clinical Goal:** Adequate perfusion with least amount of fluids
- **Plan:** Review urine output each hour, consider any alerts and patient status, and adjust fluid rate as needed
- In **Training Mode**, we can *fast-forward* time to do top-of-the-hour fluid updates

- The “Next Update” *fast-forward* time feature shows in Training Mode but not in normal clinical mode



Time period  
for UO update



Don't enter  
additional fluids  
for this update



training-0462 65 kg 30% HPB: 2 22:00

< Fluid Update

---

Time

From: 21:34  
To: 22:00 **26 minutes**

---

Fluids In/Out

Urine Output  mL

☐ UO Unknown 0.1 mL/kg/hr

Primary Fluid was  ▼

Infusion rate  mL/hr

Infusion volume 130 mL

---

Additional Fluids In

Total additional fluids 0 mL

▼

---

Recommendation

1	2	3	✕
4	5	6	
7	8	9	
	0		✓

From: 21:34

From: 21:34

**26** minutes

To: 22:00

### Urine Output

3

mL

0.1

m

mL/kg/hr

Lactated Ringer's

300

mL/hr

130

mL

## Total additional fluids

0

mL

Select fluid...

Primary fluid

Lactated Ringer's

300

mL/hr

↑ 20%

360

mL/hr

↑ 20%

360

mL/hr

**Submit Update**



Hourly  
Update



Stop Burn  
Nav



Enter  
Notes



Enter  
Checklist



Main  
Menu



Next  
Update



# The Checklist is optional

- It does not affect the recommendations
- But these values are also important for monitoring resuscitation



training-9253 65 kg 30% HPB: 1 15:22 Sim: 54

< Enter Checklist

### Vitals

Systolic BP	✓	112	mmHg
Diastolic BP	✓	76	mmHg
CVP			mmHg
Heart Rate	✓	88	bpm

### Bladder Pressure

Bladder Pressure			mmHg
------------------	--	--	------

### Labs

ScvO2			%
Lactate			mg/dL
Base Excess			mEq/L
Hemoglobin	✓	13.2	g/dL





Hemoglobin



13.2

g/dL

### Check Extremities

- ☒ Elevate burned extremities
- ☒ Check for tightness

### Check Pulses

Left Upper



Normal



Right Upper



Weak



Left Lower



Normal



Right Lower

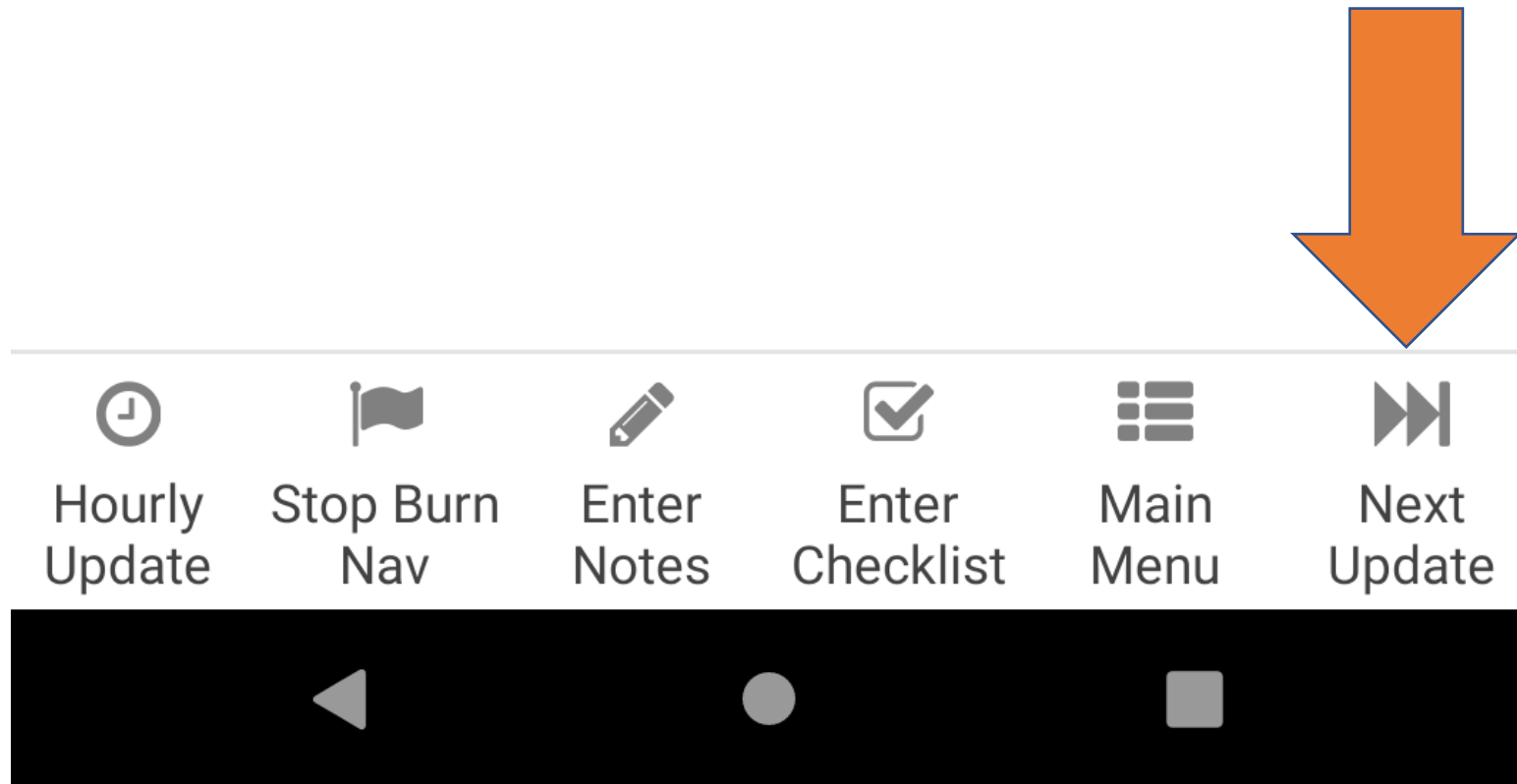


Normal



Done







training-0462 65 kg 30% HPB: 3 23:01

< Fluid Update

Time

From: 22:00 To: 23:01 61 minutes

Fluids In/Out

Urine Output 23 mL

☐ UO Unknown 0.3 mL/kg/hr

Primary Fluid was Lactated Ringer's

Infusion rate 360 mL/hr

Infusion volume 366 mL

Additional Fluids In

Total additional fluids mL

Select fluid...

training-0462 65 kg 30% HPB: 3 23:01

< Fluid Update

Additional Fluids

- Lactated Ringer's
- LR + 5% Dextrose
- Plasma-lyte
- Normal Saline
- Whole Blood
- Fresh Frozen Plasma
- Pathogen Reduced Plasma
- Packed Red Blood Cells
- IV Medications
- 5% Albumin
- 25% Albumin
- Oral Resuscitation Fluids
- Tube Feeds
- Other

We gave 250 mL FFP

Additional Fluids In

☒ Fresh Frozen Plasma 250 mL ☐ Repeat

Total additional fluids 250 mL

Select fluid...

**WARNING:** Giving fluids in addition to the primary resuscitation fluid may require an adjustment to the fluid infusion rate by the user, different from the rate recommended by Burn Navigator. The attending physician should be contacted to determine the appropriate fluid infusion rate.

Recommendation

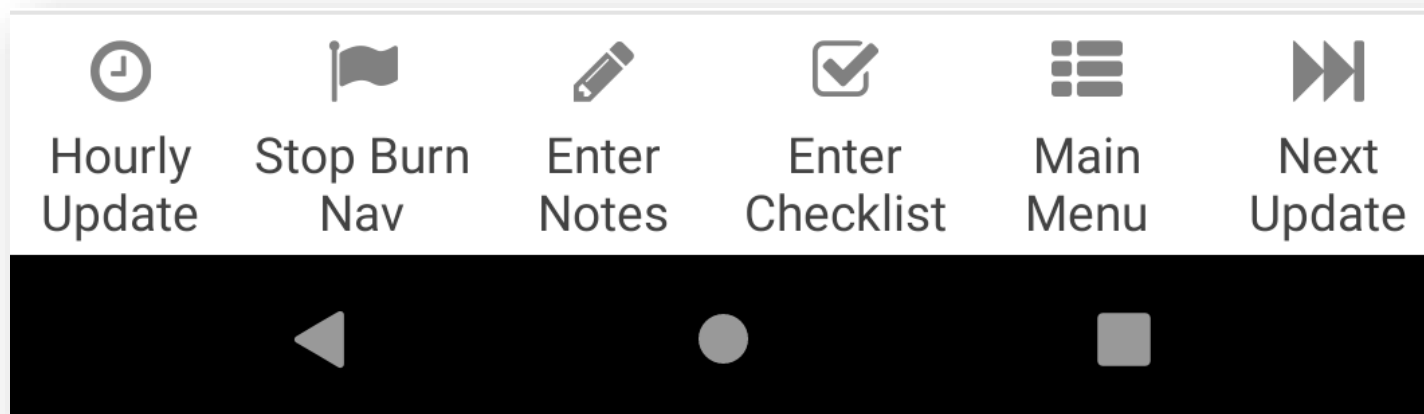
Primary fluid Lactated Ringer's

Previous rate 360 mL/hr

Recommended rate ↑ 19% 430 mL/hr

Enter new rate: ↑ 19% 430 mL/hr

Submit Update



training-0462    65 kg    30%    HPB: 4    00:01

◀    Fluid Update

---

Time

From: 23:01    59 minutes

To: 00:00

---

Fluids In/Out

Urine Output    63    mL

☐ UO Unknown    1.0    mL/kg/hr

Primary Fluid was    Lactated Ringer's    ▼

Infusion rate    430    mL/hr

Infusion volume    423    mL

---

Additional Fluids In

Total additional fluids    0    mL

Select fluid...    ▼

Safety questions appear when a decrease will be recommended

Safety Questions

Is the patient...	Yes	No
Hypotensive?	<input checked="" type="radio"/>	<input type="radio"/>
Hyperglycemic?	<input type="radio"/>	<input checked="" type="radio"/>
On pressors?	<input type="radio"/>	<input checked="" type="radio"/>
On diuretics?	<input type="radio"/>	<input checked="" type="radio"/>

Alert! Consult with attending physician about an appropriate fluid rate during presence of hypotension, hyperglycemia, pressors or diuretics.

---

Recommendation

Primary fluid    Lactated Ringer's    ▼

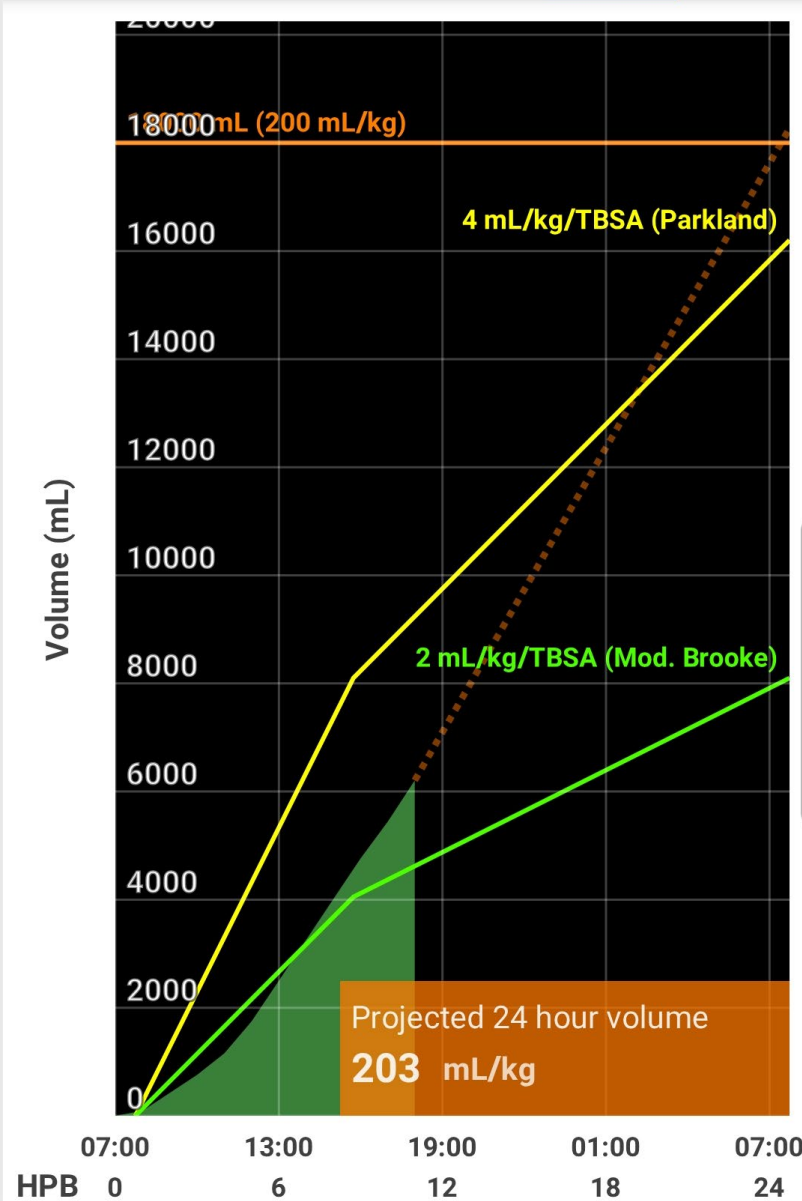
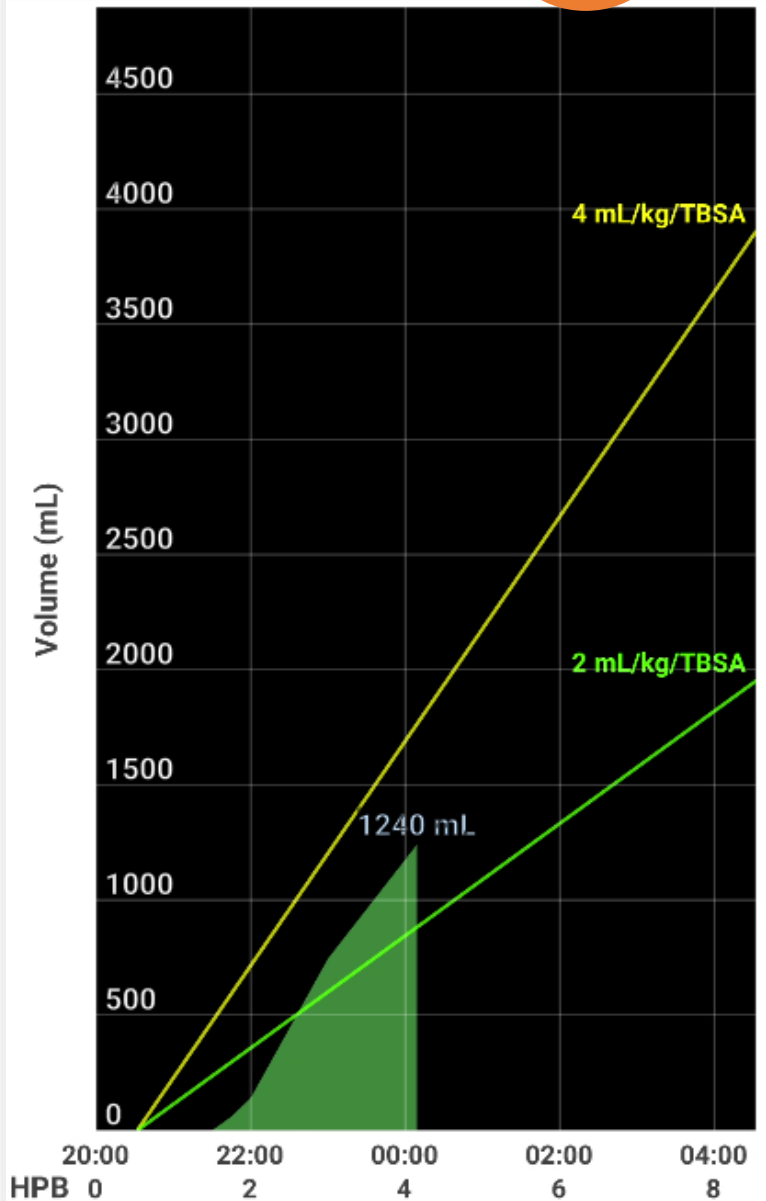
Previous rate    430    mL/hr

Recommended rate    ↓ 21%    340    mL/hr

Enter new rate:    430    mL/hr

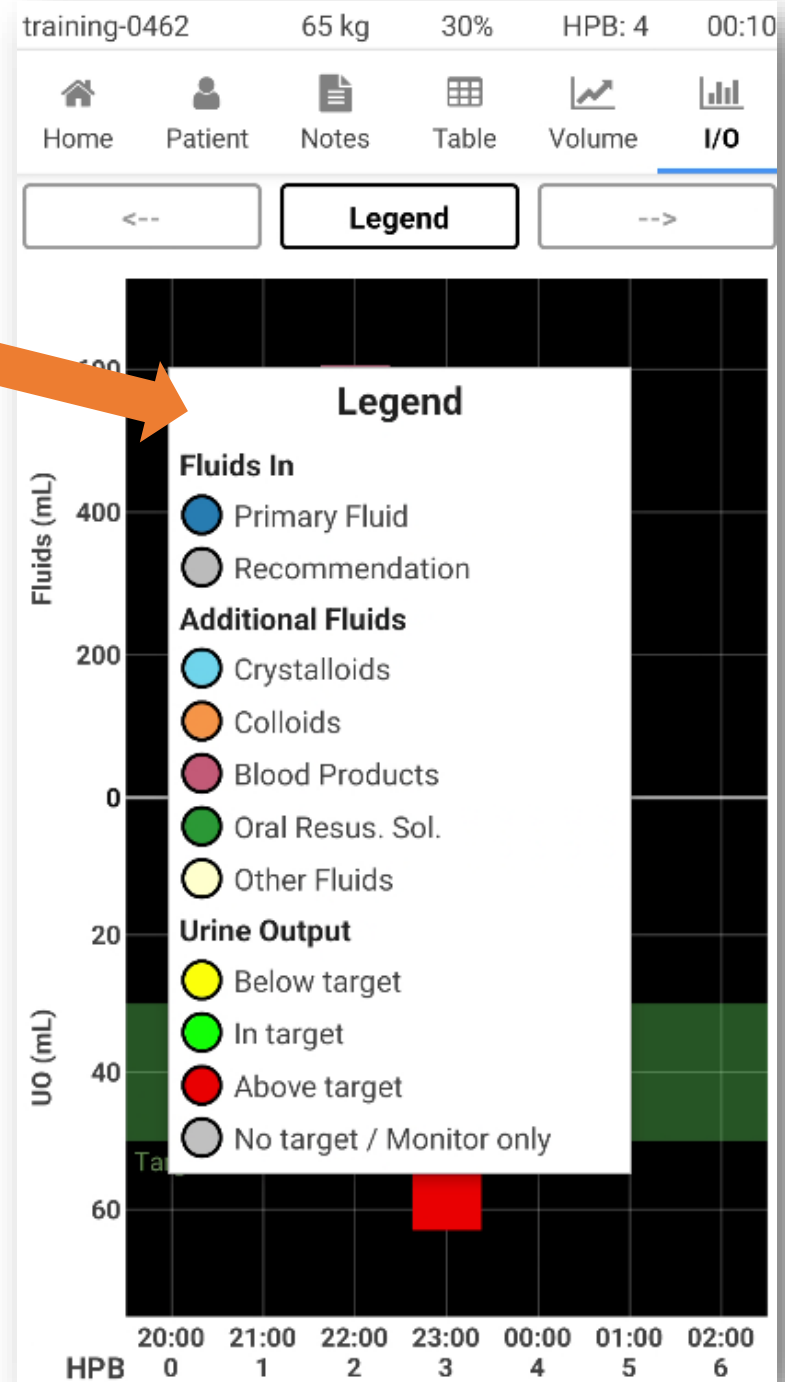
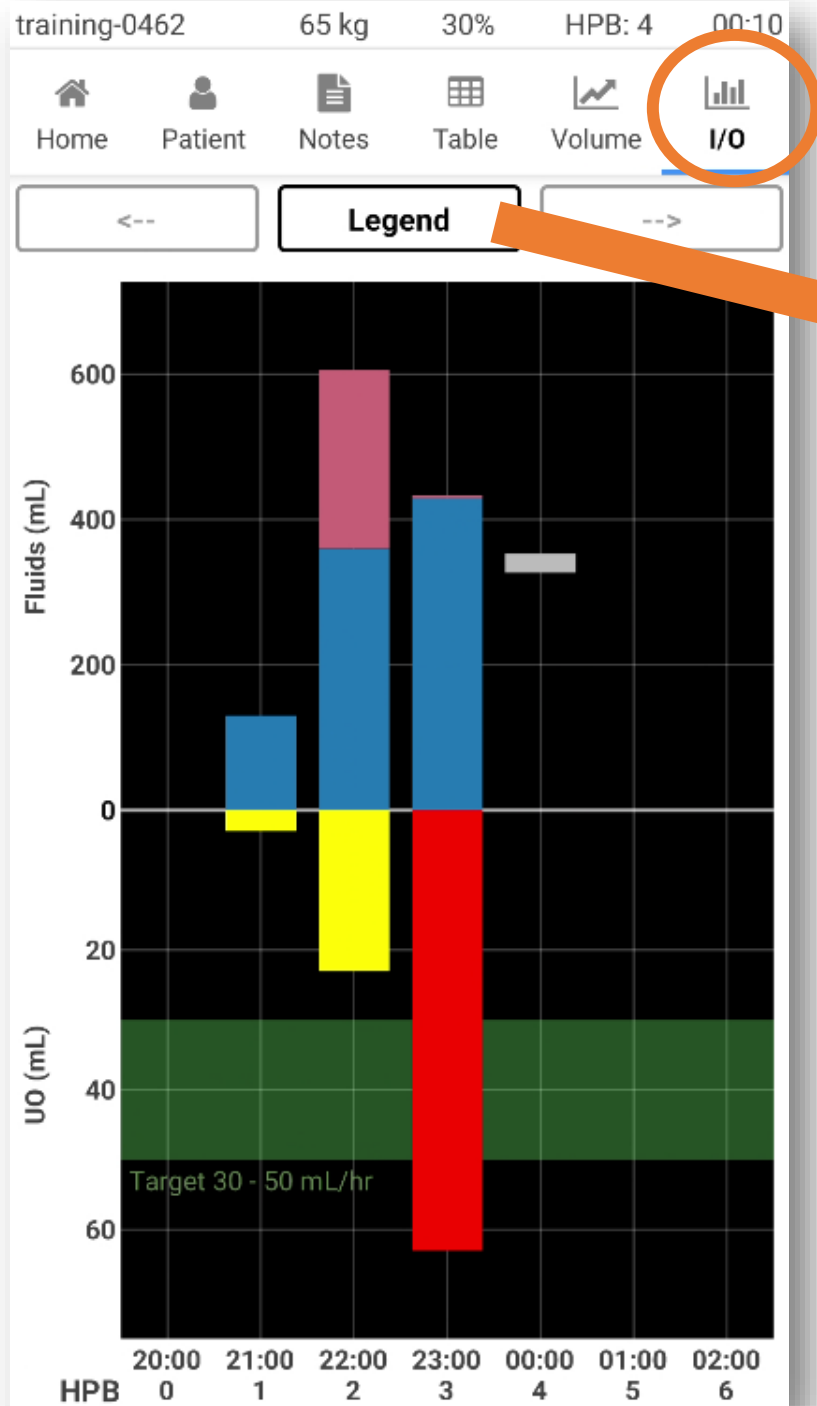
Submit Update

Enter new rate of 430 mL/hr due to hypotension



## 24-hr Volume Projection:

- Shows by HPB 10
- Assumes you stay at current rate until HPB 24
- 200-249 mL/kg **orange box**
- 250+ mL/kg **RED BOX**



### 23:04 (HPB 3)

#### Checklist

Systolic BP	=	112 mmHg
Diastolic BP	=	76 mmHg
CVP	=	--- mmHg
Heart Rate	=	88 bpm
Bladder Pressure	=	--- mmHg
ScvO2	=	--- %
Lactate	=	--- mg/dL
Base Excess	=	--- mEq/L
Hemoglobin	=	13.2 g/dL
Burned extremities elevated		
Tightness checked		
Left Upper pulse	=	normal
Right Upper pulse	=	weak
Left Lower pulse	=	normal
Right Lower pulse	=	normal

### 21:34 (HPB 1)

Myoglobinuria?	Unknown
Hyperglycemia?	Unknown
High blood alcohol?	Unknown
End stage renal disease?	Unknown
Congestive heart failure?	Unknown

### 21:34 (HPB 1)

Resuscitation Plan:

Adult predictive algorithm

Target UO 30-50 mL/hr

Initial formula: Rule of Ten

Initial formula rate: 300 mL/hr

Entered rate: 300 mL/hr

Max recommendation: 1850 mL/hr

#### Actual Times (edit)

#### Hourly Averages

HPB	HPB0	HPB1	HPB2	(HP
Clock Hour	20-21	21-22	22-23	
UO Vol. (mL)	0	3	23	
UO (mL/kg/hr)	0.0	0.0	0.3	
Rec. Rate (mL/hr)	0	130	360	430
Actual Rate (mL/hr)	0	130	360	
∨ Actual Vol. (mL)	0	130	360	
Lac Ringer's (mL)	0	130	360	
∨ Total Adj. Fluids (mL)			246	
FFP (mL)			246	
Total Res. Fluids (mL)	0	130	606	
Total Add. Fluids (mL)			246	
Total Fluids In (mL)	0	130	606	
Total Cumulative (mL)	0	130	736	

training-0462    65 kg    30%    HPB: 3    23:16

Home    **Patient**    Notes    Table    Volume    I/O

Cite ID    training-0462

Weight    65 kg    143 lbs

Height       cm       in

TBSA    30 %    **Guide**

Confounders    **Unknown**

Elapsed time since burn    2 hrs    44 mins

Burn time    20:32

Burn Nav started    21:34    (HPB 1)

Protocol (view only)    **Adult predictive algorithm**

Min rate after HPB 8    **100 mL/hr**

Fluids pre-Burn Nav       mL

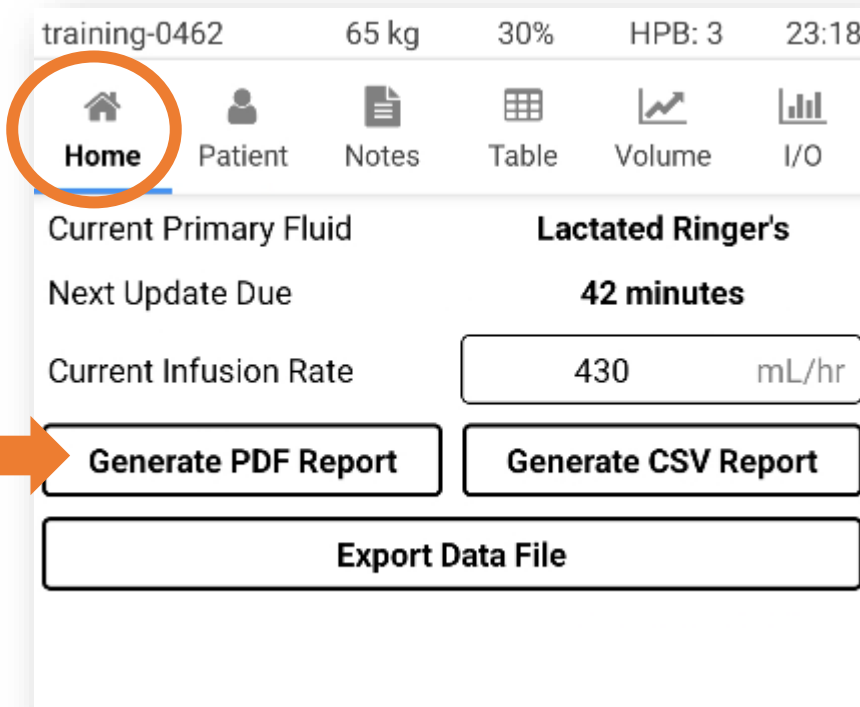
UO pre-Burn Nav    0    mL

Patient tab lets you:

- Change any value from your initial patient setup
- Revise TBSA, weight
- Edit/update Confounders

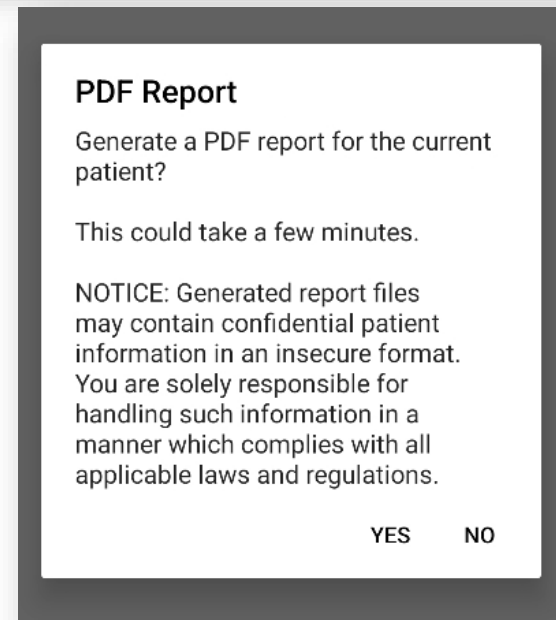
Home tab has **data export** options

(*Data handoff* is different and covered next)



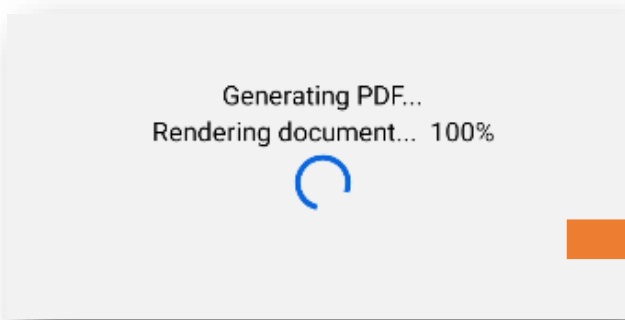
The screenshot shows the 'Home' tab of a medical application. At the top, patient information is displayed: 'training-0462', '65 kg', '30%', 'HPB: 3', and '23:18'. Below this is a navigation bar with icons for 'Home' (circled in orange), 'Patient', 'Notes', 'Table', 'Volume', and 'I/O'. The main content area displays patient data: 'Current Primary Fluid' is 'Lactated Ringer's', 'Next Update Due' is '42 minutes', and 'Current Infusion Rate' is '430 mL/hr'. At the bottom, there are three buttons: 'Generate PDF Report' (highlighted with an orange arrow), 'Generate CSV Report', and 'Export Data File'.

Choose to generate a PDF report

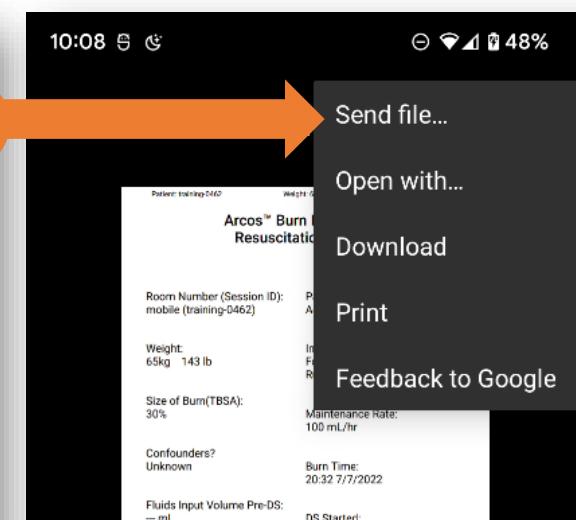
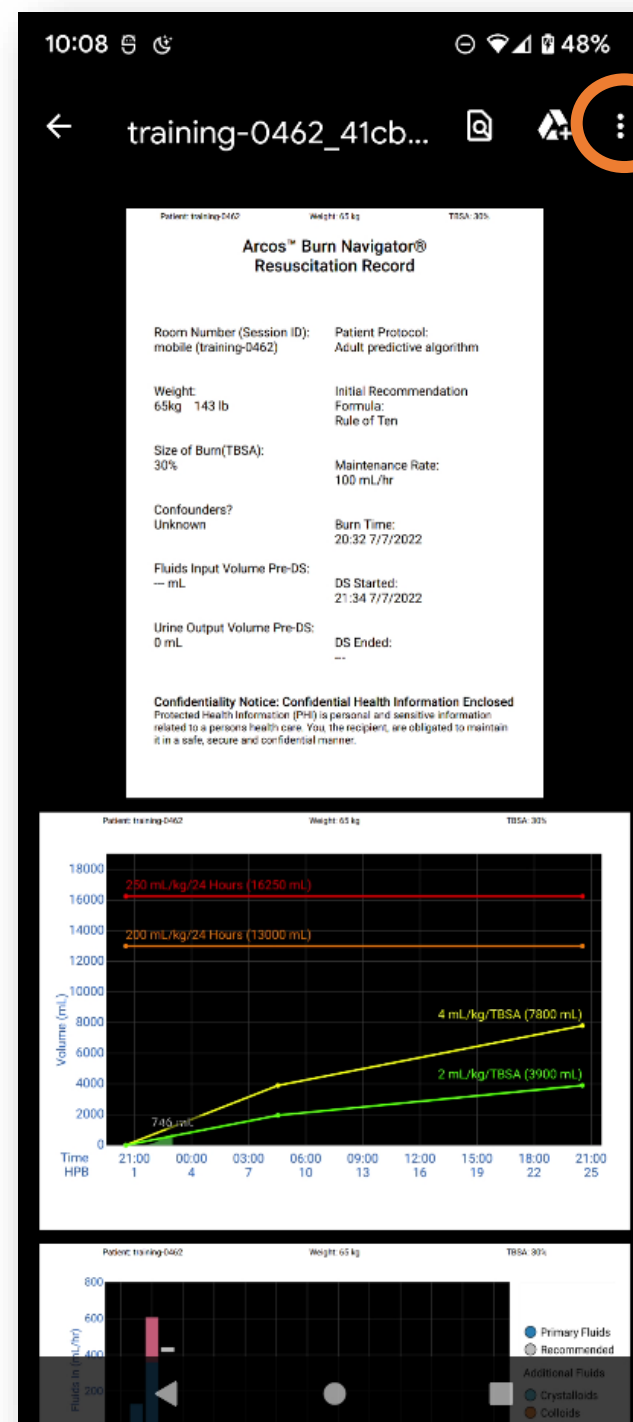


The screenshot shows a dialog box titled 'PDF Report'. It contains the text: 'Generate a PDF report for the current patient?' followed by 'This could take a few minutes.' Below this is a 'NOTICE' section: 'Generated report files may contain confidential patient information in an insecure format. You are solely responsible for handling such information in a manner which complies with all applicable laws and regulations.' At the bottom right, there are two buttons: 'YES' and 'NO'.





You need to choose a PDF viewer app already on your phone

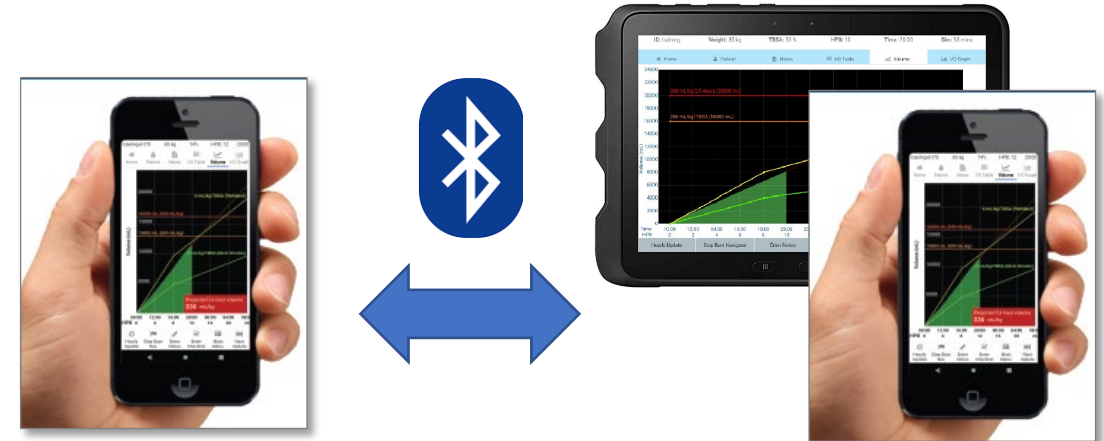


Your PDF viewer app should have options for **Print**, **Send**, etc.

# Data Handoff & Integration

- Data Handoff

Role 2 → Transport → Role 3 ...



- EMR Integration

- Phone or Tablet → Burn Nav Web
- Burn Nav Web → EMR (HL7 messages)



## Example safety alerts

Alert! Consult with attending physician about an appropriate fluid rate during presence of hypotension, pressors or diuretics.

Alert!

Urinary output is not responding to fluid therapy. Check Foley catheter for obstruction and check bladder pressure. Patient may be a fluid “non-responder”. Contact attending physician.

UO was >4mL/kg/hr. Notify attending and assess patient's blood glucose, BP, HR, CVP and Hb before lowering rate.



- Do not follow the recommendations without thought
- Recommendations are based primarily on **urine output**
- Urine output is **not always** a good guide for **adequate perfusion**
- Take the entire clinical situation into consideration

# Keep in Mind!

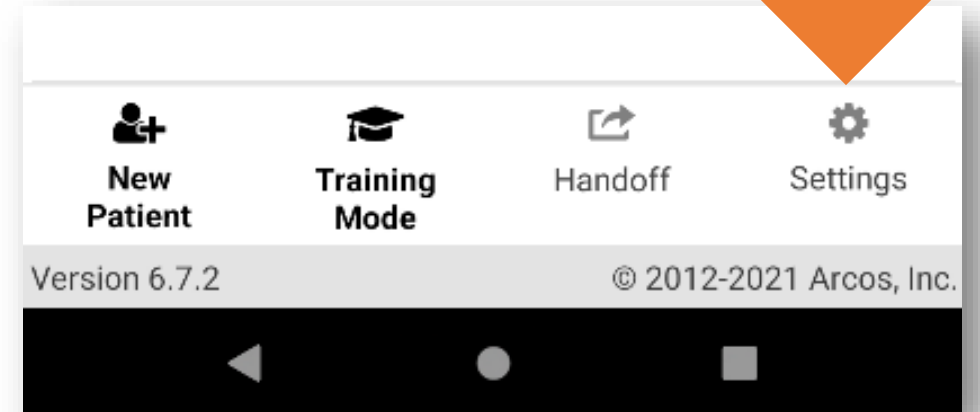
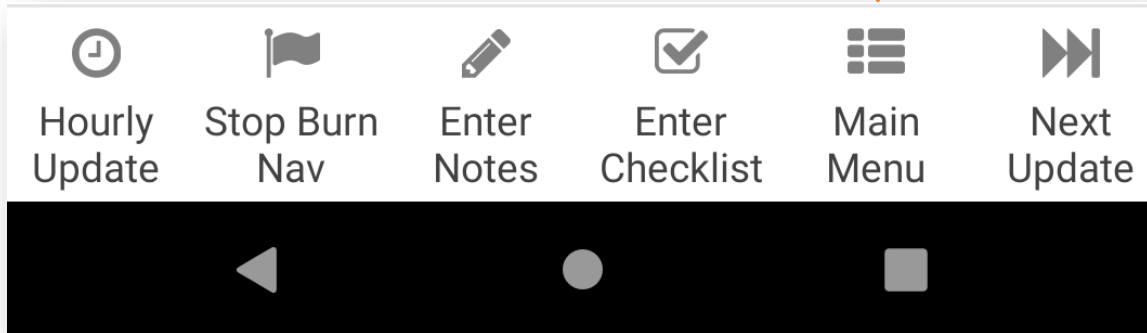
## Recommendations are only recommendations!

Understand the whole clinical picture, communicate with the attending physician, and do what's best for the patient

As a clinical decision support tool, Burn Navigator is not intended to replace clinical decision judgement, rather it informs clinical decision making

Users should always rely on their clinical judgment when making decisions regarding patient care. The Burn Navigator recommendations are not a substitute for clinical judgment.

There are several settings you can review and change



## Clinical Settings

“Pediatric”  
defaults are used  
if weight is <40 kg



**Arcos Burn Navigator**

**Clinical Settings** Admin Settings License

**General Settings**

- ☒ Hourly Update Sound
- ☐ Show projected mL/kg/TBSA on volume graph
- ☐ Enable PROPOLIS study recommendations
- Rec. Increase Cap: 270 mL/kg
- High Proj. Decrease: 0 %

**Protocol Settings - Adult Predictive**

- Max rec. % change: 20 %
- Initial rate formula: Rule of Ten
- Min. rate formula: Manual
- Manual min. rate: 100 mL/hr

**Protocol Settings - Custom Pediatric**

- Max rec. % change: 10 %
- Initial rate formula: 3 mL/kg/TBSA
- Min. rate formula: 4-2-1 Formula
- Manual min. rate: 20 mL/hr
- UO targets: 0.5 to 1 mL/kg/hr

**Initial rate formula**: Rule of Ten

**Min. rate formula**: Manual

**Manual min. rate**: 100 mL/hr

**Protocol Settings - Custom Pediatric**

- Max rec. % change: 10 %
- Initial rate formula: 3 mL/kg/TBSA
- Min. rate formula: 4-2-1 Formula
- Manual min. rate: 20 mL/hr
- UO targets: 0.5 to 1 mL/kg/hr

**Protocol Settings - Custom Adult**

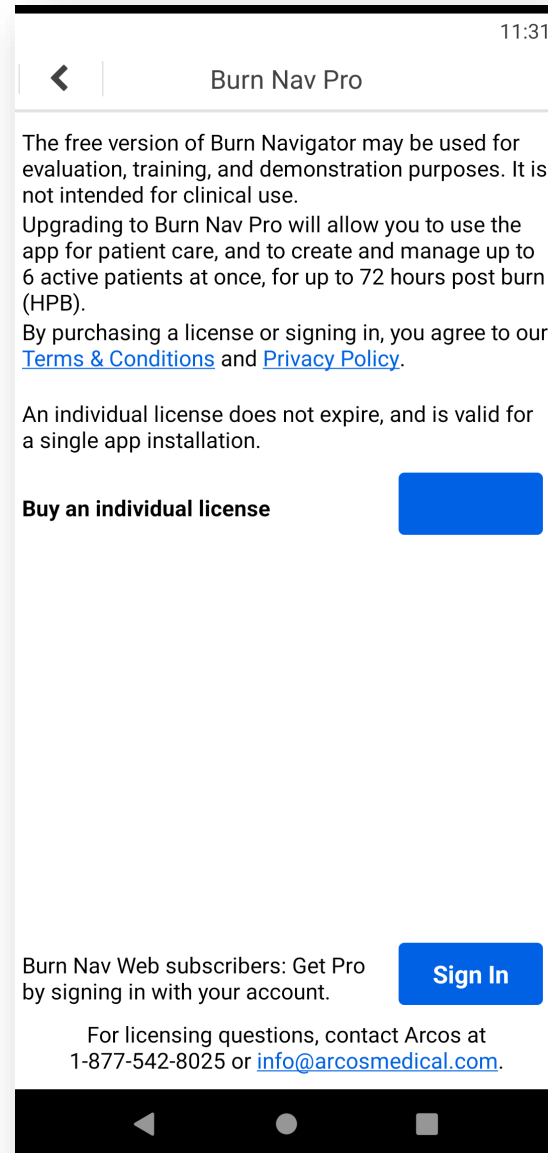
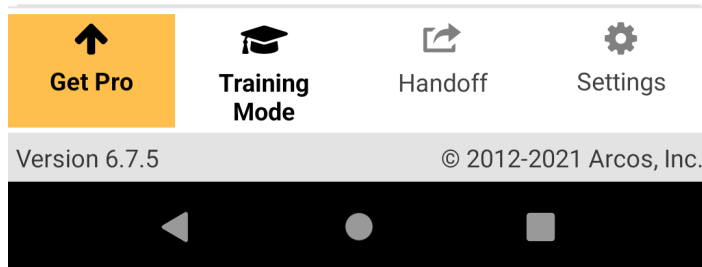
- Max rec. % change: 10 %
- Initial rate formula: Rule of Ten
- Min. rate formula: Manual
- Manual min. rate: 100 mL/hr
- UO targets: 30 to 50 mL/hr

# License for Clinical Use

## *Android App Instructions*

Contact us for **iPhone** licenses:  
[info@arcosmedical.com](mailto:info@arcosmedical.com)

Press the “Get Pro”  
button



Buy an individual license:

- Unlimited clinical use
- One-time purchase for this particular phone
- License is consumed (does not transfer to another phone)

# Three Versions of Burn Navigator

## 1. Web app

Group account for a hospital

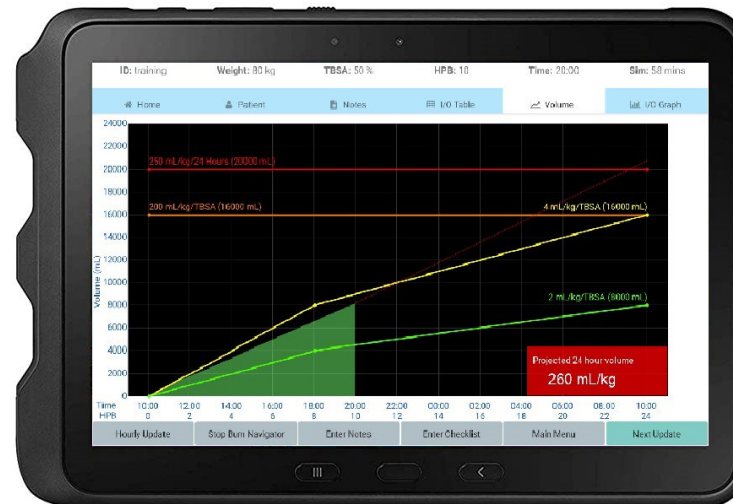


## 2. Android/iPhone app



## 3. Rugged tablet

10" screen





# Arcos<sup>™</sup> Burn Navigator<sup>®</sup>

Please contact us for any questions!

[info@arcosmedical.com](mailto:info@arcosmedical.com)

877-542-8025