First There First Care Conference Gathering of Eagles

Navigating the Intrusions, Inclusions, Confusions, and Solutions in Prehospital Transfusions:

Paul E. Pepe, MD, MPH

Eagle's Group de la Sanguine

DISCLOSURE for Continuing Medical Education Purposes

- This activity has been planned and implemented in accordance with the accreditation requirements and policies of the *Accreditation Council for Continuing Medical Education (*ACCME) through the joint providership of White Coat Institute (d.b.a. *GetMyCME*) and the *Gathering of Eagles* alliance.

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How Far Have We Come and Where Are We Going in Prehospital Transfusions?

AKA THE STATE OF THE UNION

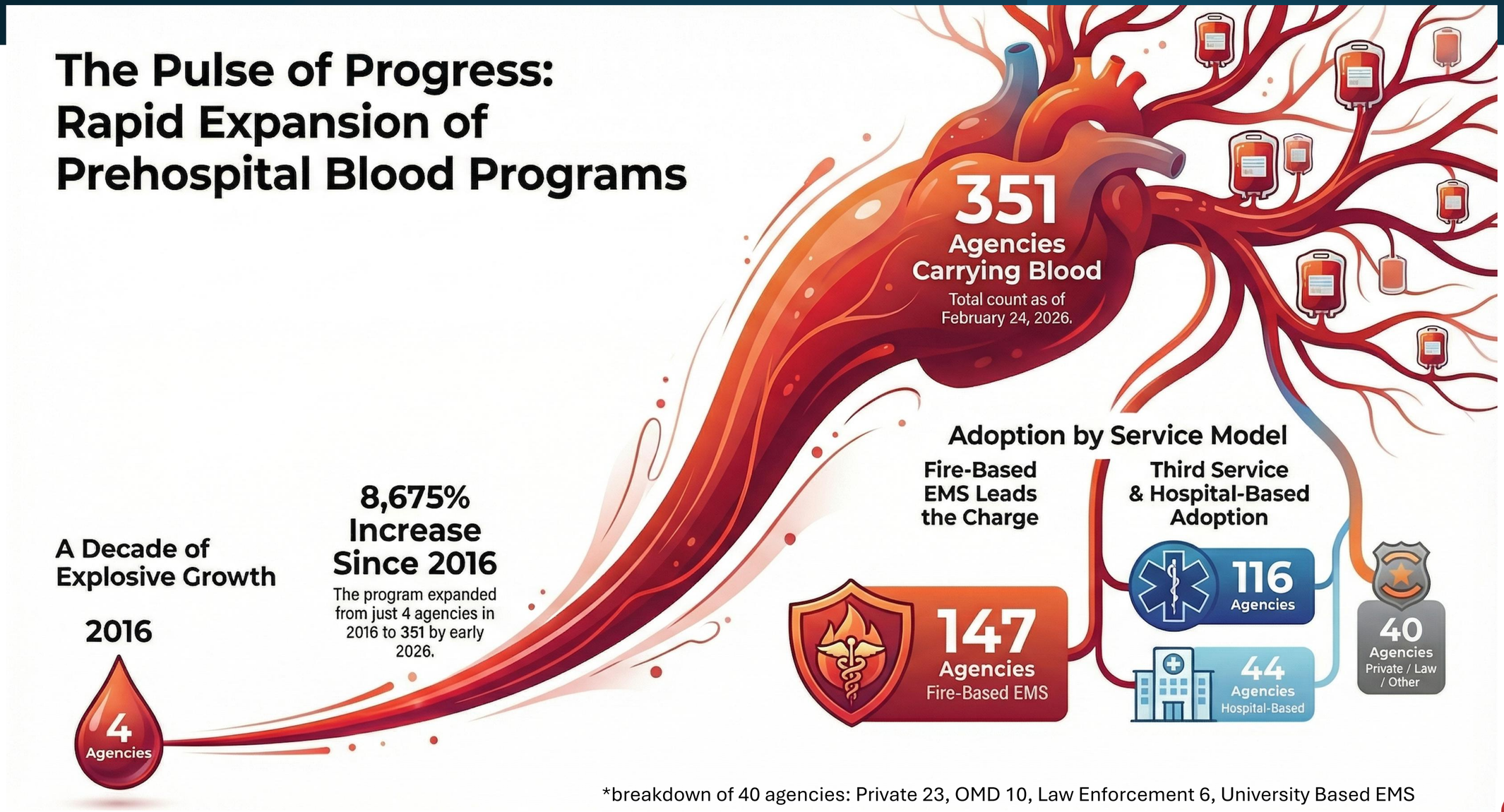
Eric Bank, LP, NRP, FAEMS, Assistant Chief of EMS, Harris County Emergency Services Department
Holly O'Byrne, NRP, MPA, Lieutenant/Paramedic, DC Fire and EMS
Randall M. Schaefer, DNP, RN, ACNS-BC, CEN – Lt Colonel (ret.), U.S. Army; Chief Operating Officer, Schaefer Consulting, New Braunfels, TX

Way back in 2016, in Suburban Houston , Texas

Concept

Reality

Growth



*breakdown of 40 agencies: Private 23, OMD 10, Law Enforcement 6, University Based EMS Training Academy 1.

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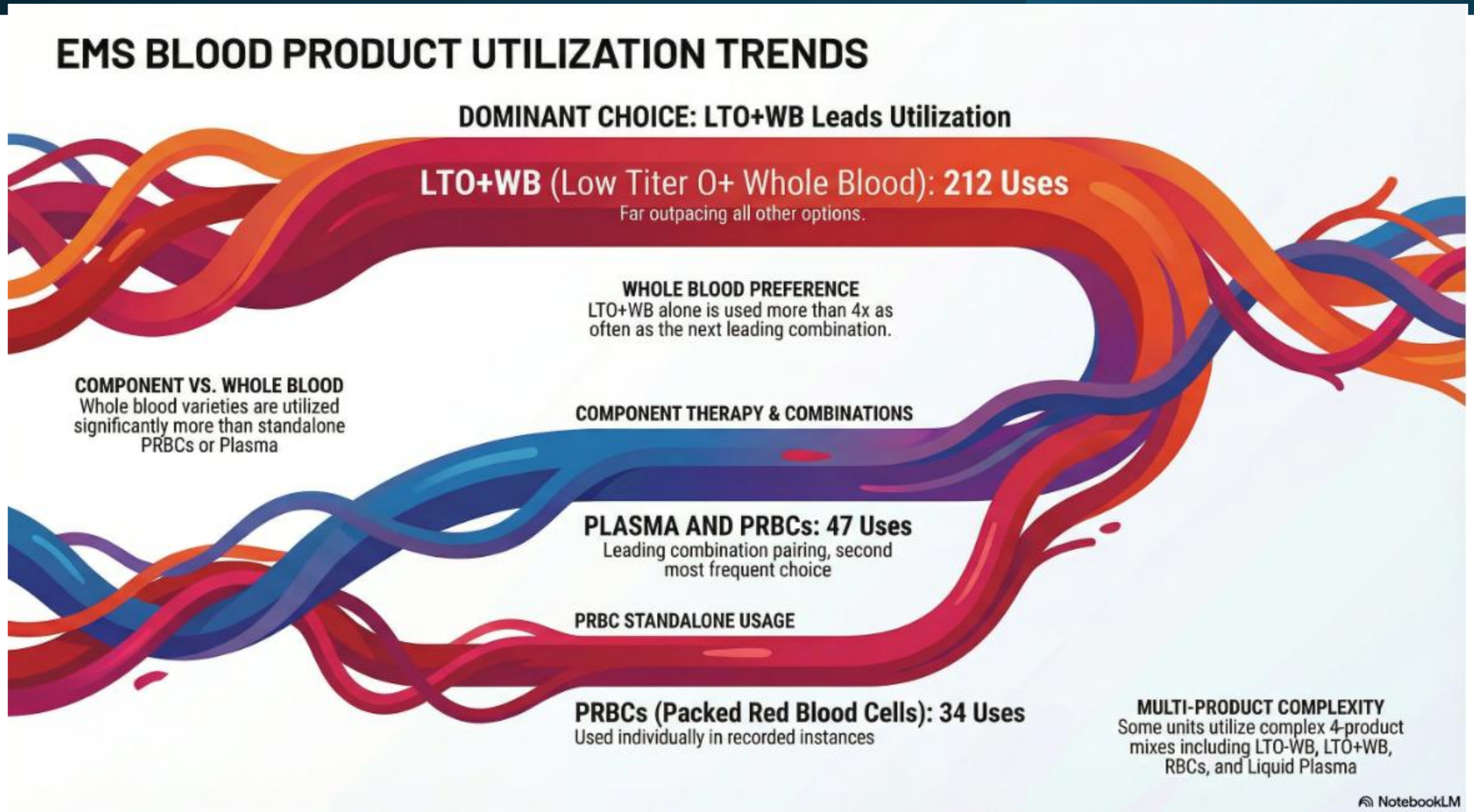
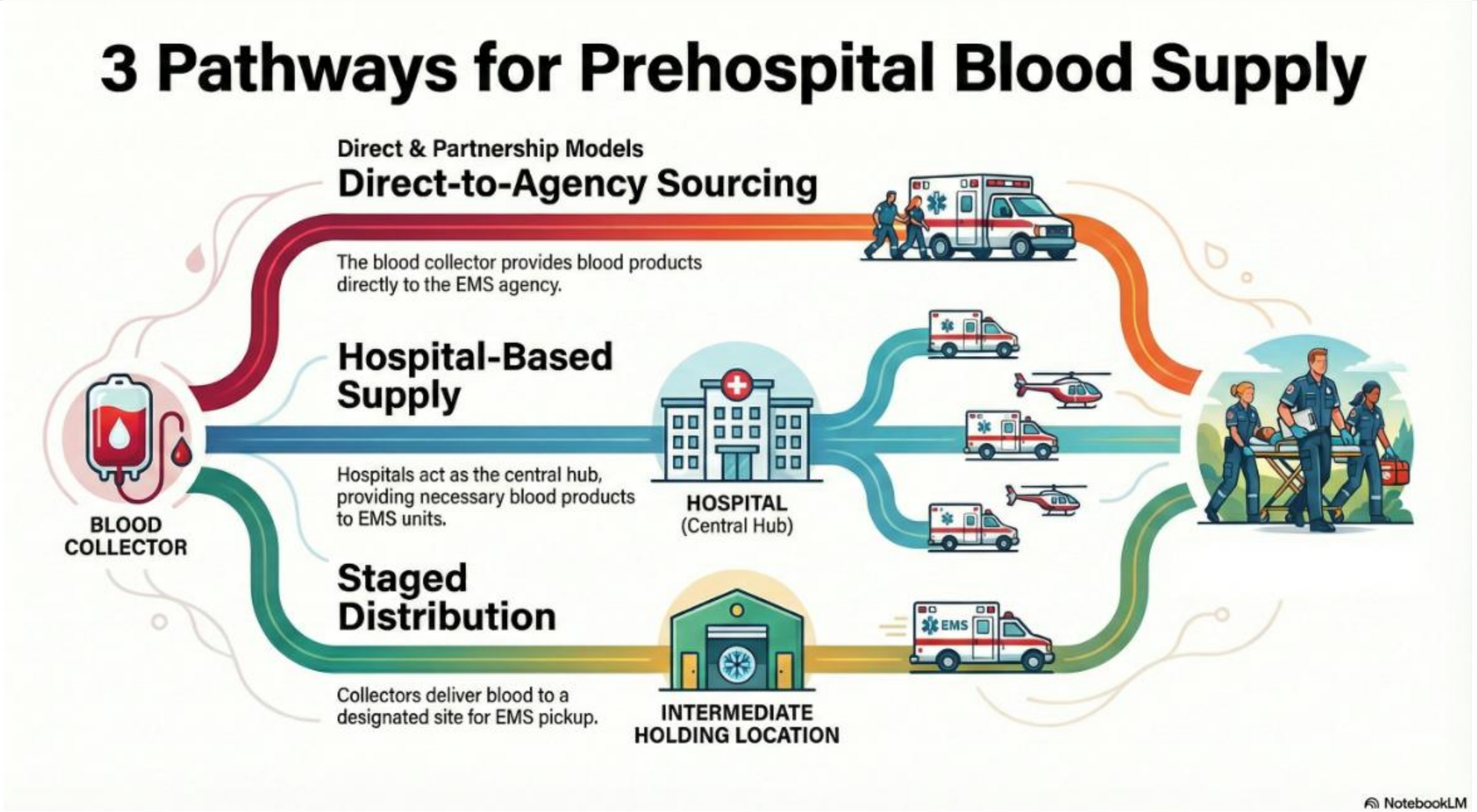
Clinical Preferences and Supply Trends



Blood Sourcing Models



4 Pillars for EMS Blood Programs

Pillar 1: Rationale for the use, and description, of blood products that can be transfused in the prehospital setting
Pillar 2: Storage of blood products outside of the hospital blood bank and how to move them to the patient in the prehospital setting
Pillar 3: Prehospital transfusion criteria and administration personnel
Pillar 4: Documentation of prehospital transfusion and hand over to the hospital team

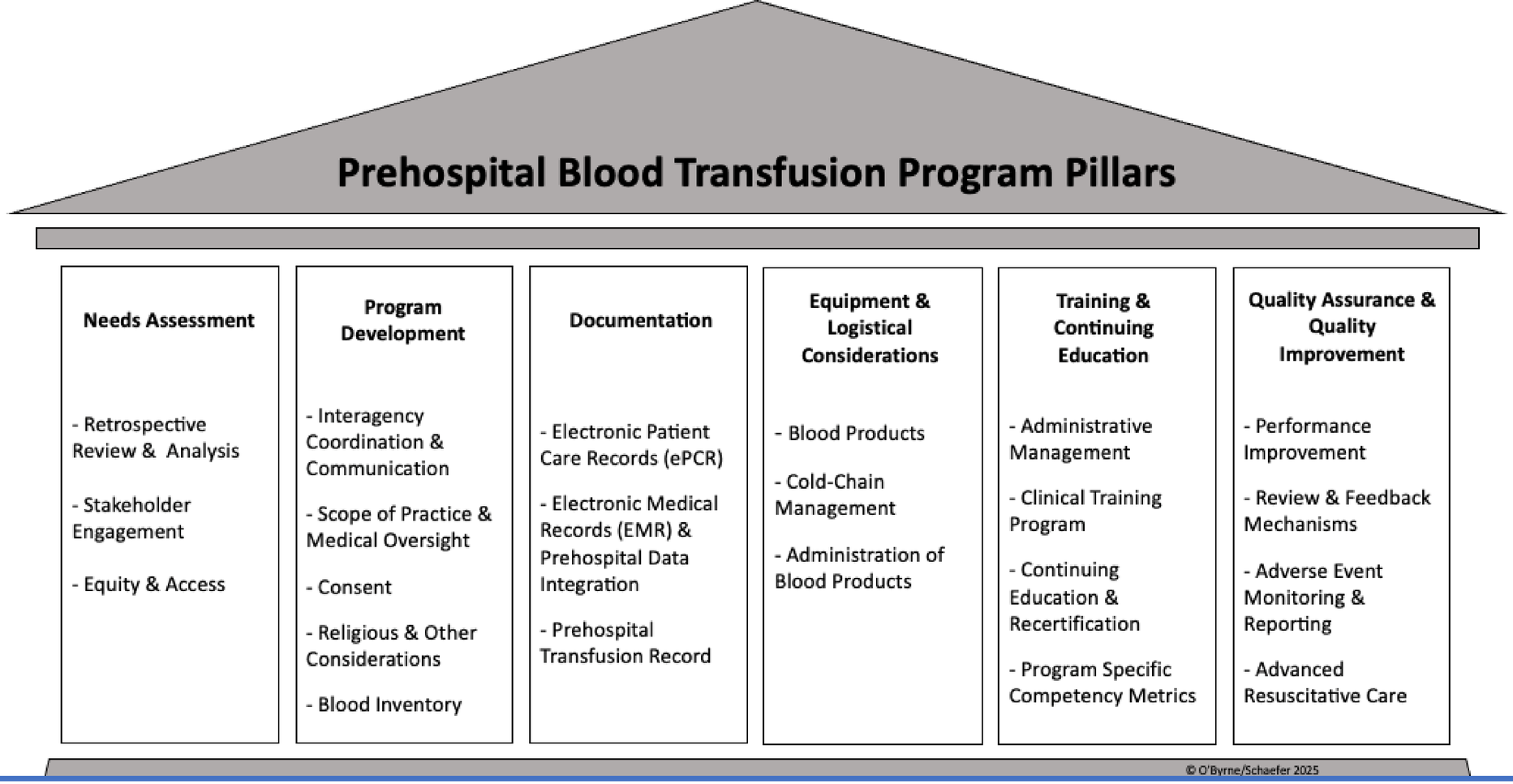
In 2021 with around 70 agencies in the US a group of the of prehospital blood gurus, under the leadership of Dr. Mark Yazer, came up with our 4 Pillars to help guide progress in a rapidly growing prehospital environment. This ultimately led to the following paper

THOR-AABB Working Party Recommendations for a Prehospital Blood Product Transfusion Program

Mark H Yazer 1 , Philip C Spinella 2 , Eric A Bank 3 , Jeremy W Cannon 4 , Nancy M Dunbar 5 , John B Holcomb 6 7 , Bryon P Jackson 8 , Donald Jenkins 9 , Michael Levy 10 , Paul E Pepe 11 12 , Jason L Sperry 13 , James R Stubbs 14 , Christopher J Winckler 15

Abstract

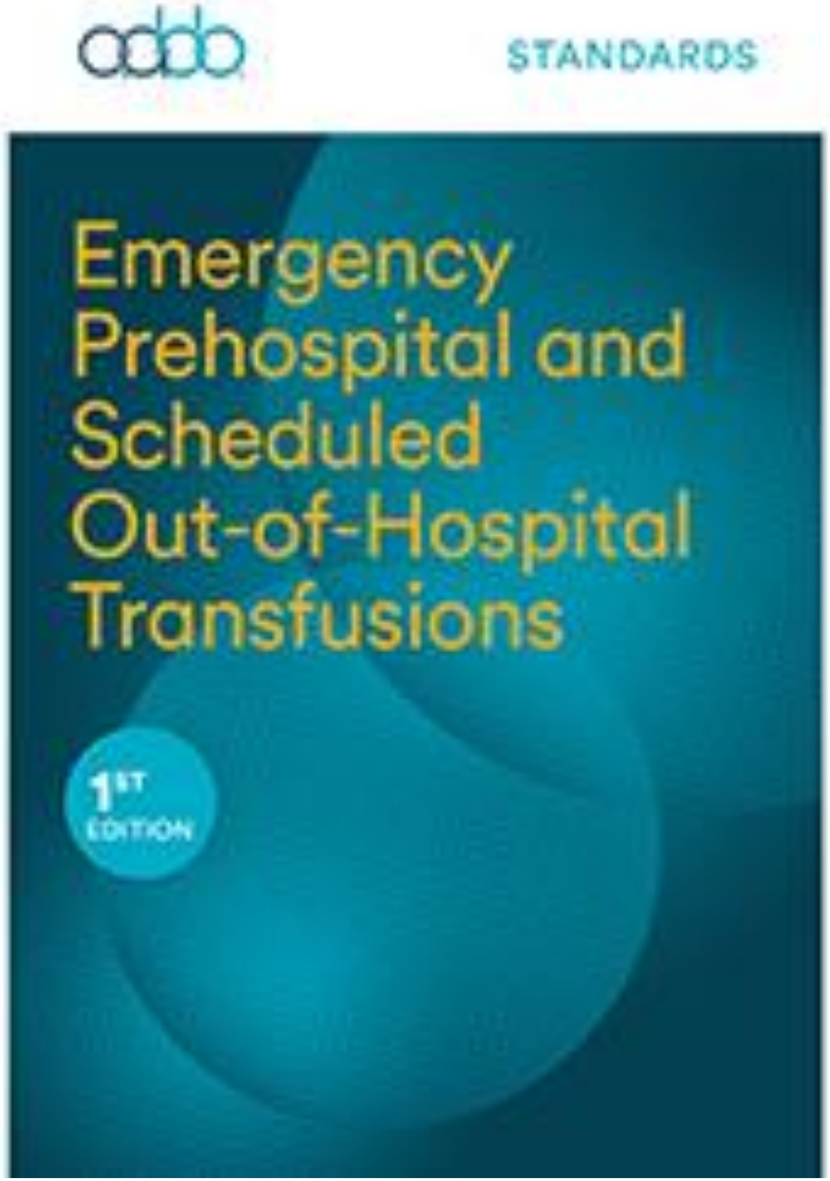
- The evidence for the lifesaving benefits of prehospital transfusions is increasing. As such, emergency medical services (EMS) might increasingly become interested in providing this important intervention. While a few EMS and air medical agencies have been providing exclusively red blood cell (RBC) transfusions to their patients for many years, transfusing plasma in addition to the RBCs, or simply using low titer group O whole blood (LTOWB) in place of two separate components, will be a novel experience for many services. The recommendations presented in this document were created by the Trauma, Hemostasis and Oxygenation Research (THOR)-AABB (formerly known as the American Association of Blood Banks) Working Party, and they are intended to provide a framework for implementing prehospital blood transfusion programs in line with the best available evidence. These recommendations cover all aspects of such a program including storing, transporting, and transfusing blood products in the prehospital phase of hemorrhagic resuscitation.



In 2025 with around 250 agencies in the US a group of prehospital blood gurus, under the leadership of my very good friend and colleague Holly O'Bryne , Lt. DC Fire and EMS/Whole Blood Coordinator came up with our 6 Pillars to help guide progress in a rapidly growing prehospital environment. What is now close to 380 US ground EMS Agencies. This too will be published as part of the up and coming RDCR Text Book

Combined Effort

- EMS
  - Providers
  - Medical Directors
- Blood Bankers
- Transfusion Medicine
- Trauma Surgery
- Emergency Medicine
- Anatheisa
- Nursing
- Former Military
- FDA
- CLIA
- AABB
  - Staffers
  - Members

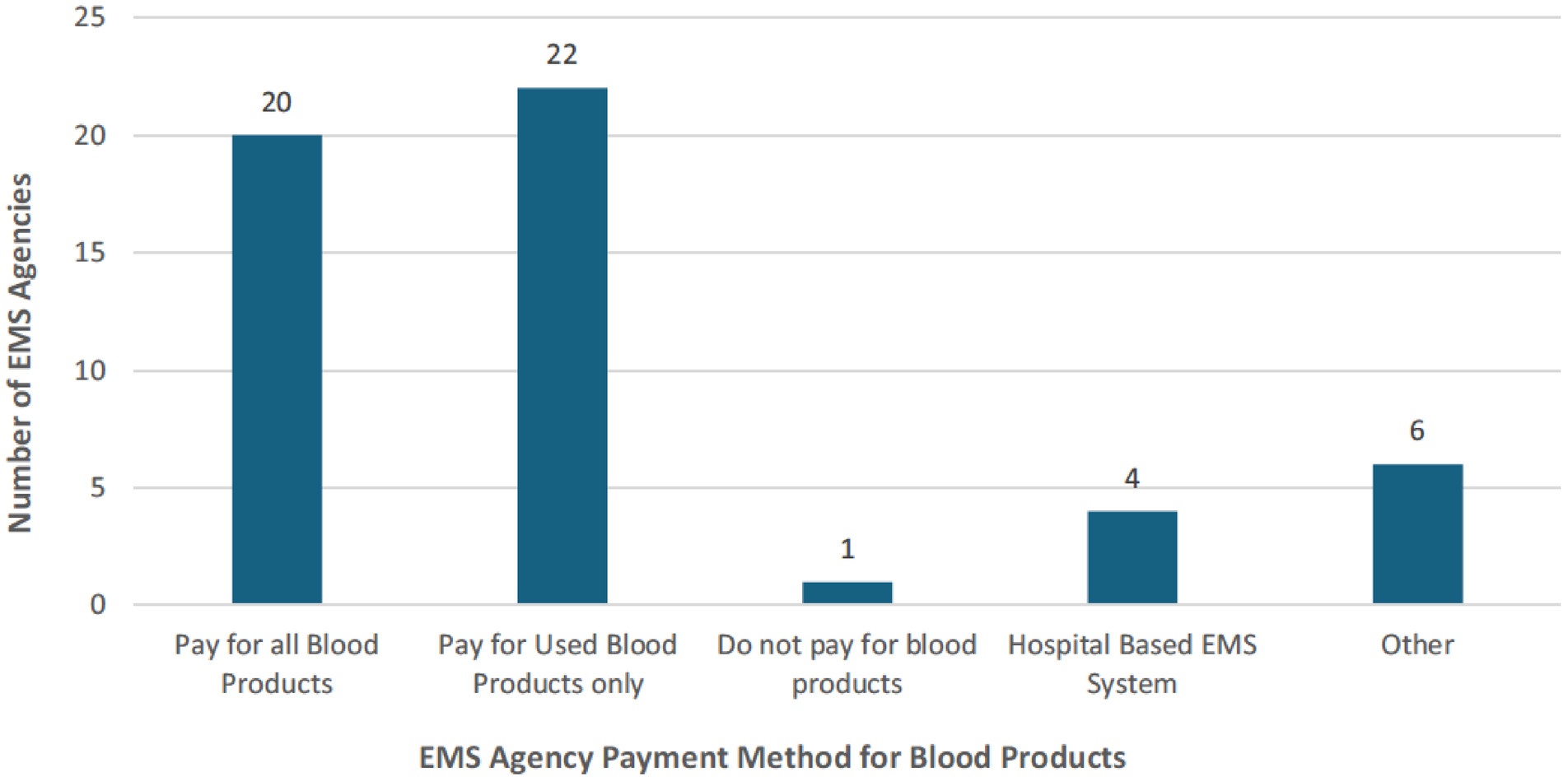


What about the Dollars

CMS AMBULANCE SERVICE

BLOOD & MONEY

EMS Agency Payment Method for Blood Products



Hurson T, Schaefer R, Carico C, Griffin R, Bank E, Krohmer J, et al. Evaluating reimbursement for prehospital blood transfusions: A nationwide survey. *Transfusion*. 2025; 65(Suppl. 1): S6–S13. https://doi.org/10.1111/trf.18217

SCHAEFER CONSULTING

SUCCESS ..... Almost !!!

In Jan of 2025, CMS added Prehospital Blood was added to the EMS ALS-2 bundle

-So what did this mean for EMS:

Patients who need a blood transfusion become part of the ALS-2 Bundle

Most patients sick enough too need a transfusion, are typically ALS-2

EMS transfusion cost is 1500-1800 per patient

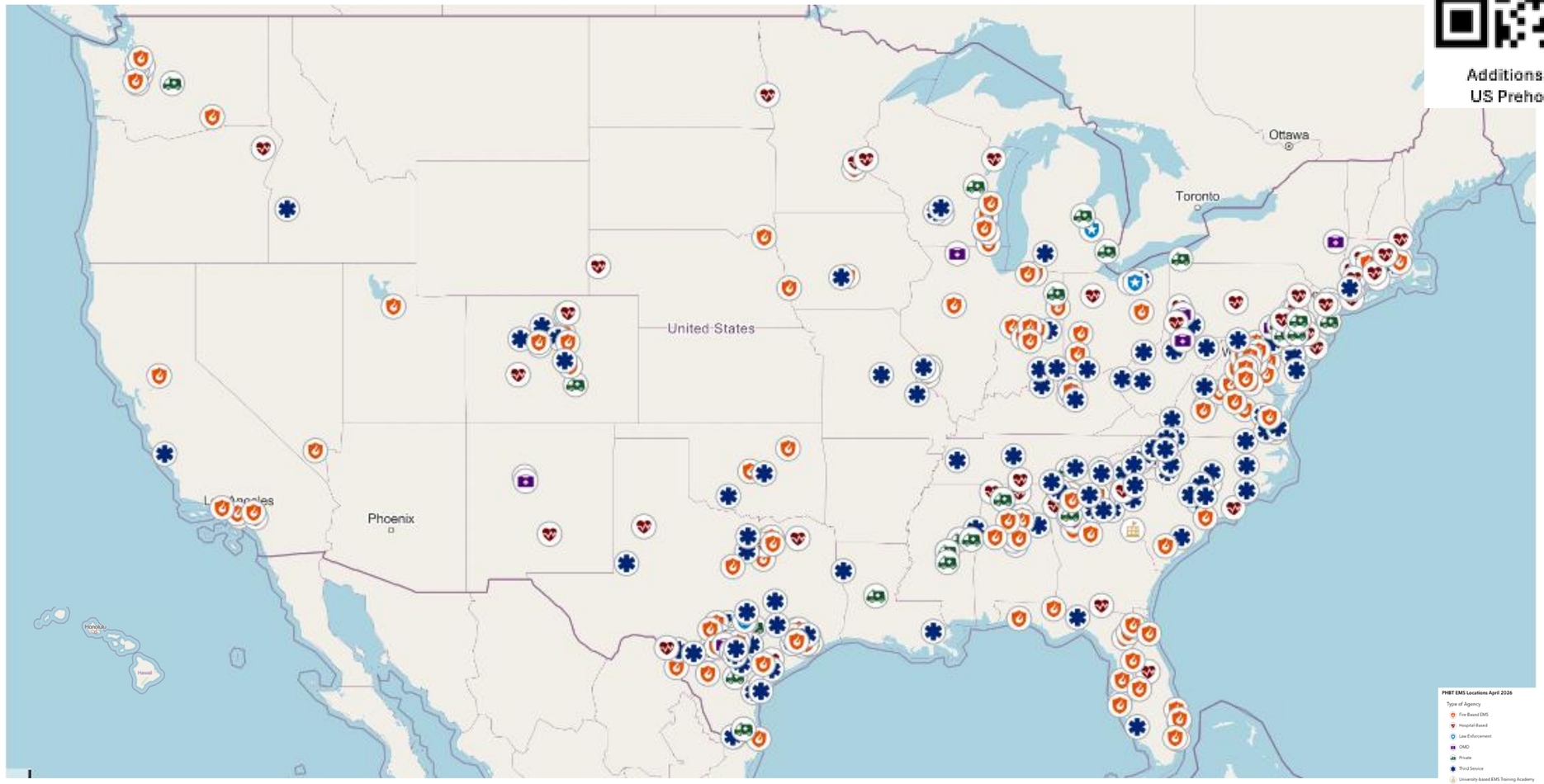
ALS-2 National Reimbursement averages 750.00

PHBTC Map June 1 , 2026

The Road Map to 400 +!!!

Link to
PHBTC Map

Additions or Corrections to
US Prehospital Blood Map



Moving The Pendulum of Resuscitation

Juan C Duchesne MD MPH FACS FCCM FCCP
Professor of Surgery
Division Chief and Trauma Medical Director
Department of Surgery, Division of Acute Care Surgery
University of Mississippi Medical Center

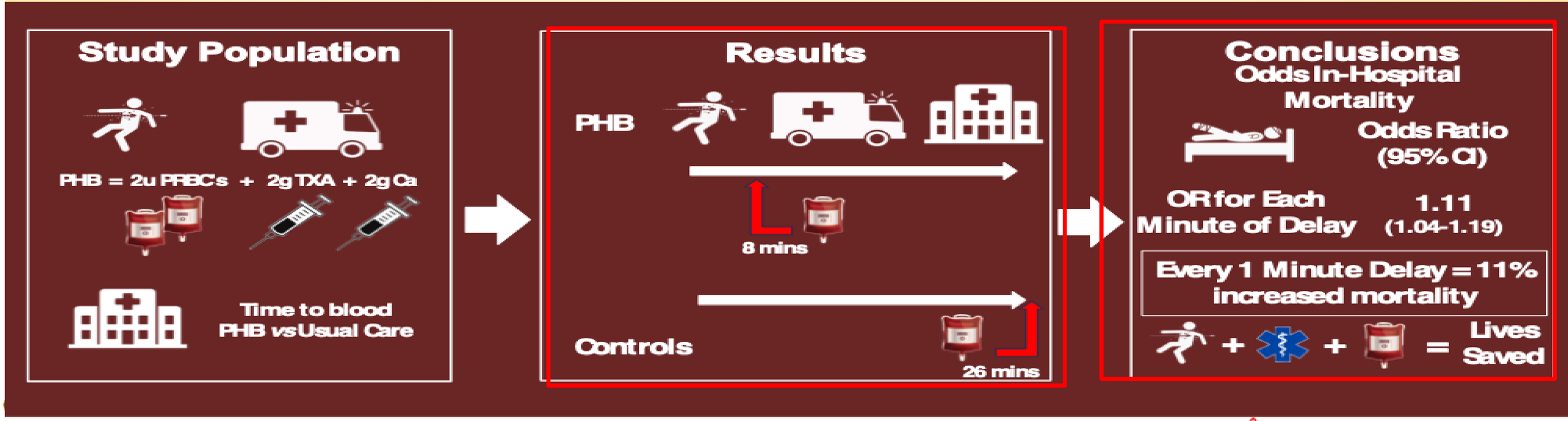
DISCLOSURES

None.

No relationship with Big Blood, Big Trauma, or Big Helicopter.

Just a strong belief that hemorrhage kills—and minutes matter.

Every Minute Matters: Extending the Continuum of Care Through Early Prehospital Blood Administration



Duchesne J, McLafferty BJ, Broome JM, et al. Every minute matters: Improving outcomes for penetrating trauma through prehospital advanced resuscitative care. *J Trauma Acute Care Surg*. May 1, 2024.

Author twitter handles: @Tulane_Surgery; @JakeBroome; @MarkPiehl

Western Trauma Association

11% mortality increase for each minute delay to blood administration. Early interventions such as PHB may help minimize "dead zones" in trauma care by bringing effective resuscitation closer to the point of injury.

Western Trauma Association 2024: Scalea Award Winner

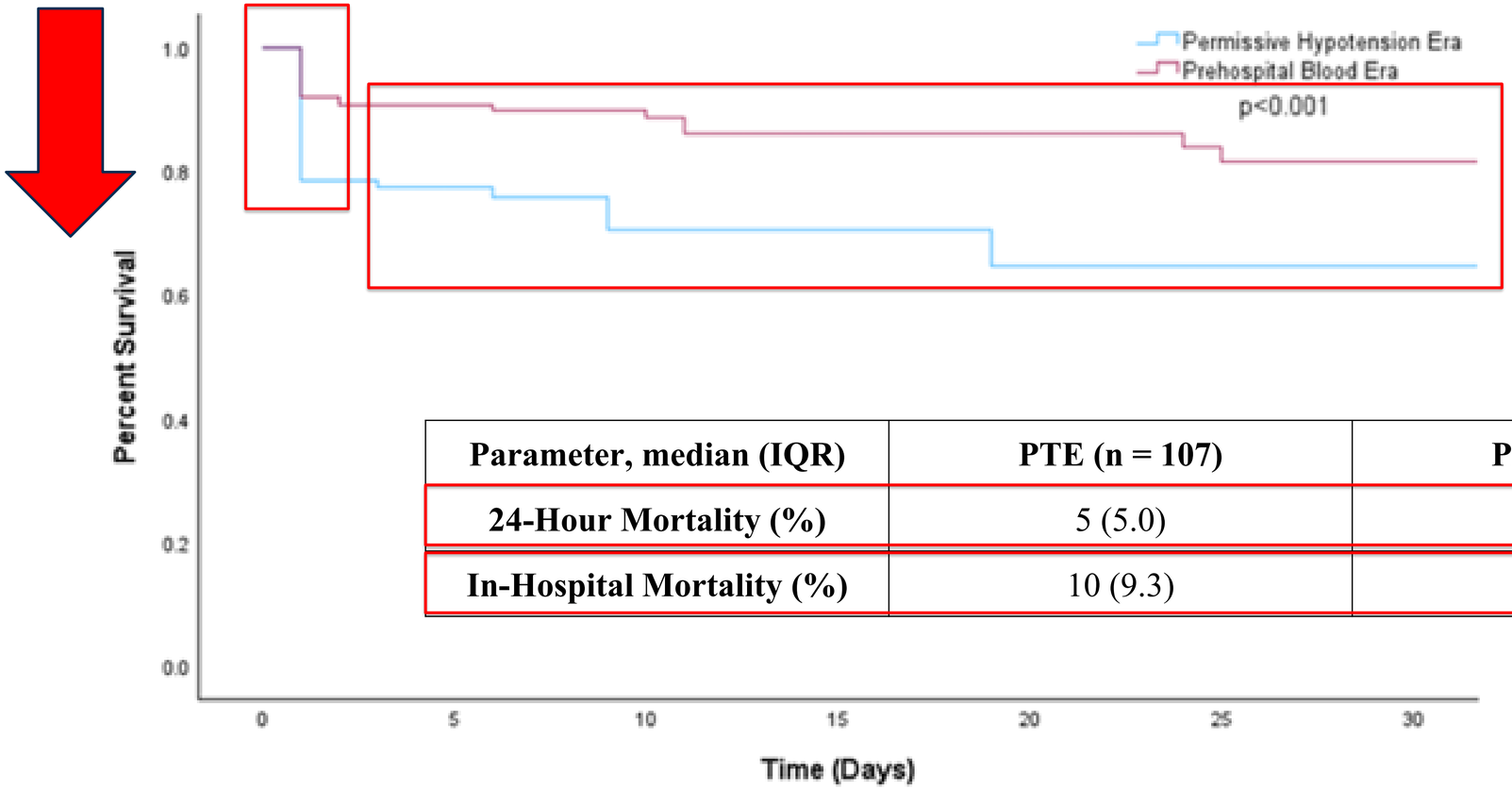
Normotension Saves Lives: Challenging Permissive Hypotension in the Prehospital Blood Era

**Jacob M Broome MD, Alyscia Severance MD, Coleman Johnson MD,
Sydney Caputo MD, Mark Piehl MD MPH, Thomas Dransfield, Meg Marino MD,
David Rayburn MD, Juan Duchesne MD MPH**

JTACS 2026- Under Review

Results

Early Hemorrhage Mortality



Parameter, median (IQR)	PTE (n = 107)	PH (n = 107)	p-value
24-Hour Mortality (%)	5 (5.0)	20 (18.7)	<0.001
In-Hospital Mortality (%)	10 (9.3)	27 (25.2)	<0.001

SWiFT • TOWAR • PRECISION

What the major 2026 prehospital blood studies tell us

SWiFT

NEJM 2026

DESIGN

- Phase 3, multicenter, unblinded randomized superiority trial
- 10 air ambulance services in England
- n = 616
- Compared up to 2 units of whole blood vs standard component care

KEY RESULT

Primary outcome (death or massive transfusion within 24 h):

48.7% WB vs **47.7%** Standard Care

No superiority signal

TAKE-HOME

Whole blood was not better than standard component therapy in this air-medical system.

TOWAR

NEJM 2026

DESIGN

- Pragmatic multicenter phase 3 open-label cluster-randomized trial
- 44 air-medical bases
- n = 1,020
- Compared up to 2 units of low-titer group O whole blood vs components

KEY RESULT

30-day mortality:

25.9% WB vs **20.5%** Components

Adjusted OR 1.24 (95% CI 0.87–1.76)

No mortality benefit

⚠ Component ratio was not truly 1:1

TAKE-HOME

TOWAR narrows the debate but does not close it.

PRECISION

JACS 2026

Caputo / Duchesne et al.

DESIGN

- Prospective multi-institutional blood analysis
- 9 EMS systems
- n = 339
- Compared prehospital whole blood vs pRBCs

KEY RESULT

Overall, pRBCs were not inferior to WB

Signal favoring WB in blunt trauma

WB reduced subsequent in-hospital transfusion needs

TAKE-HOME

Benefit may depend on injury phenotype, timing, product choice, and transport context.

SYNTHESIS

1. Whole blood is not universally superior to components.

2. Context matters: air-medical system vs ground EMS.

3. Mechanism and phenotype matter: blunt trauma may behave differently.

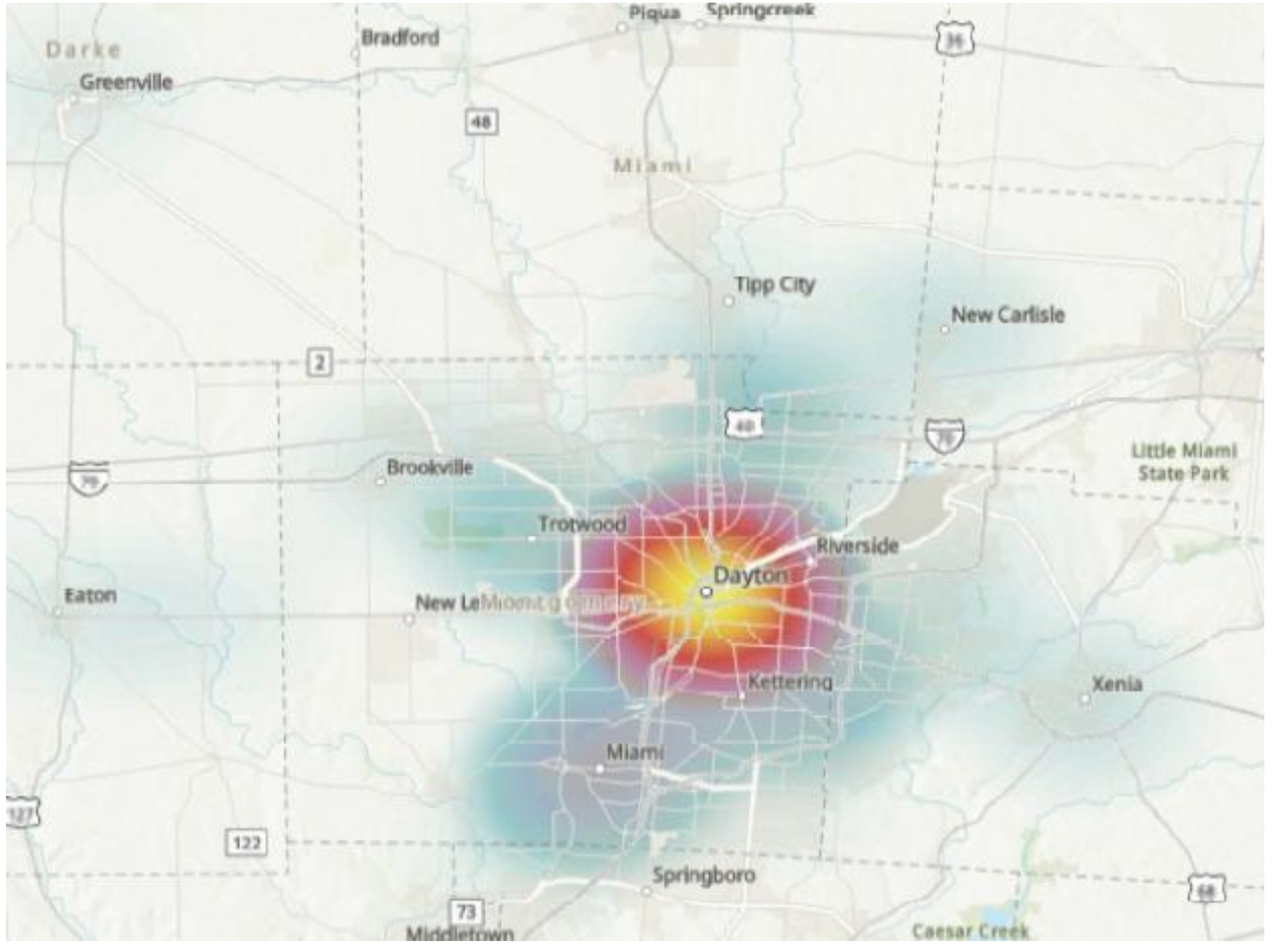
4. Future direction: precision prehospital resuscitation.

BOTTOM LINE: The field may be moving from 'Which product is best?' to "Which patient benefits most, and when?'

Studies summarized: SWiFT (Smith et al., NEJM 2026); TOWAR (Sperry et al., NEJM 2026); Precision Resuscitation (Caputo et al., J Am Coll Surg 2026).

The Rural Mural: Blood in Non-Urban Settings

- James Augustine, MD
- Lee County, FL
- Dayton, OH



5 goals for the Dayton Prehospital and Emergency System Blood Program:

- Blood available in EMS to provide earlier advantageous care to hemorrhagic shock patients with trauma, OB, or medical cause
- Blood products that are in this program cycled to allow for essentially zero waste
- Net reduction in the overall blood needs in the region, based on the number of units administered to resuscitate shock patients, and reduced use of mass transfusion protocols.
- Costs of the program minimized by regional base, hard costs of the program shared by the EMS system and the hospitals
- Common public education program which increases blood donations

Regional Basis for Rural Program

- Greatest need area based on long transport times for trauma, OB, or medical patients
- Blood products cycled with multiple units circulating in the region, and those units being cycled back into the trauma centers, to avoid wastage, and reducing costs, while expanding the number of eligible patients
- Blood sited in supervisor units with flexibility to travel, but frequency for confidence in use
- Costs of the program minimized by a regional base, the ability to charge for blood when used in either the prehospital care or in the resuscitation bays
- A common public education program which increases blood donations

Access: Blood Bank and Governance Board

- Assure blood product availability, shelf life, and reduction in wastage, acknowledging that some increased wastage may occur without coordination and emphasizing the importance of strategies such as cycling near-expiration blood through trauma centers
- Clear governance and guardrails to prevent fragmented implementation, ensure equitable access to blood products, and maintain a truly regional program rather than parallel independent efforts
- ***A Blood Program Oversight Group*** to oversee the program, with hospitals, EMS, and Fire Chiefs appointing members. This group oversees policies and procedures, and assists with overseeing the finances.

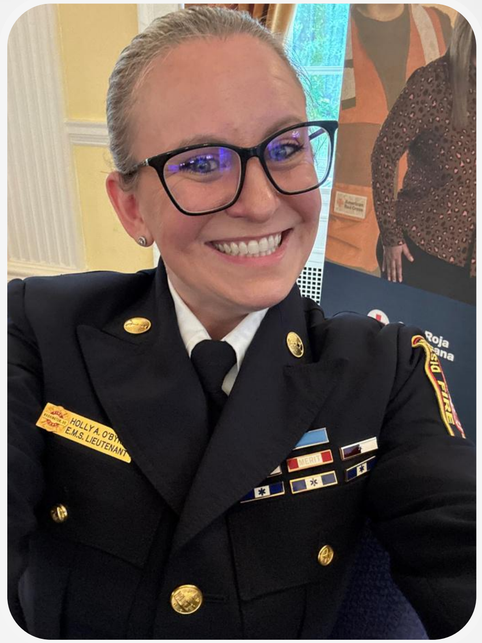
Protecting Women: How We Should be Navigating the Rh Factor Issue

Holly O'Byrne, NRP, MPA, Lieutenant/Paramedic, DC Fire and EMS
Randi Schaefer, DNP, RN, ACNS-BC, CEN, Schaefer Consulting LLC

DISCLOSURES

Holly O'Byrne:
No commercial relationships or conflicts of interest to disclose

Randi Schaefer:
Clinical Consultant – 410 Medical, QinFlow, TacMed



What Programs Need To Do

AABB Section 1 Organization, Subsection 1.1.1 – Medical Director Qualification The Transfusion Administration Service shall have a medical director who is a licensed physician and qualified by education, training, and/or experience in activities required by these *Prehospital and Out-of-Hospital Standards.*

The medical director shall have responsibility and authority for all medical and technical policies, processes, and procedures, and for the support services that relate to the care and safety of the transfusion recipients.

Do Women Want Blood?

A review of attitudes to urgent RhD-positive transfusions in female patients and the risk for hemolytic disease of the fetus and newborn

2026 Guidelines

The THOR Network Best Practices for Females of Childbearing Potential with Life-Threatening Hemorrhage: Guidance for Emergency Medical Services and Hospitals

Females of Childbearing Potential and Life-Threatening Hemorrhage

What's the Problem?

- Hemorrhage remains a leading cause of preventable death.
- Prehospital blood programs continue to expand.
- Concerns regarding RhD alloimmunization can create hesitation in blood product selection.
- Providers are often forced to balance immediate survival against potential future pregnancy risks.

The RhD Dilemma

Transfusion of RhD-positive blood to an RhD-negative female may result in:

- Alloimmunization
- Future pregnancy complications
- Hemolytic disease of the fetus and newborn (HDFN)

However:

- Not every exposure results in alloimmunization.
- Not every alloimmunized patient becomes pregnant.
- Not every pregnancy results in HDFN.

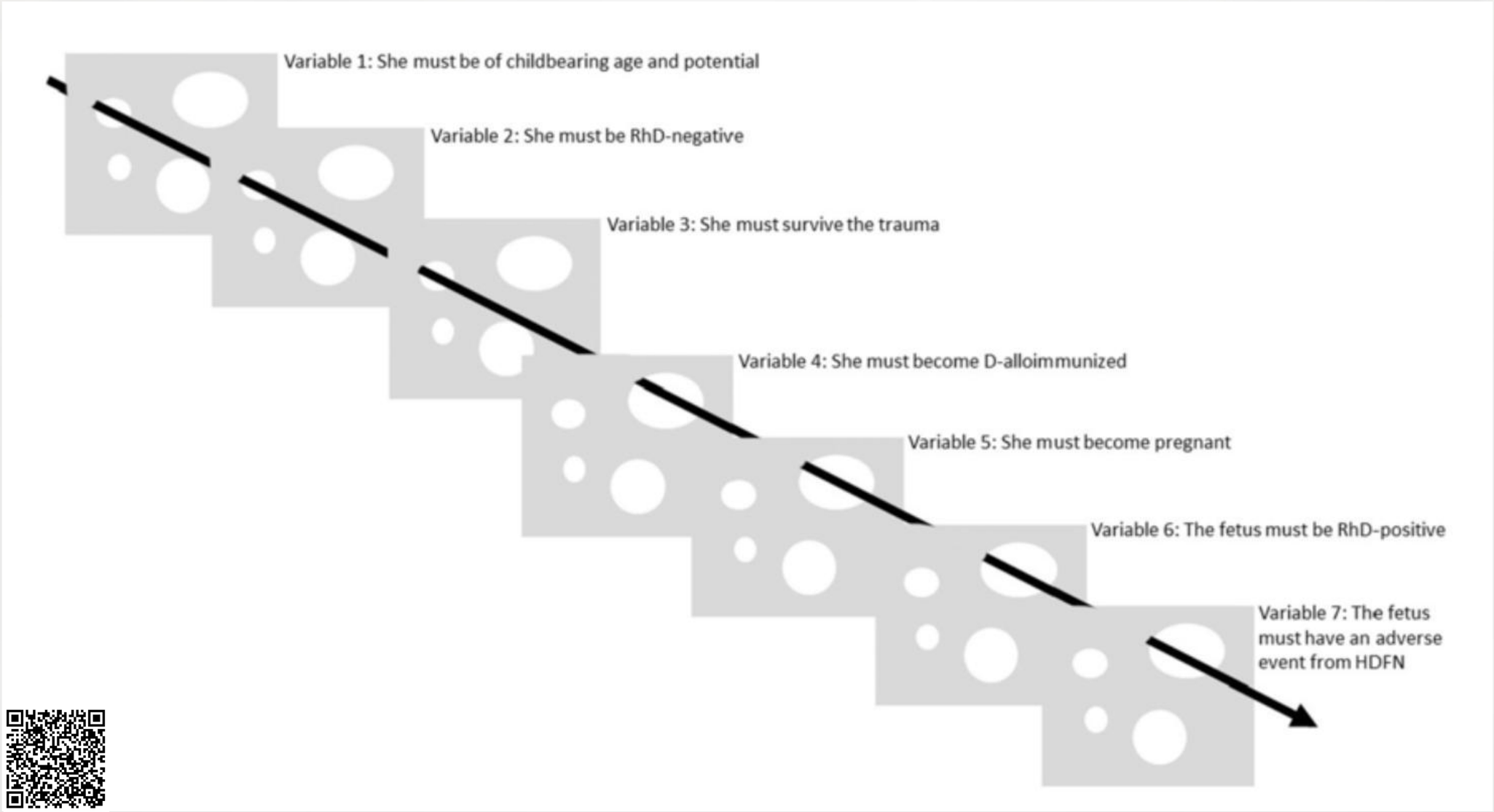
The Core Recommendation

Treat the Hemorrhage First

- Blood product availability should not delay transfusion.
- Life-threatening hemorrhage takes precedence over theoretical future risk.
- Systems should develop policies that support rapid blood administration.

The patient in front of you comes first.

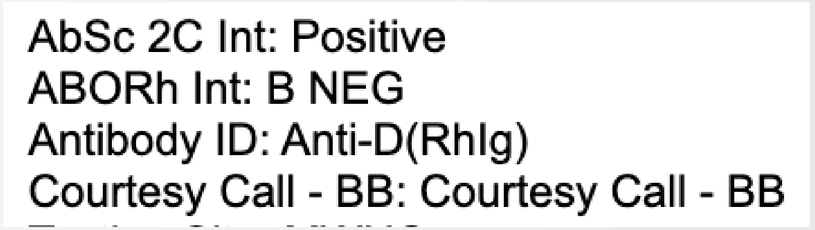
The Swiss Cheese Model



What Programs Need To Do

Successful systems should establish:

- Clear transfusion policies
- Documentation requirements
- EMS-to-hospital communication
- Patient notification processes
- Follow-up pathways
- Quality improvement review



What Programs Need To Do

PLACE PATIENT STICKER HERE

Prehospital Blood Product Transfusion Record

Patient Name:	DCFEMS Incident #:	Receiving Facility MRN:

ISBT Donation Number (Affix sticker below)	Product Type	Transfusion Date & Start Time	Transfusion Complete (Check One)	Transfusion Reaction (Check One)	WBT Initials
1. Affix Sticker Here or Write Unit #	LTOWB		Yes Ongoing	Yes No	
2. Affix Sticker Here or Write Unit #	LTOWB		Yes Ongoing	Yes No	
3. Affix Sticker Here or Write Unit #	LTOWB		Yes Ongoing	Yes No	
4. Affix Sticker Here or Write Unit #	LTOWB		Yes Ongoing	Yes No	

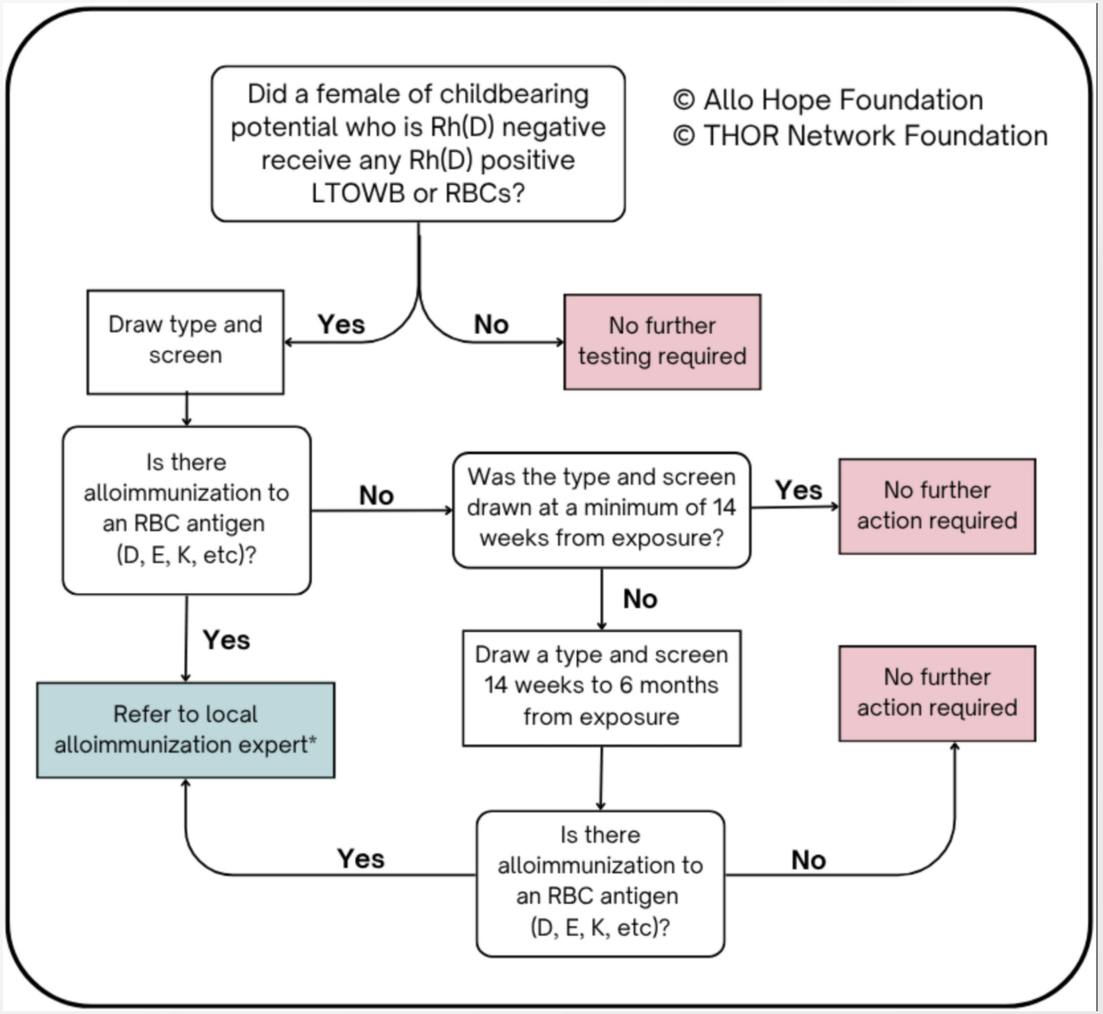
Transport Unit #:	EMSS Unit #:	Field Transfusionist (WBT) *(Printed Name and DC Health Cert #)*	Field Transfusionist Assistant *(Printed Name and DC Health Cert #)*
	EMS____		

Receiving Facility (Check One):	Comments:
☐ @H02 – CHILDREN'S NATIONAL MED CNTR ☐ @H04 – MEDSTAR TRAUMA ☐ @H05 – HOWARD UNIVERSITY HOSPITAL ☐ @H07 – GEORGETOWN UNIVERSITY HOSPITAL ☐ @H08 – GEORGE WASHINGTON UNIV HOSPITAL ☐ @H12 – SIBLEY MEMORIAL HOSPITAL ☐ @H13 – WASHINGTON HOSPITAL CENTER ☐ Other: _____	

Blood Bag and Form given to: _____ *PRINTED NAME*

_____ *SIGNATURE*

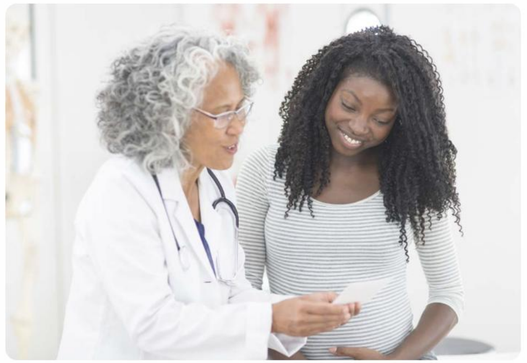
White Copy: *DC Fire and EMS*
Yellow Copy: *ED/Trauma Center*
Pink Copy: *Blood Bank/Transfusion Services*



ALLO HOPE
FOUNDATION

Empowering Patients to Advocate for the Right Care

Provider Checklist



Find a Doctor

Letter to Providers

View all Advocacy Resources

Hospital Roadmap

How I do it: An Institutional Protocol for the Management of RhD Negative Women who Receive RhD Positive Blood

QUESTIONS?

Randi Schaefer

Holly O’Byrne

Aggressive Calcium Chloride Dosing Reduces Early Mortality in Trauma Patients Receiving Whole Blood Resuscitation

Aashish Rajesh M.B.B.S., Lauren Barry, B.S. , David Limon M.D., Prem Patel B.S., Sondra Epley, B.S.N., Kristi Hargrove, Pharm D., Daniel Giddings, Pharm D., Joshua Tobin M.D., Brian Eastridge M.D., Susannah Nicholson M.D.,

Donald Jenkins M.D.

Present by David Miramontes MD

UT Health San Antonio

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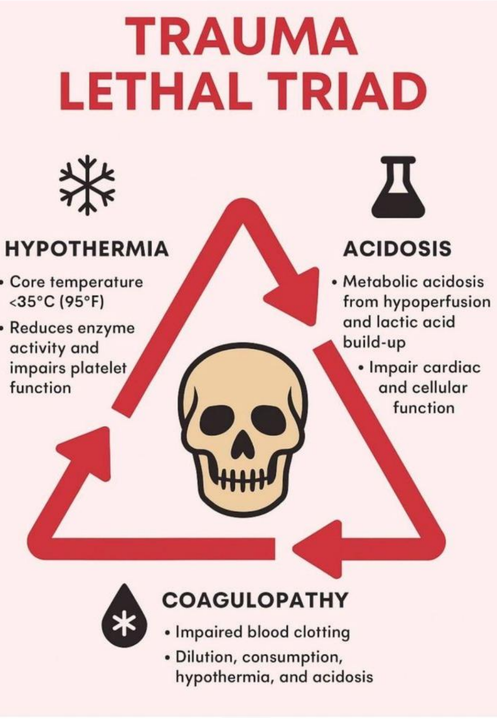
Background

- Hemorrhagic shock – leading cause of preventable trauma death
- Present paradigm – early resuscitation with blood (minimize crystalloid)
- Hypocalcemia in trauma – multifactorial – citrate chelation, intracellular shifts due to ischemic tissue
- >50% trauma patients have hypocalcemia on admission[1,2] ***(65% in UH Study population)***
- ***70-90% patients getting Transfused are HypoCalcemic !!!!!!***



1. Webster S, Todd S, Redhead J, Wright C. Ionised calcium levels in major trauma patients who received blood in the Emergency Department. *Emerg Med J EMJ*. 2016;33(8):569-572. doi:10.1136/emermed-2015-205096

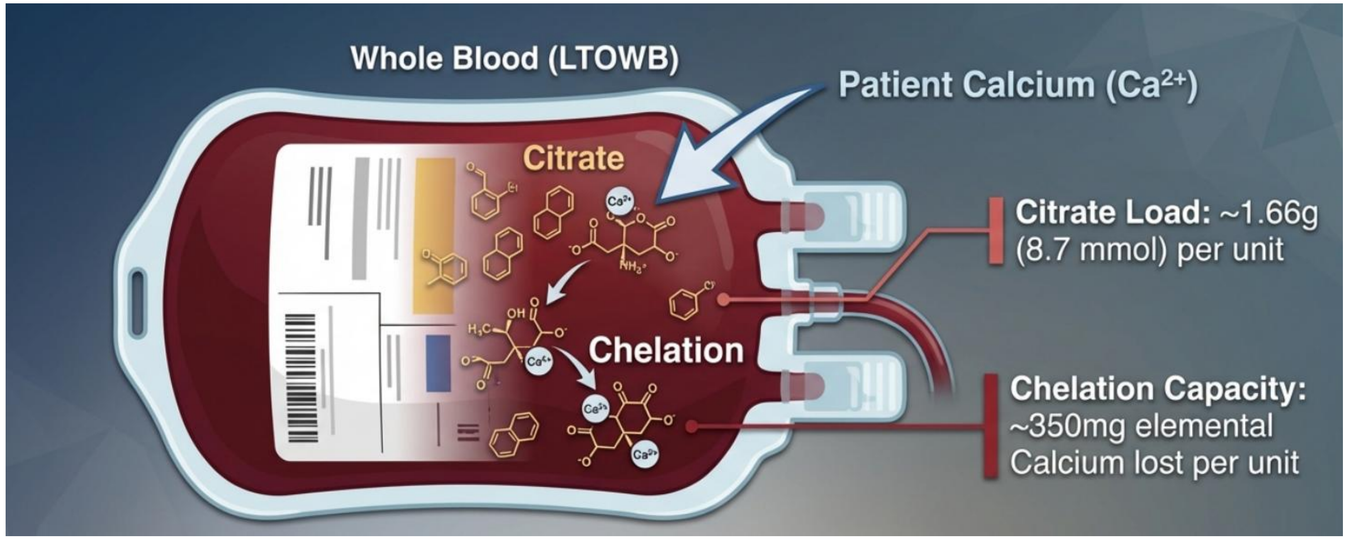
2. Magnotti LJ, Bradburn EH, Webb DL, et al. Admission ionized calcium levels predict the need for multiple transfusions: a prospective study of 591 critically ill trauma patients. *J Trauma*. 2011;70(2):391-395; discussion 395-397. doi:10.1097/TA.0b013e31820b5d98

Discussion

- CPDA stored blood has approximately 1.66g (8.7 mmol) of citrate per unit

- Calcium binds citrate in 1:1 molar ratio (1 mmol calcium = 40mg elemental calcium)

- Each unit of whole blood therefore chelates 8.7mmol (350mg) elemental calcium



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Aggressive Calcium Chloride Dosing Reduces Early Mortality in Trauma Patients Receiving Whole Blood Resuscitation

Methods:

- Retrospective cohort study (2020 – 2023)
- Assess ideal early (4-hour) ratio of Ca:LTOWB
- Ratios defined as:

1. Continuous variable
2. Mutually exclusive groups (grams/unit)
3. Threshold ratios (≥ 1g:2u, ≥ 1g:3u , ≥ 1g:4u)

Chloride and Gluconate formulations assessed

Results:

- Calcium chloride to LTOWB ratio was associated with reduction in odds of 24-hour mortality (saOR=0.23[0.06–0.88], p= .032)
- Threshold dosing $CaCl_2$:LTOWB at ≥1g/2 units produced an 84% reduced odds of 24-hour mortality (saOR = 0.164 [0.034-0.796], p=.025), a result that neared significance when restricting analysis to patients receiving ≥2 units of LTOWB

Conclusion:

Calcium chloride at ratio of **≥1g** per 2 units of LTOWB showed association with improved survival and may represent a clinically relevant target for resuscitation in trauma hemorrhagic shock

Rajesh A et al. *Journal of Trauma and Acute Care Surgery*.
DOI: 10.1097/TA.0000000000005009

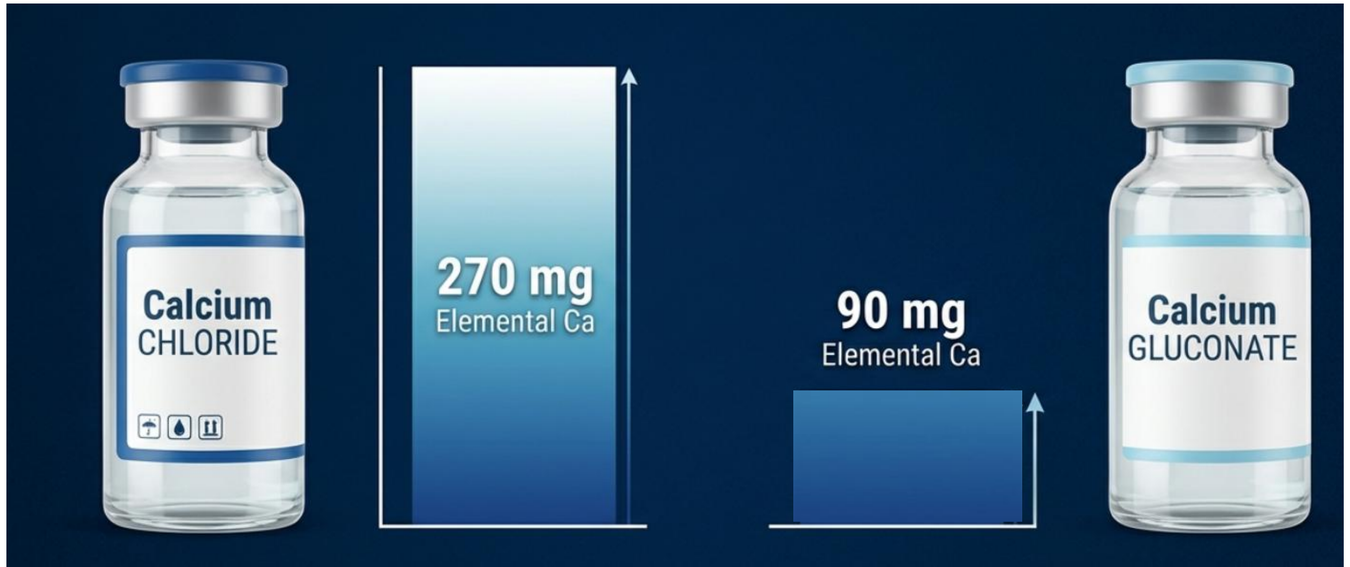
@JTraumAcuteSurg

The Journal of Trauma and Acute Care Surgery®

Conclusions

- In trauma patients receiving LTOWB and calcium <4 hrs. arrival Calcium chloride at a ≥1g per 2 units ratio optimized the reduction in 24-hour mortality (84%)

- ≥1g CaCl2 per 2 units of LTOWB dosing protocol may be a relevant target during resuscitation of trauma patients with hemorrhagic shock



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Questions

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UT Health San Antonio
Emergency Health Sciences
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