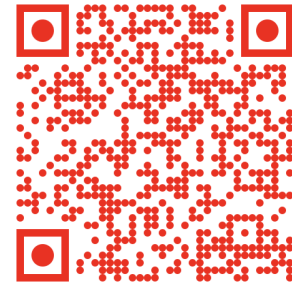


Scaling Prehospital Blood Access: Supply, Rotation, and Cost Implications for a National EMS Strategy

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Disclosures

MJL is a consultant with Stryker, GMR, Abbott, Bound Tree and Cressilon. He is the Chair of the Stop the Bleed Coalition. Any opinions expressed by MJL are his own and do not represent any government agency or organization.

PPY is a consultant for Fresenius Kabi and Cerus. Any opinions expressed by PPY are her own and do not represent of the American Red Cross

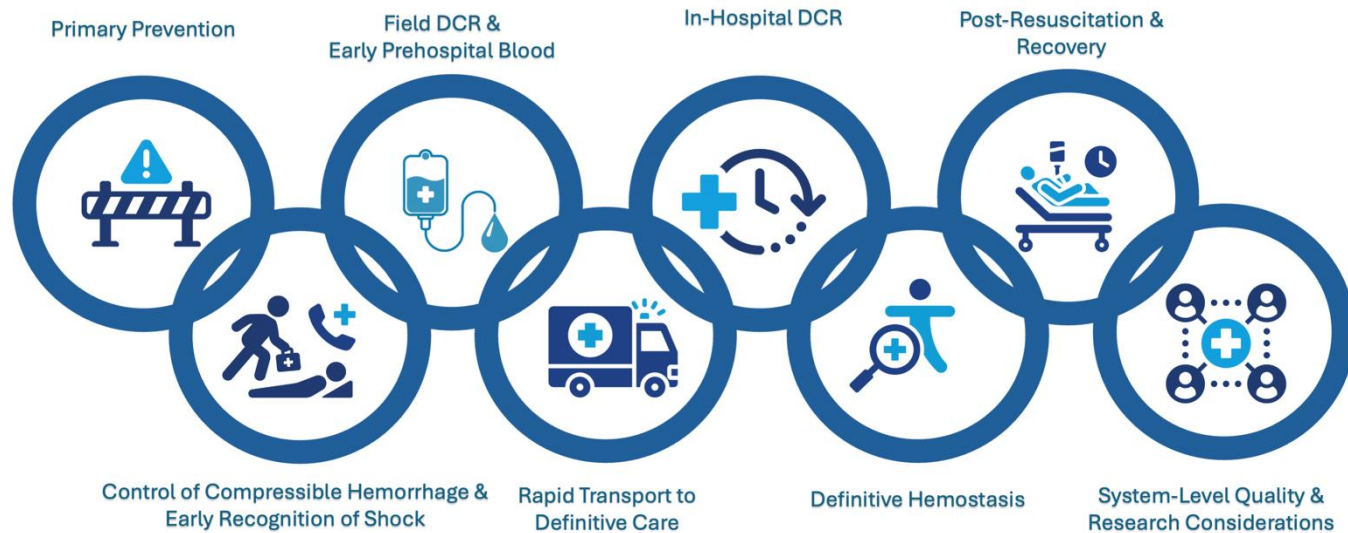
The Problem: A Critical Gap in Access to Care

Why It Matters

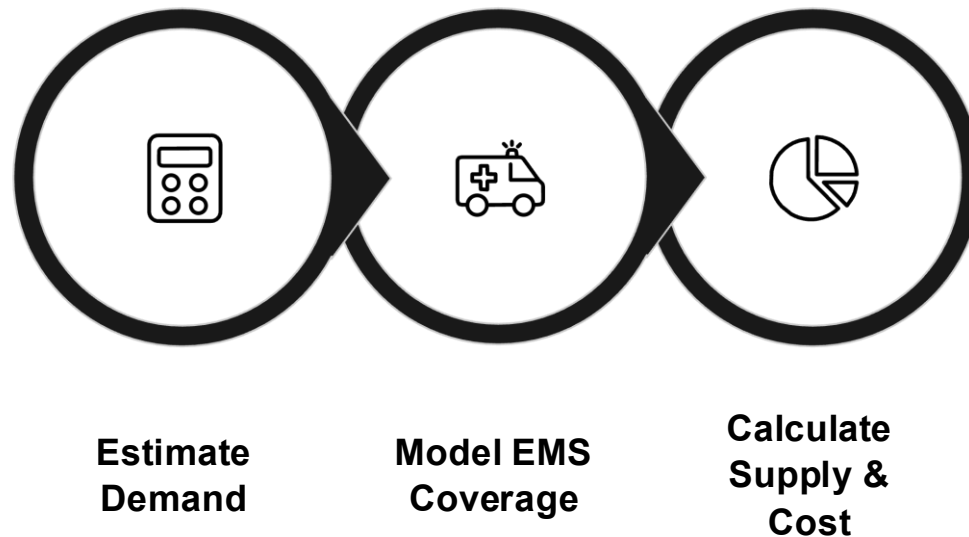
Traumatic hemorrhage is the **leading cause of preventable prehospital death**. Early transfusion improves survival by 10–30% in high-risk populations yet only ~3% of U.S. ground EMS agencies currently carry blood products.

The Knowledge Gap

No national-level guidance exists on what broad EMS implementation would require for **blood supply, donor recruitment, hospital rotation, logistics, or cost** — a critical gap for policymakers and health systems leaders.



Study Objective & Design

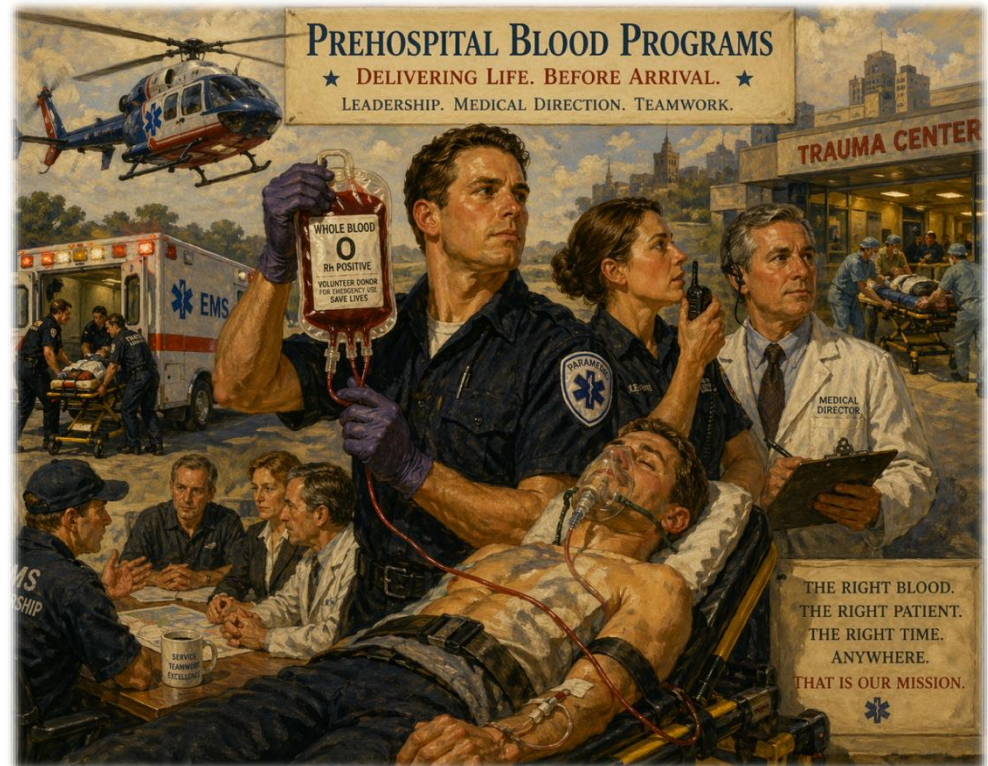


A deterministic systems-flow model linked trauma epidemiology with blood center manufacturing, EMS operational data, and cost inputs, providing the first quantitative national framework for prehospital transfusion feasibility.

Goal of Modeling “What Would it Take?”

Exercise To Determine Supplying Blood Products

- The model uses **42,472 EMS stations** as the potential for a national deployment unit.
- It compares:*
- **Targeted deployment:**
 - 10% of stations, about **4,200**
- **Broader deployment:**
 - 50% of stations, about **21,000**



* Deployment is envisioned as “blood on every ambulance”, rather it is targeted system design

Key Model Assumptions

450,000

Annual prehospital transfusion events
(300K trauma + 150K non-trauma)

42,472

Total U.S. EMS stations with at least one
vehicle; 2 units carried per blood-

36%

Annual prehospital blood utilization rate
(conservative, field-validated)

75%

EMS agencies assumed to participate in
hospital rotation programs

Two products modeled independently:

Low-Titer Group O Whole Blood (LTOWB) at \$550/unit, and

Liquid Plasma (LP) at \$65/unit.

Rationale Behind The Model's Assumptions

Targeted Deployment (10%)

Covers ~4,200 EMS stations



Expanded Deployment (50%)

Covers ~21,000 EMS stations



Over 97.4% of U.S. population lives within 25 minutes of a EMS station

Most prehospital hemorrhage deaths occur within 30 minutes



Why These Thresholds?

- 10% represents a targeted, realistic rollout to high-priority systems. 50% represents broad national coverage.
- Both scenarios were evaluated for LTOWB and LP independently across supply, discard, donor, and cost dimensions.

Headline Numbers of Blood Products

EMS Measure	LTOWB				
	Routine # of LTOWB Units Shipped	LTOWB Units Transfused	Total # LTOWB Units Shipped	LTOWB Rotated	Total # LTOWB Units Collected
50% EMS Station Coverage	757,000	225,000	982,000	551,000	1,100,000

- **10% deployment**
 - LTOWB collected: about **220,000**
 - LP collected: about **148,000**
- **50% deployment**
 - LTOWB collected: about **1.1 million**
 - LP collected: about **741,000**

Hospital Rotation: A Critical Lever

With 75% Rotation

Discard is substantially mitigated. Units not transfused in the field rotate into hospital inventory before expiration preserving the blood supply and financial viability.

Without Rotation (0%)

At 50% deployment: **~478,000 LTOWB** and **~364,000 LP** units discarded annually. Even at 10%, discard reaches ~96,000 LTOWB and ~73,000 LP units rendering large-scale expansion unsustainable.



Key Takeaway:

Blood availability requires a process and a system

Discard Impact: Rotation vs. No Rotation

Key Insight

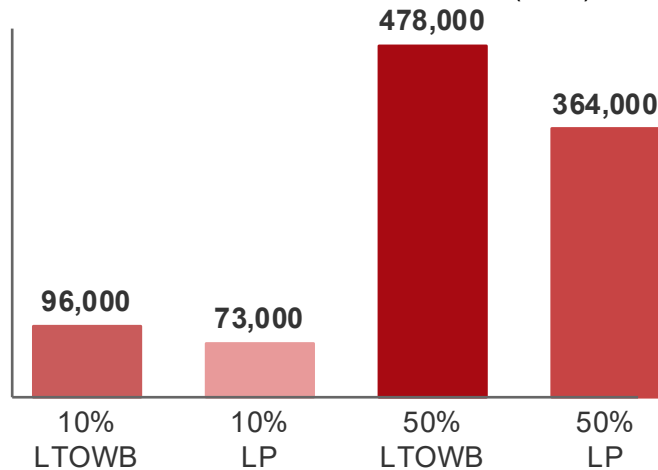
Without hospital rotation, discard volumes would place a **major strain on national blood supply**.

Integrated EMS–hospital–blood supplier partnerships are structurally essential to any viable national program.

Without Rotation Partners

(discard escalates quickly)

Annual discard without rotation (units)



At 50% deployment without rotation, discard reaches nearly half a million LTOWB units per year.

Without hospital rotation, large-scale implementation becomes inefficient and likely unsustainable.

Donor Implications

110K

New Donors Needed

At 10% EMS deployment
to sustain LTOWB supply

550K

New Donors Needed

At 50% EMS deployment
— a structural supply
constraint

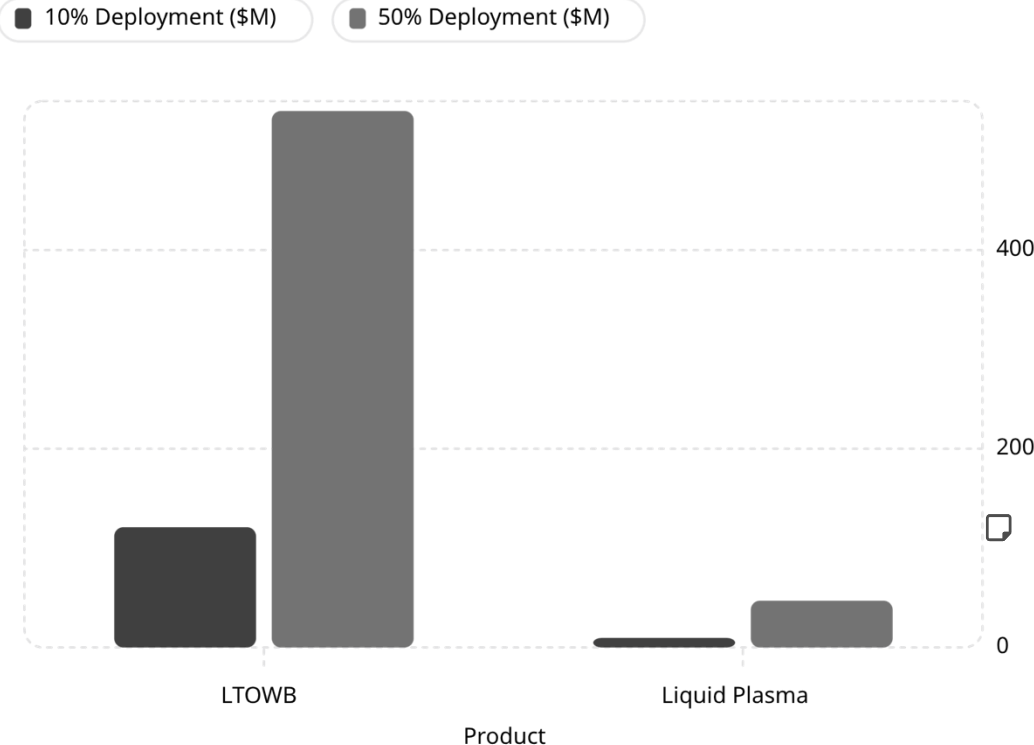
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New LP Donors Needed

LP volumes met via
redistribution from existing
whole blood collections

LTOWB donors face **stricter eligibility** (low anti-A/anti-B titers $\leq 1:200$, aspirin avoidance) and donate less frequently than standard donors — creating a structural bottleneck absent for LP.

Cost Considerations: LTOWB vs. Liquid Plasma



A Stark Contrast

At 50% deployment, LTOWB costs exceed **\$540 million annually** vs. **~\$47 million for LP**; an 11× difference driven by per-unit cost (\$550 vs. \$65) and donor infrastructure requirements.

At 50% deployment, LTOWB readiness costs ~\$2,400 per transfusion-ready event — before accounting for survival benefit.

Study Limitations

→ **Model Inputs**

Utilization rates and rotation participation based on published estimates; may vary across EMS systems.

→ **Single-Product Scenarios**

LTOWB and LP modeled independently; mixed-product strategies and system-level operational burden not evaluated.

→ **Excluded Costs**

EMS training, staffing, refrigeration, and regulatory compliance costs not included — total expenditures would be higher.

→ **Static Model**

Results reflect current practices; future advances in blood products or logistics may alter projections.

Equity & Access Considerations



Regions with **strong hospital partnerships and high donor density** are better positioned to implement and sustain prehospital transfusion. Rural and resource-limited areas, often those with **longer transport times and highest potential benefit**, face the greatest barriers.



Without coordinated planning and investment, national expansion risks **exacerbating existing disparities** in access to prehospital transfusion.

The Path Forward: A Hybrid Strategy



LTOWB Donor Recruitment

Targeted campaigns for eligible group O donors meeting low-titer criteria: essential at any deployment scale.

EMS–Hospital Rotation

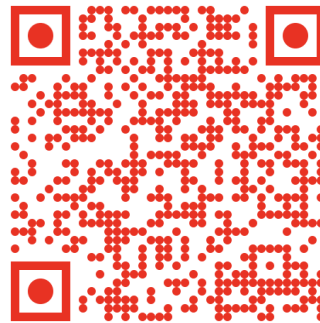
Integrated regional rotation systems are a must: without them, discard and cost render expansion unsustainable.

Strategic LP Deployment

Liquid plasma offers a cost-effective, donor-neutral complement to LTOWB: especially in resource-limited or rural settings.

Summary

- Even conservative rollout ≈ 0.6 -0.65 M units/yr
 - *Blood availability requires a process and a system.*
- Rotation partnerships essential, particularly for use of LTOWB
 - *The operational burden sits between the blood center and the patient.*
- Federal funds needed to scale.
 - *Availability Is Not the Same as Access.*



Conclusions

Feasible — But Demanding

National prehospital transfusion is achievable but requires 148K–1.1M units annually and up to **550,000 new LTOWB donors** at 50% deployment.

Rotation Is Essential

Hospital–EMS rotation partnerships are critical to mitigating discard and preserving blood supply integrity at scale.

Hybrid Strategy Recommended

A combined LTOWB + LP approach tailored to transport times, geography, and donor availability offers the most sustainable and equitable path to national adoption.



Thank you



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