VALIDATION OF THE FIELD AI TRIAGE ALGORITHM IN SPECIAL OPERATIONS SURGICAL TEAMS FOR MCE

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2026 Military Health System Research Symposium (MHSRS)

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Chobanian & Avedisian School of Medicine

BOSTON MEDICAL CENTER

Non-Disclosure

- No conflicts of interest to disclose

Trauma Triage Impact on Medical Actions

Triage Near the Point of Injury

- Improved patient survivability
- Informed stabilizing treatment

Identify Required Resources

- Efficient blood and surgical resourcing
- Prioritized medical evacuation (MedEvac)

Sustain Patients in the Field

- Prolonged life when MedEvac unavailable
- Improved long-term patient outcome

Trauma triage provides critical combat casualty decision support information

Combat Casualty Care Chain

Role 1: Point of Injury Treatment
- Provide medical treatment
- Initial trauma care
- Basic resuscitative care

Role 2: Advanced Emergency Care
- Provide medical treatment
- Advanced trauma management
- Advanced resuscitative care
- Emergency surgery

Role 3: Specialty Care
- Provide specialty medical treatment
- Advanced trauma management
- Advanced resuscitative and intensive care

Role 4: Definitive Care
- Role 3 specialty care topics
- Large capacity for mass casualty treatment / recovery
- In-patient hospital beds for specialized long-term care

minutes | hours | days

Battalion Aid Station | ***Forward Surgical Teams*** | ***Combat Support Hospitals*** | ***NDMS: CONUS Facilities***

Military Services | Defense Health Agency | VA / Civilian

CONUS: Contiguous United States
NDMS: National Disaster Medical System

Field Decision Support During Denied Access

Role 1: Point of Injury Treatment
- Provide medical treatment
- Initial trauma care
- Basic resuscitative care

Role 2: Advanced Emergency Care
- Provide medical treatment
- Advanced trauma management
- Advanced resuscitative care
- Emergency surgery

- **Heightened complexity of patient care over days**
- **Current process highly manual and dependent on written forms**

CONUS: Contiguous United States
NDMS: National Disaster Medical System

Field AI Triage (FAIT) System Architecture

FIRST RESPONDER RESPONSE

CONTEXTUAL INFORMATION

AUDIO*

AUDIO OR WEARABLES

PHYSIOLOGICAL SIGNALS & VITALS

Example First Responder Input

"Twenty-nine-year-old male. Gunshot wound to the left lower chest. Only one ballistic wound is appreciated. Initial vitals, heart rate of 132, blood pressure of 84 over 52, respiratory rate of 30, …"

** Leveraging hands-free bone conduction microphone*

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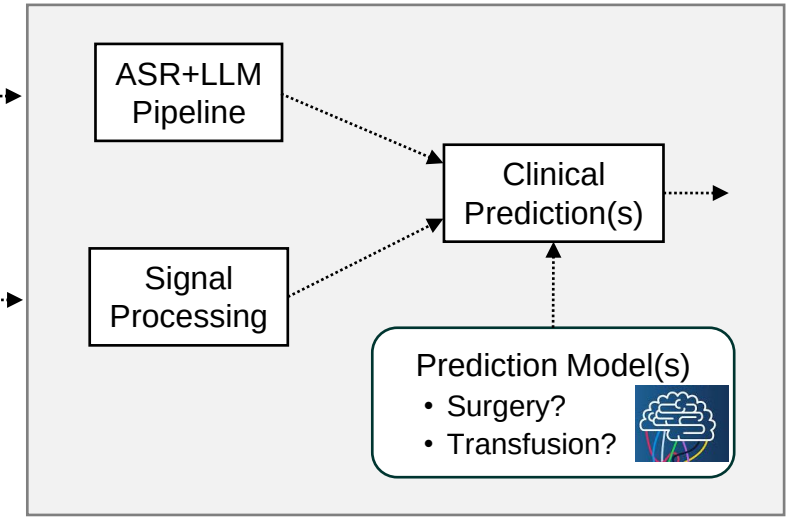
INGESTION PIPELINE & ANALYTICS



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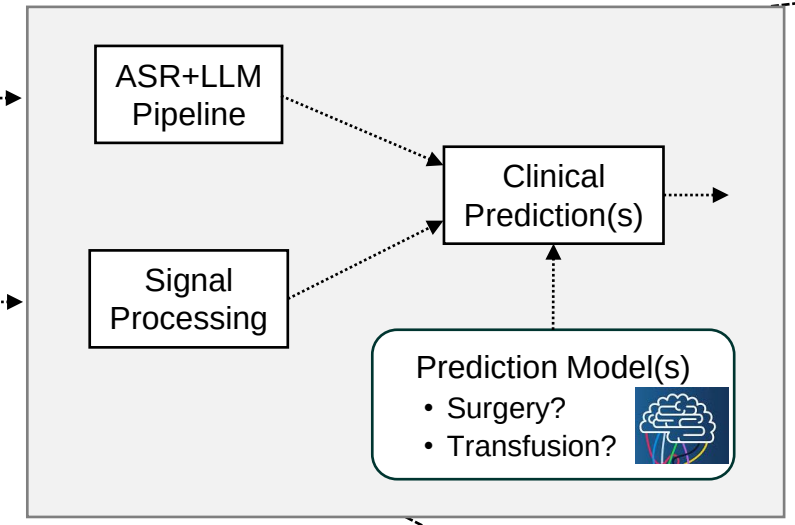
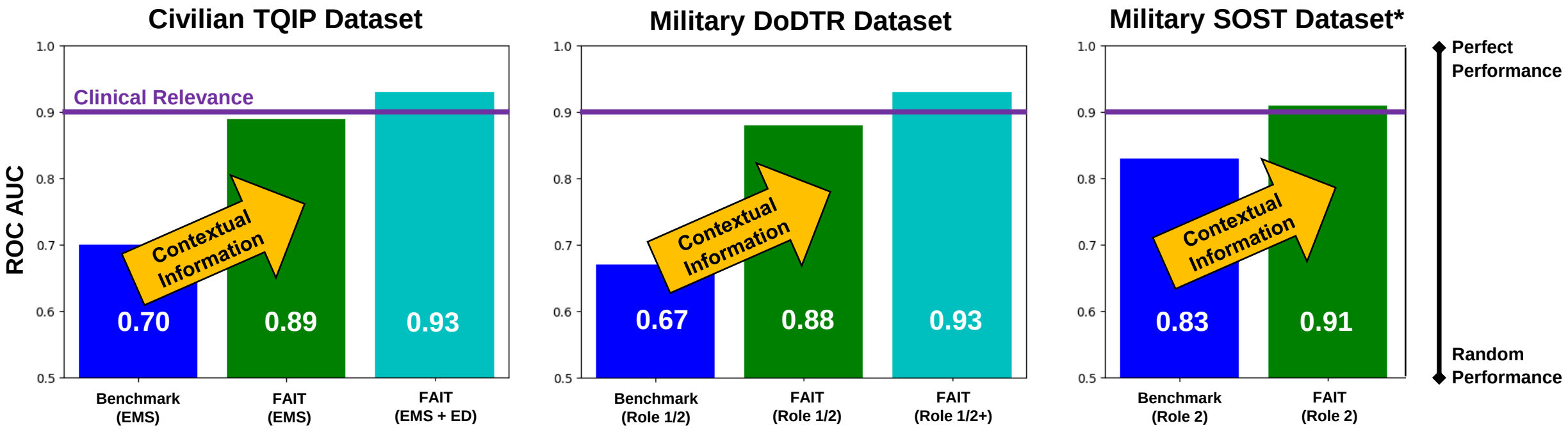


ANDROID App

Developing a fieldable capability that enables frontline clinicians to make objective decisions

ASR: Automatic Speech Recognition
LLM: Large Language Model

Previous Work: Massive Transfusion Prediction Performance



*No data available to support Role II+ analysis

FAIT performance approaches clinical significance

ROC: Receiver Operator Characteristic
AUC: Area Under the Curve

DoDTR: DoD Trauma Registry
SOST: Special Operations Surgical Team
TQIP: Trauma Quality Improvement Program

Analysis Aim

Evaluate the Field Artificial Intelligence Triage (FAIT) algorithm in predicting **transfusion** and **operative needs** for trauma patients in an **austere mass casualty event (MCE)** combat setting

Analysis Methods

- **Patient population**: Military and civilian subjects involved in mass casualty events (MCE) and treated by a SOST team in a Role-2 setting during the years 2017 and 2019

- **Field AI Triage (FAIT) Algorithm**
  - Inputs: vitals, sex, visible external injuries, mechanism of injury, E-FAST
  - Clinical Predictions: Transfusion (>0 & >4 Units), Exploratory Laparotomy, Thoracostomy

- **Experimental Paradigm**
  - 5-fold cross validation leveraging a logistic regression classifier
  - Median imputation of missing values
  - Evaluation: Receiver Operating Characteristic (ROC) and ROC Area Under the Curve (AUC)

Data Characterization

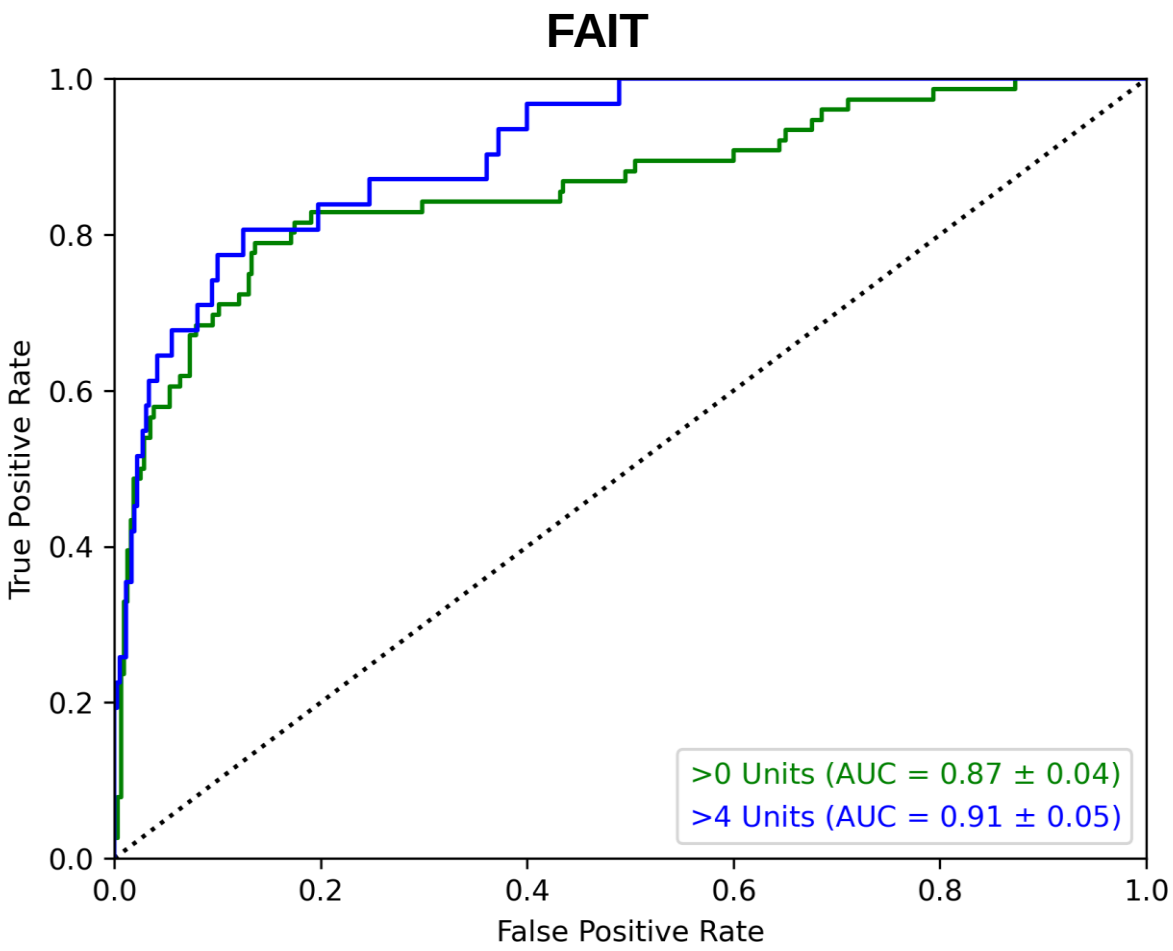
Demographics	
Patients	391 Total *340 Male* *51 Female*
Mass Casualty Events	37

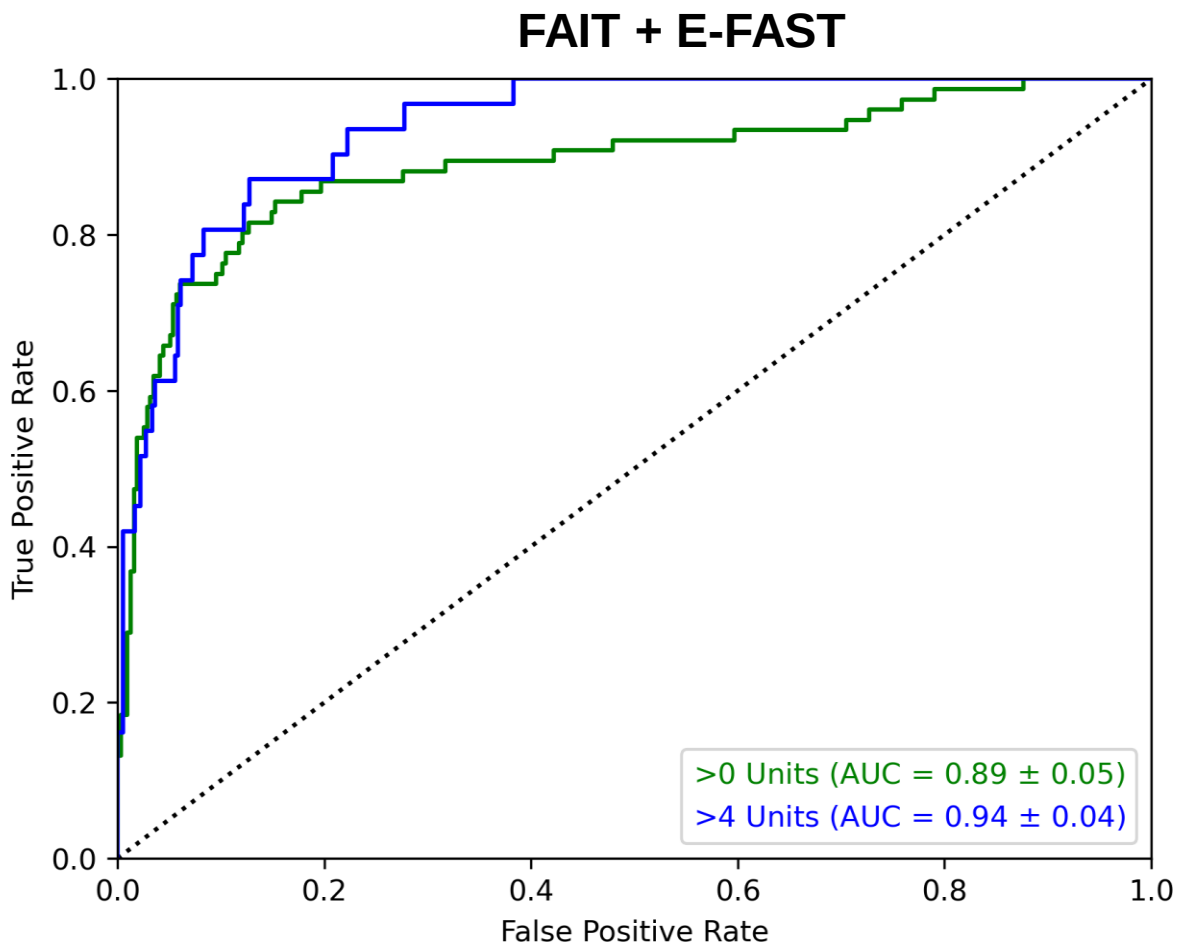
Transfusions	
Units per MCE	10.6
Units per pt	1.00
> 0	76 (19.4%)
> 4	31 (7.9%)

Mechanism of Injury	
Blunt	10 (2.6%)
Penetrating	144 (36.8%)
Blast	194 (49.6%)
Mixed	43 (11%)

Procedures	
Thoracostomy	44 (11.3%)
Exploratory Laparotomy	39 (10%)
Cricothyroidotomy	3 (0.8%)
Fasciotomy	5 (1.3%)
REBOA	5 (1.3%)
Thoracotomy	9 (2.3%)

Results: Transfusions



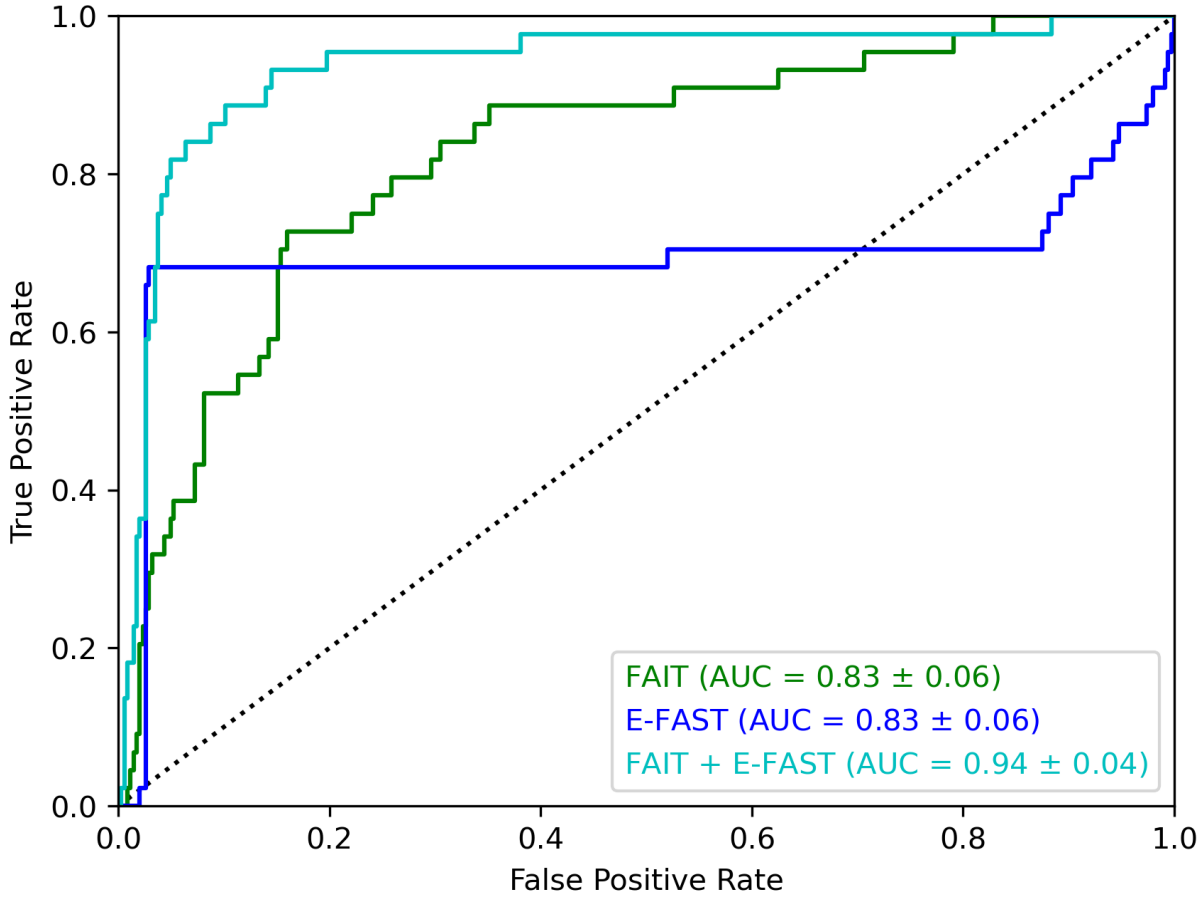


FAIT: Field AI Triage

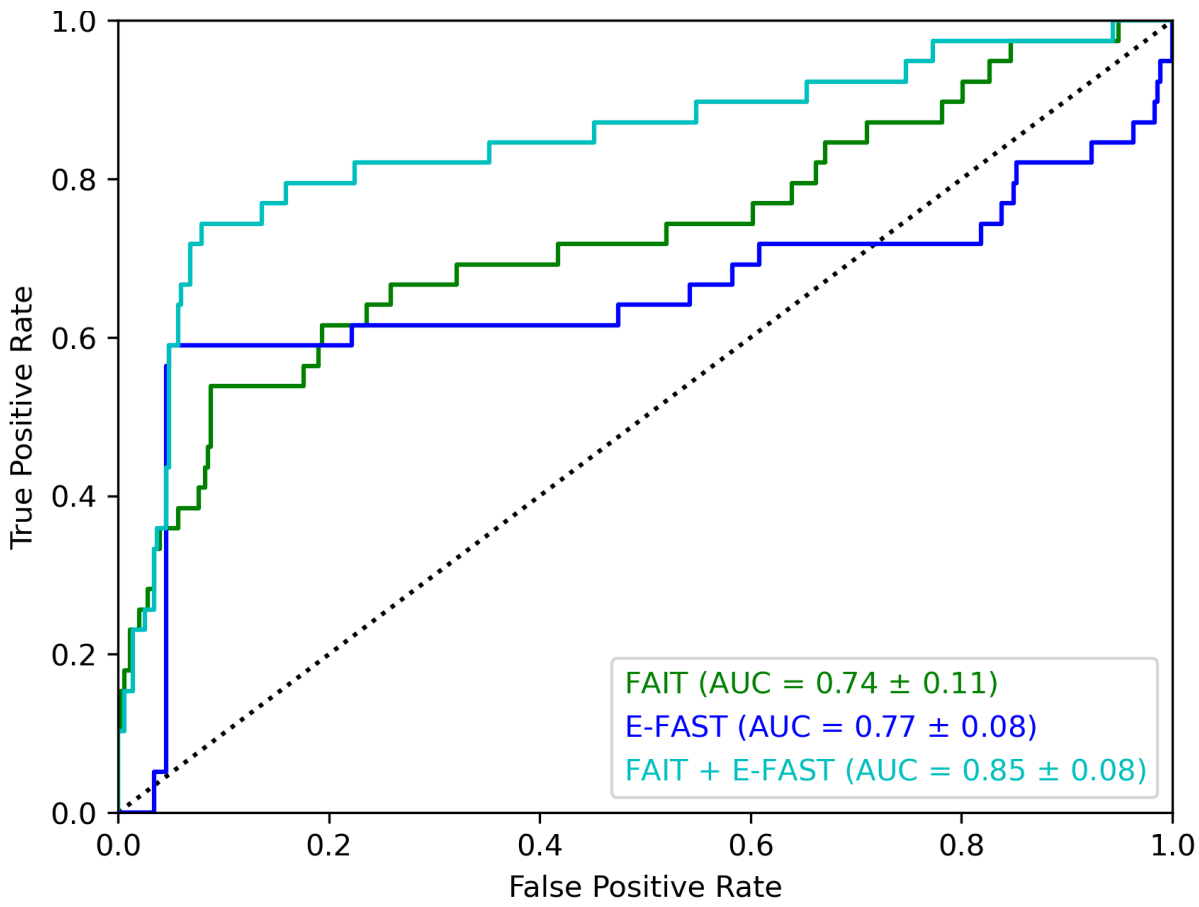
AUC: Receiver Operating Characteristic (ROC) Area Under the Curve
E-FAST: Extended Focused Assessment with Sonography in Trauma

Results: Surgeries

Thoracostomy



Exploratory Laparotomy*



*Exploratory laparotomies are often used diagnostically in SOST environments

SOST: Special Operations Surgical Team
FAIT: Field AI Triage
AUC: Receiver Operating Characteristic (ROC) Area Under the Curve
E-FAST: Extended Focused Assessment with Sonography in Trauma

Analysis Limitations

- Limited power due to small cohort
- Potential for bias from limited data collectors and operative decision-making
- Laparotomies used as diagnostic tools may confound model performance
- Population is predominantly military-age males, which limits generalizability
- Single-timepoint vitals
- Retrospective design

Conclusions

- FAIT predicts transfusion and surgical needs using immediately available data in combat settings
- Supports the feasibility of real-time, data-driven triage in austere environments
- May enable targeted resource allocation (blood products, surgical prioritization)
- Supports the use of FAIT as a scalable decision-support tool with potential applicability in mass casualty scenarios

FAIT Team

MIT Lincoln Laboratory

- Kevin Brady, PhD
- Brian Telfer, PhD
- Donald Coulombe
- Maj Brent Lavey, MD
- Ryan McKindles, PhD

Special Operations Surgical Team (SOST)

- David M Northern, MD
- Regan Lyon, MD

Boston Medical Center

- Noelle Saillant, MD
- Emanuele Lagazzi, MD
- Chrisanto Torres, MD

University of Pennsylvania

- Allan Stolarski, MD

DHA Combat Casualty Care (Sponsor)

- Therese West, PhD

DHA Joint Trauma System (Collaborators)

- COL Jennifer Gurney, MD
- LTC (Ret) Jonathan Stallings, PhD

QUESTIONS

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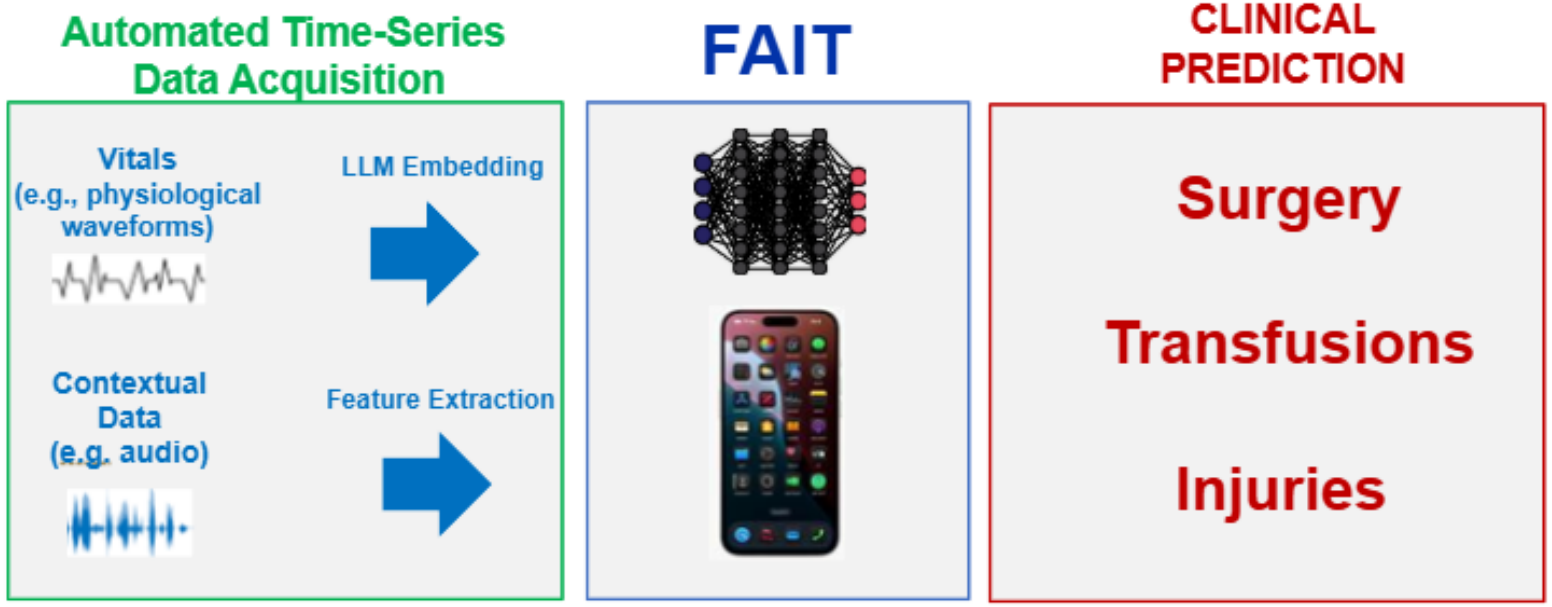
School of Medicine

NEXT STEPS



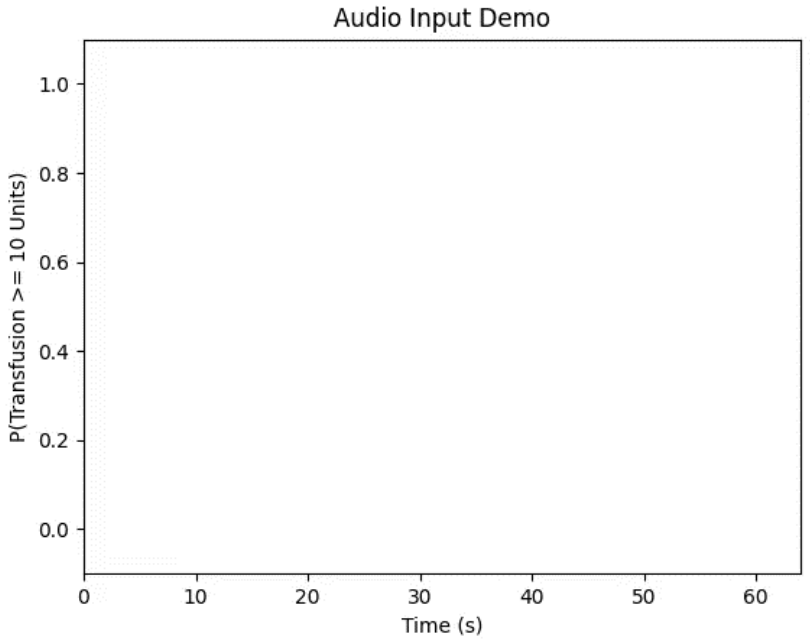
- Automated data collection
- Contextual features large language model
- Sensor data with wearable devices (Lifelens, Zoll)

- FAIT App
- Prospective real-life validation in EMS, trauma bay, ICU

NEXT STEPS

LLM

Contextual Features from EMS Audio Speech Collected by Close-Talk Microphone

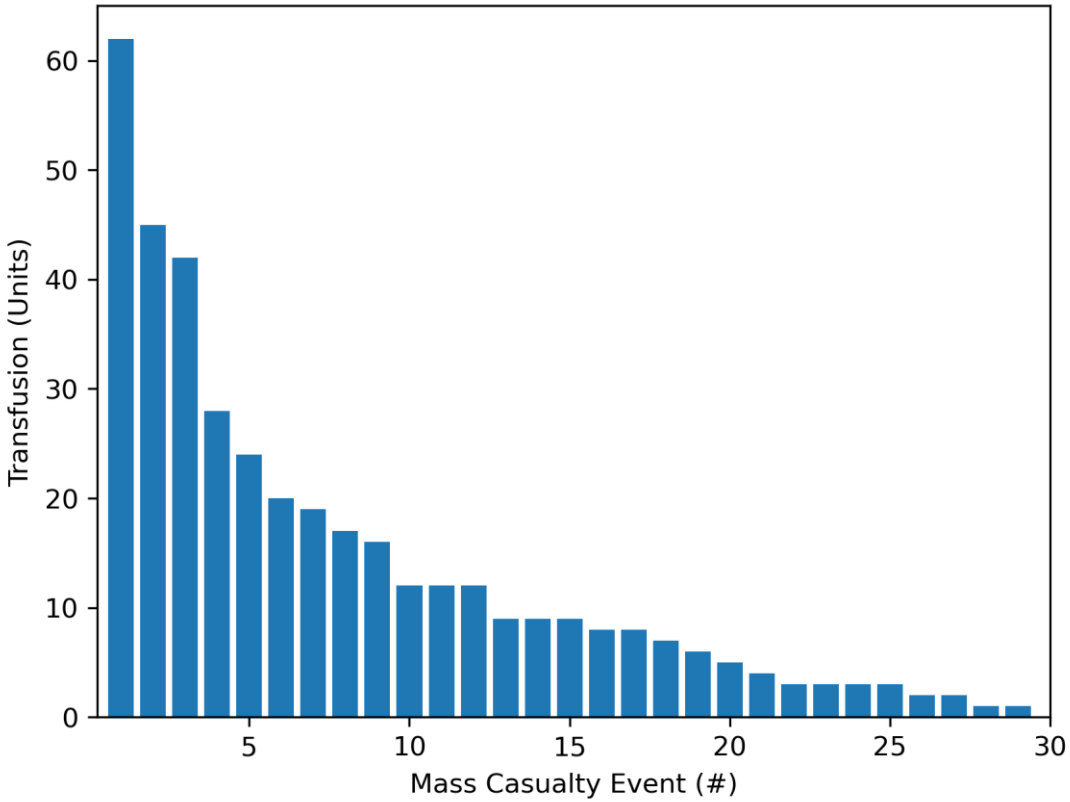


Real Time Vitals

Wearable Devices (Lifelens, Zoll)

Special Operations Surgical Team (SOST) Mass Casualty Resource Characterization

Transfusion Resources



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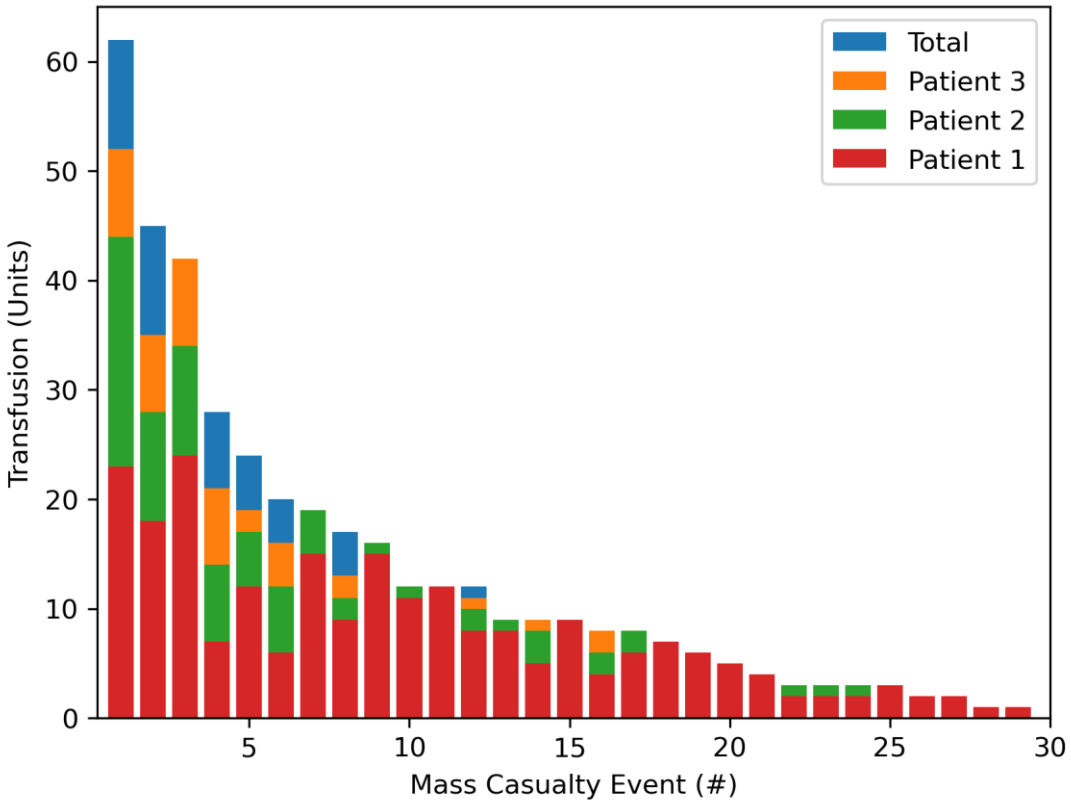

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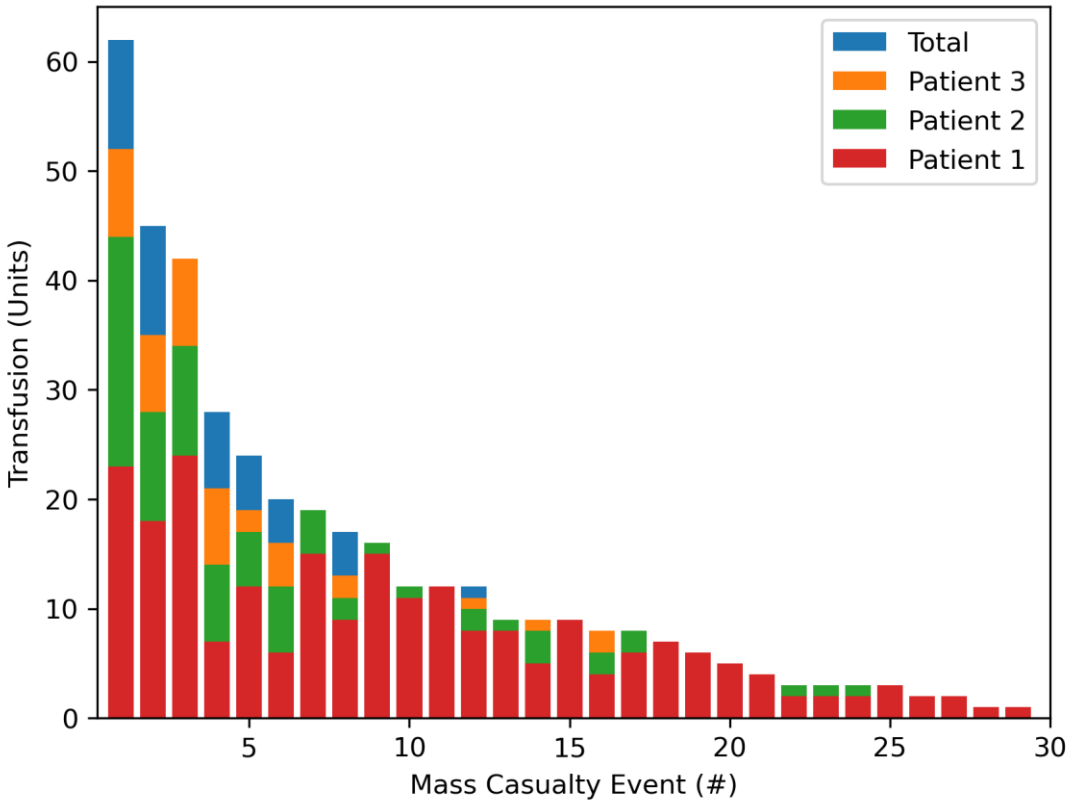
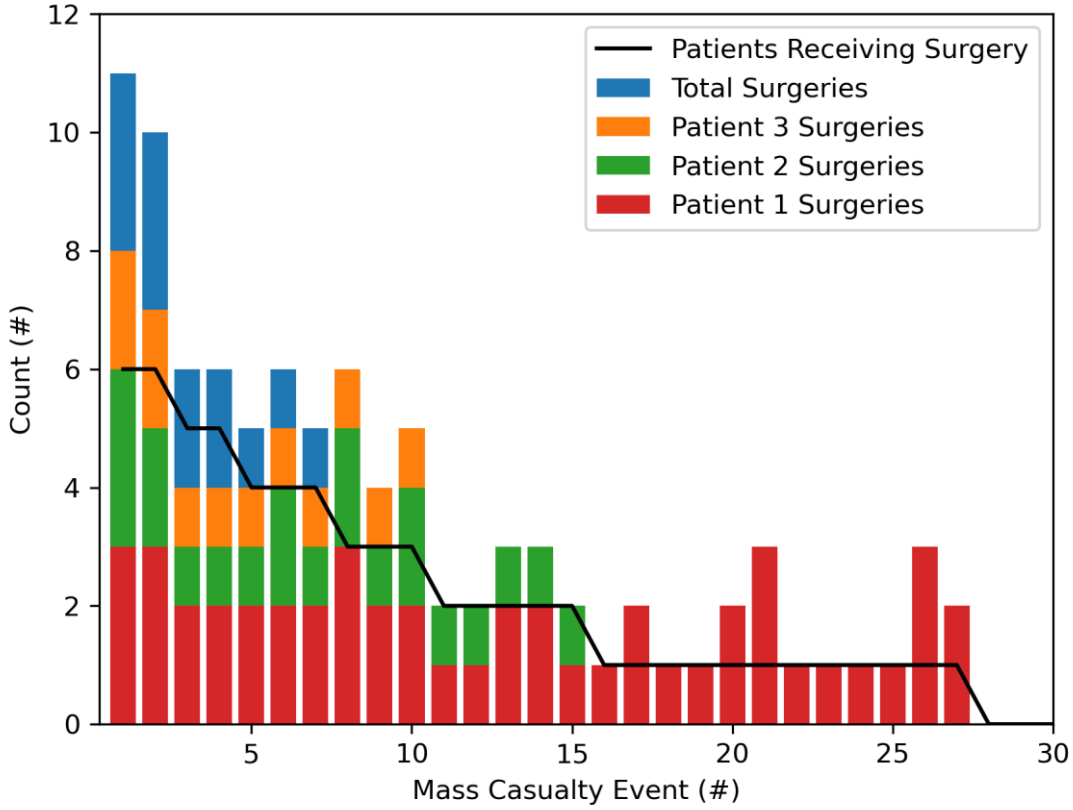
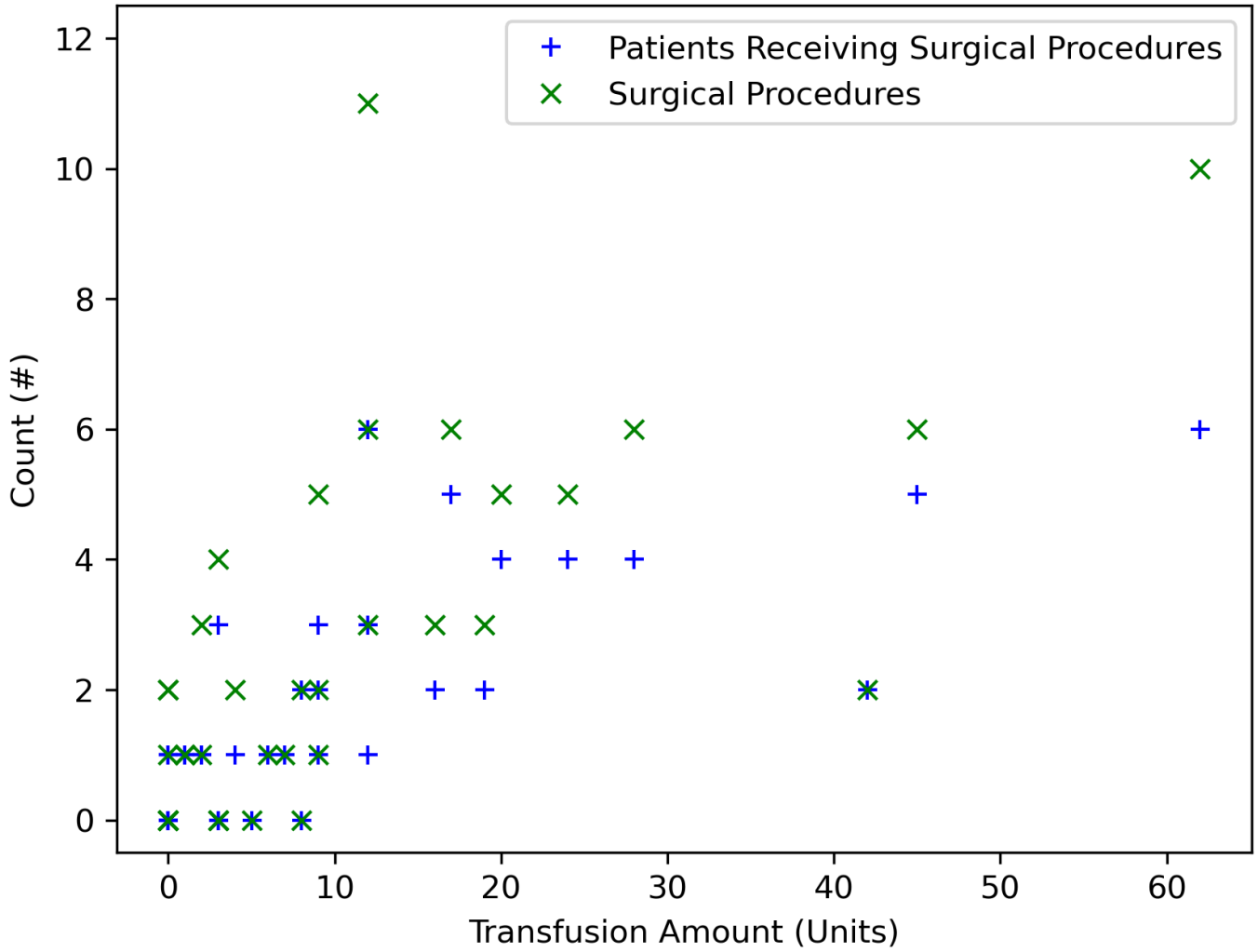


Surgical Resources



Special Operations Surgical Team (SOST) MCE Event Resource Characterization



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VITALS (Wearables)

CONTEXTUAL INFORMATION (Audio)

Data Ingestion Pipeline

Sensors

Audio

Physiological Sensors

User Interface

Extract Information

ASR

LLM

Signal Processing

DNN

Extract Measures

Vitals

Visible Injury Description

Mechanistic Injury Description

GCS

Demographics

IN-FIELD MEASURES

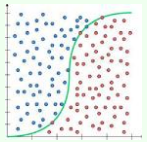
Clinical Prediction Pipeline

FAIT clinical inputs

$$\begin{bmatrix} 32 \\ \vdots \\ 2 \end{bmatrix}$$

- Feature normalization
- Missing data imputation

Clinical domain-specific model



Pre-trained model(s)

CLINICAL PREDICTIONS

- Injury assessment
- Treatment options
- Required resources

DNN: Deep Neural Network
GCS: Glasgow Coma Score
ASR: Automatic Speech Recognition
FAIT: Field AI Triage
LLM: Large Language Model