Helicopter EMS-Constant Evolution

Conflicts of Interest

Objectives

1)A brief history of air medical transport in the USA

2) Understand Capabilities and Justifications for Use

3) Future Challenges

DaVinci's "Aerial Screw"

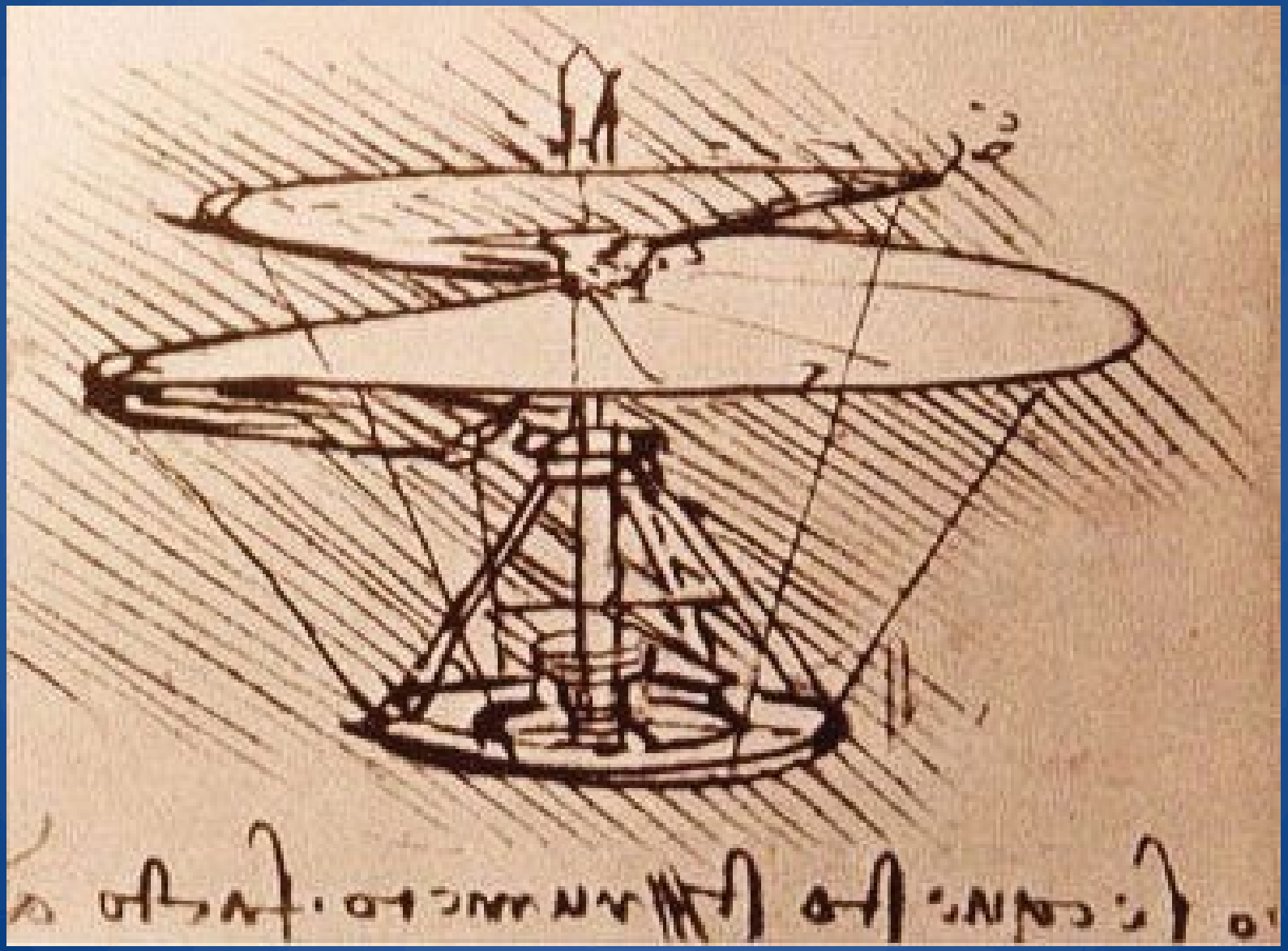
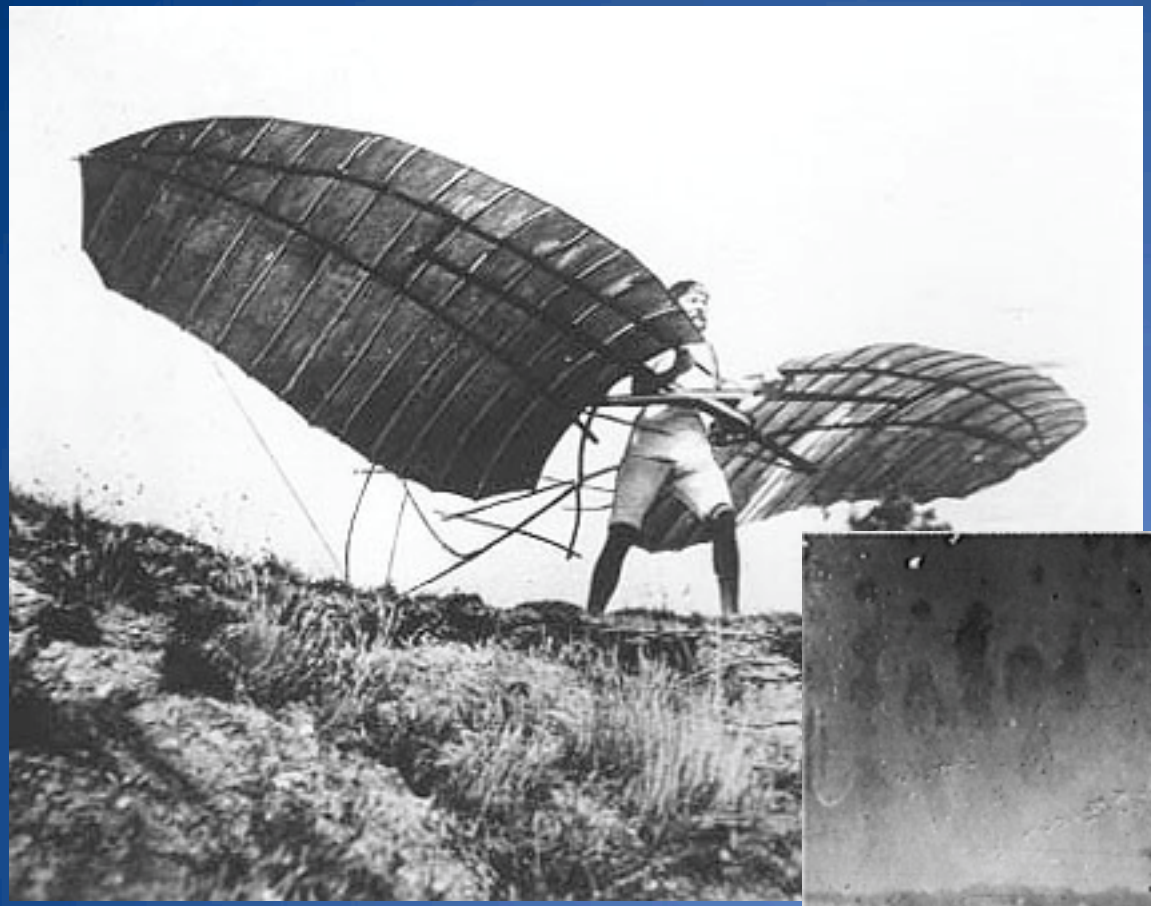
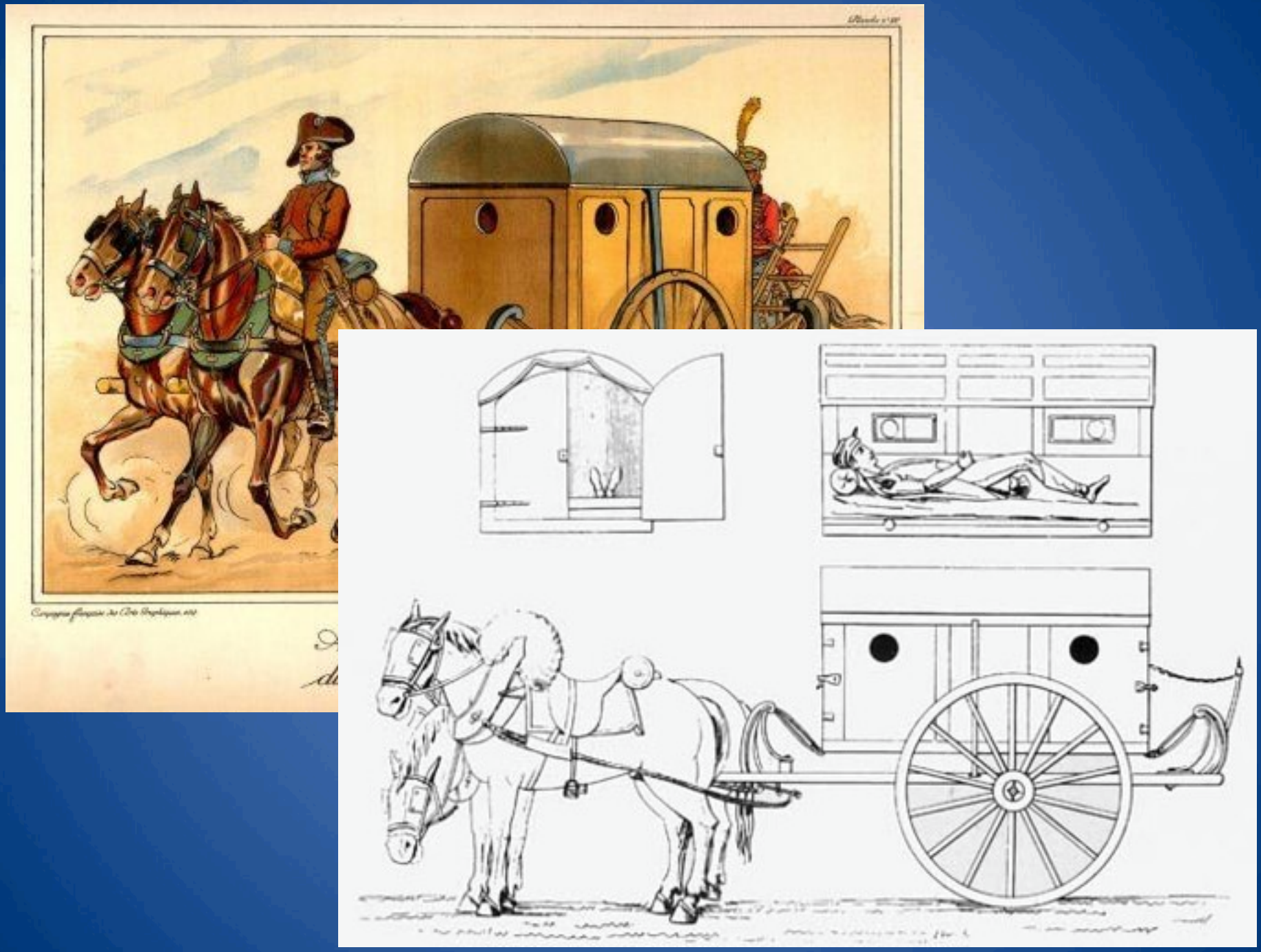


Fig. 1. — Croquis de Léonard de Vinci.




1804



ESSAY

ON THE

RECOVERY

OF THE

APPARENTLY DEAD.

By CHARLES KITE,

Member of the Corporation of Surgeons in London,
and Surgeon at Gravesend in Kent.

Being the Essay to which the Humane Society's Medal was adjudged.

To which is prefixed,

DR. LETTSOM's ADDRESS

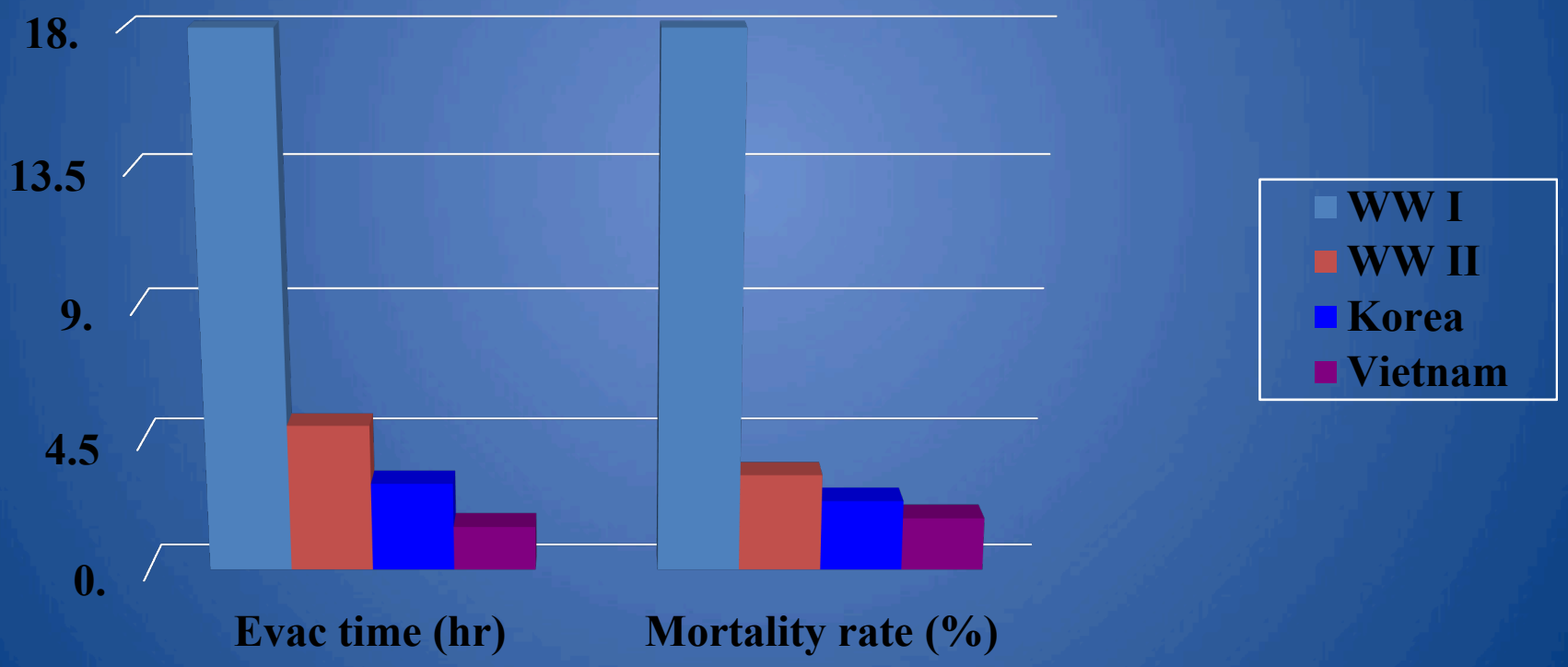
ON THE DELIVERY OF THE MEDAL.

——— *hac animas ille evocat Orco*
Pallentes. VIRG.

LONDON:

PRINTED FOR C. DILLY IN THE POULTRY.

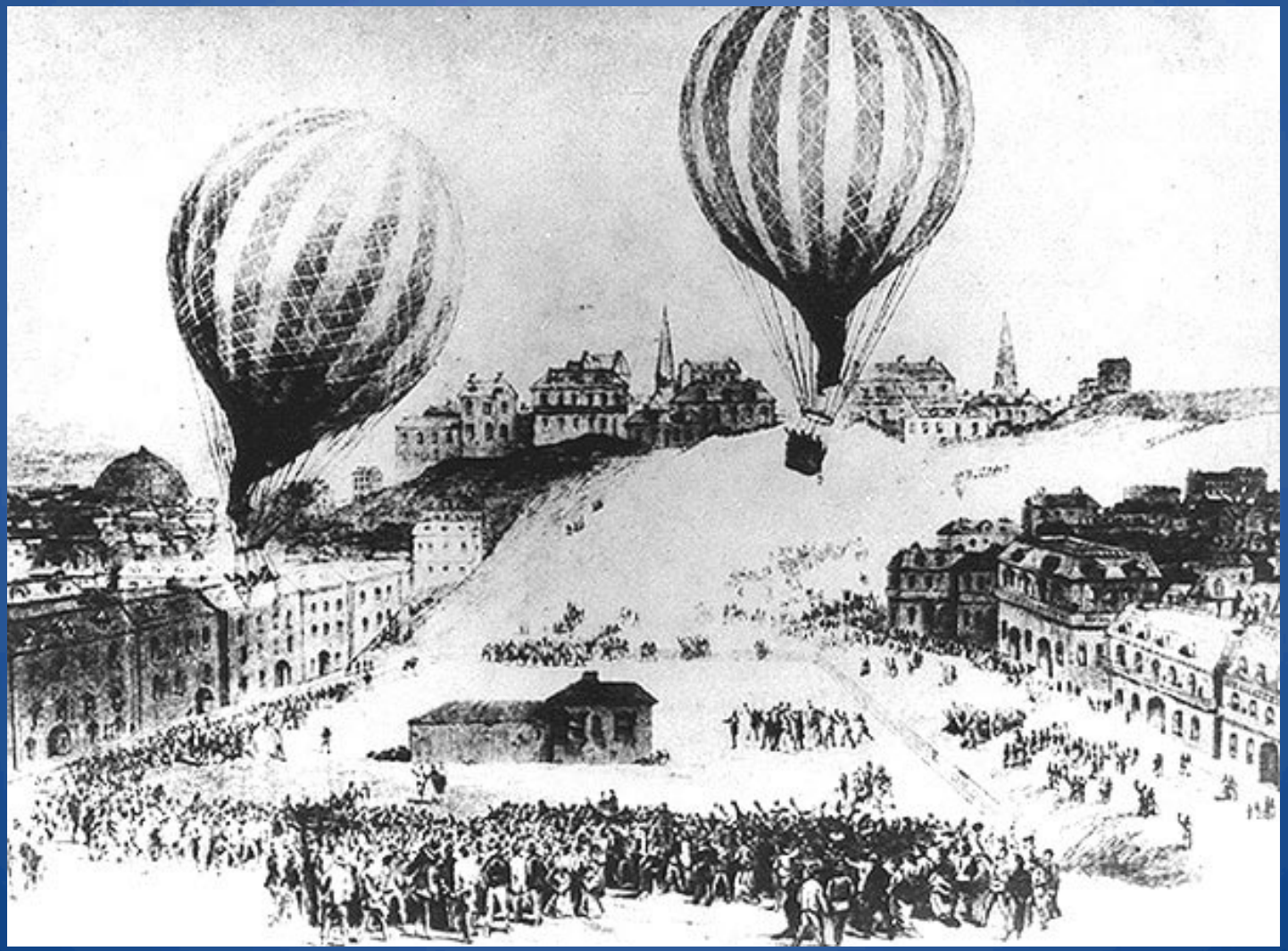
War casualty stats




CY AIR

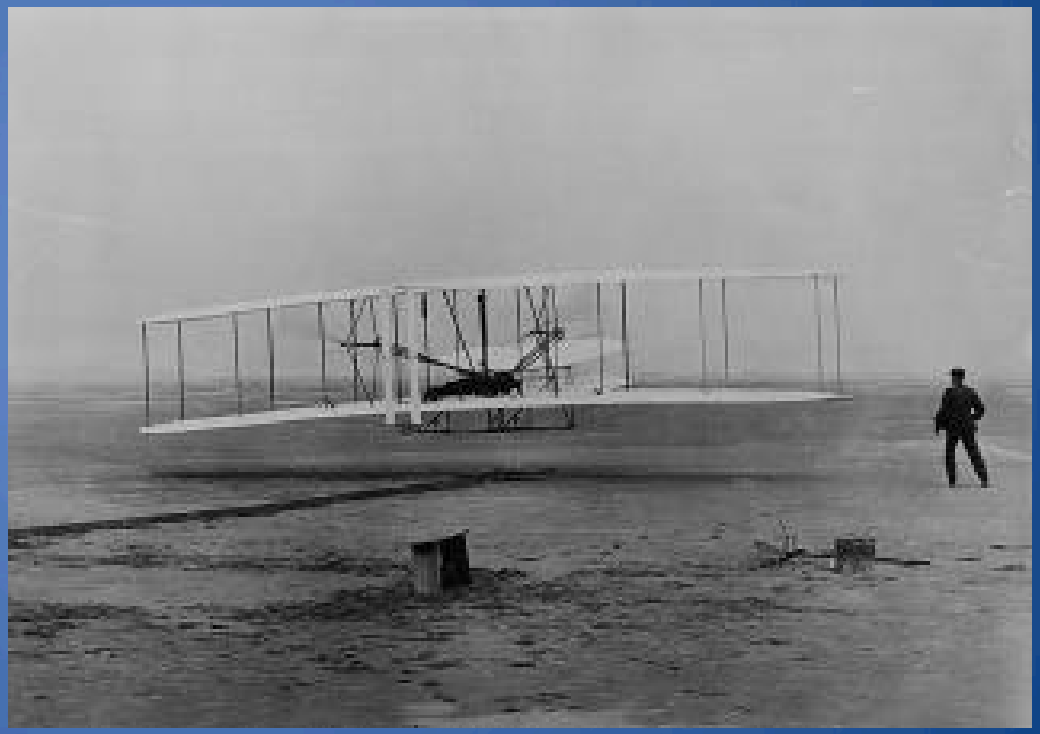
First Air Medical Transport?

1870-1
The Franco-Prussian War
First Aeromedical Evacuation



1903

- Wright brothers invent the airplane



1910

- Grossman and Rhoades present to war department

DENIED

"If no mistake you have made, losing you are. A different game you should play."

1915
Serbian retreat from Albania

“Are there not enough dead in France today without killing the wounded in airplanes?”

French Government’s response to air evacuation- 1915

1920

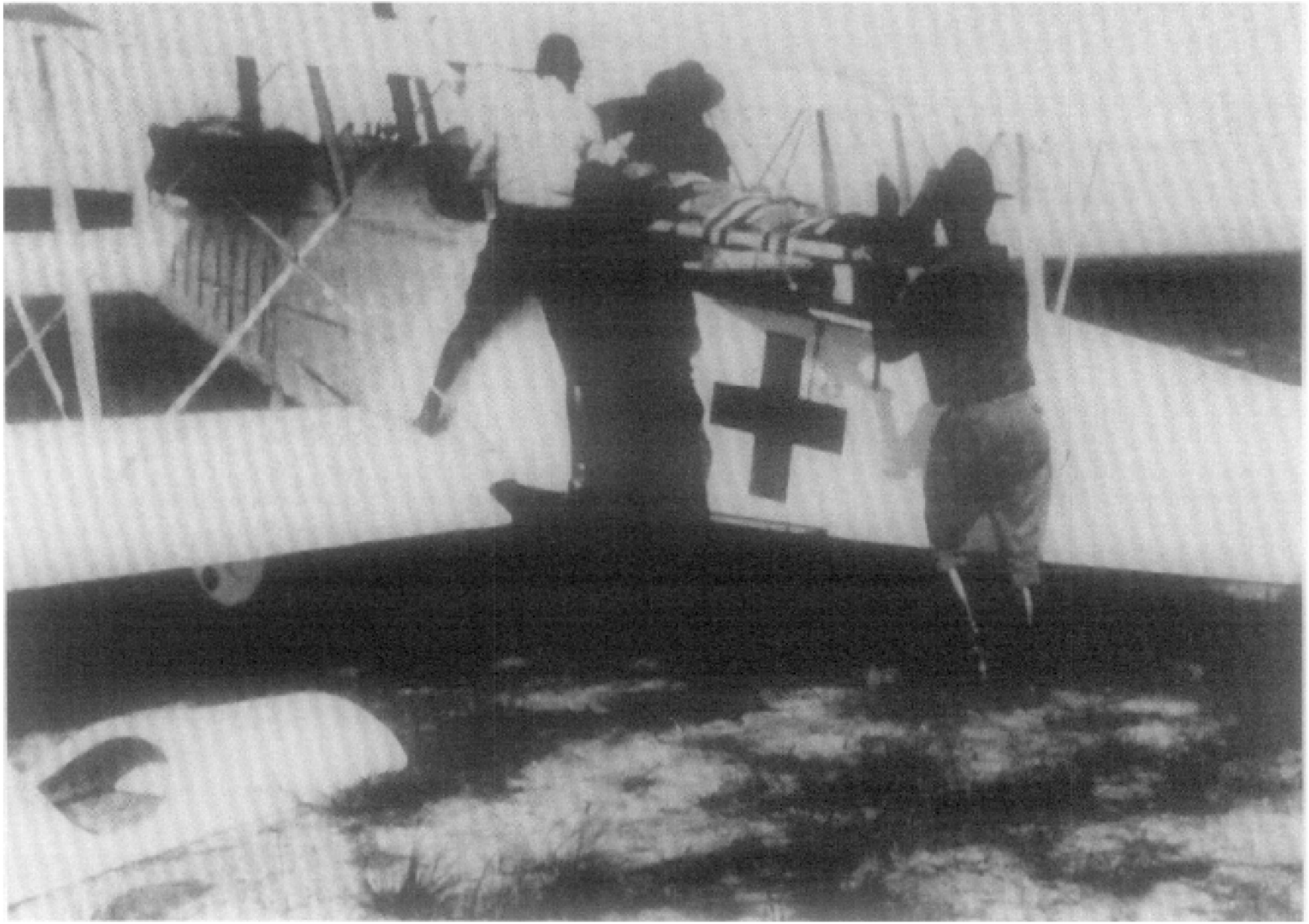


Figure 1. Curtis JN-4 (1918). This biplane ambulance carried a single patient in the open rear cockpit.

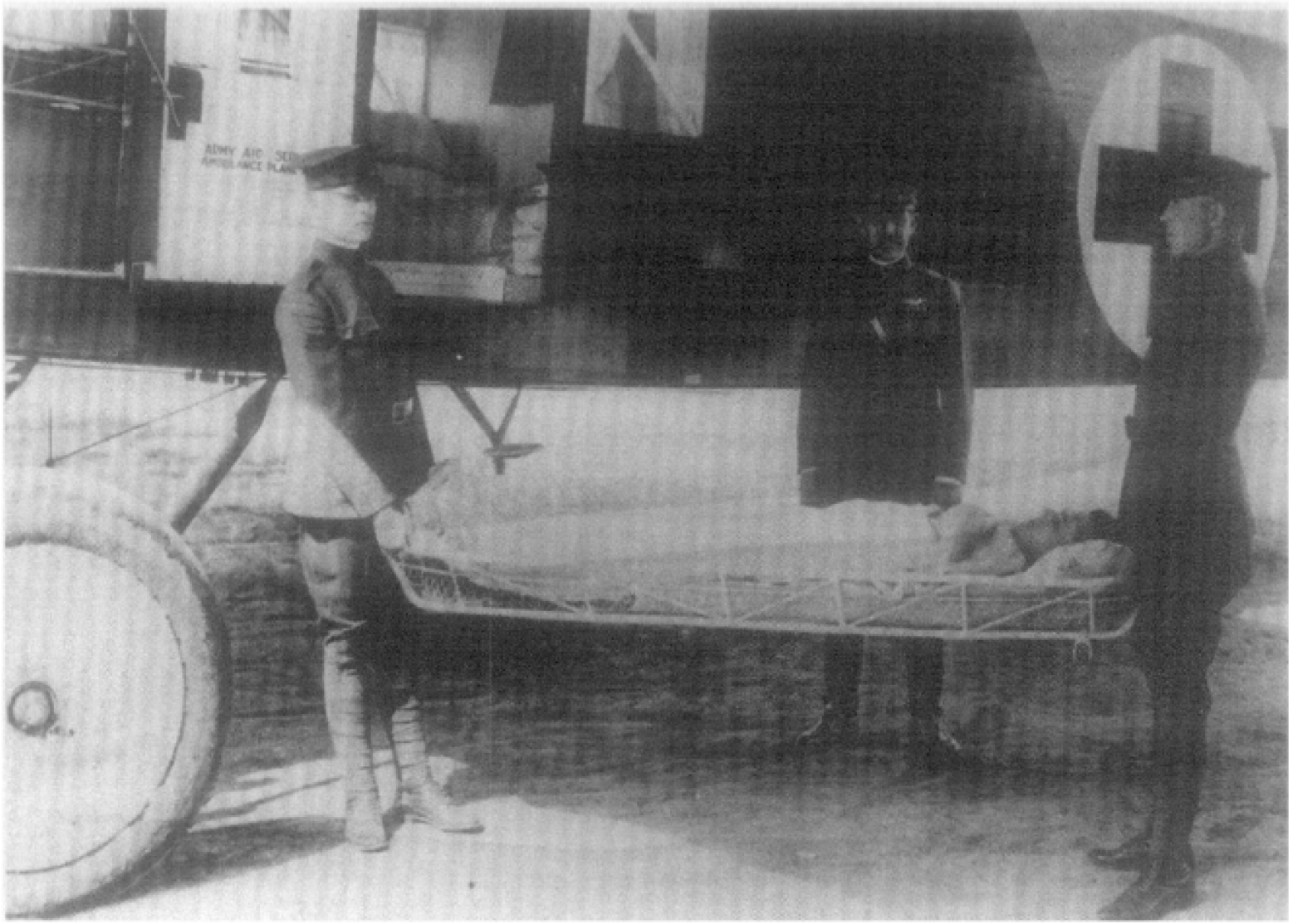


Figure 2. Cox-Klemin A-2 (1923). One of the earliest airplane ambulances to carry a medical attendant in flight.


JOIN
U.S. ARMY AIR CORPS

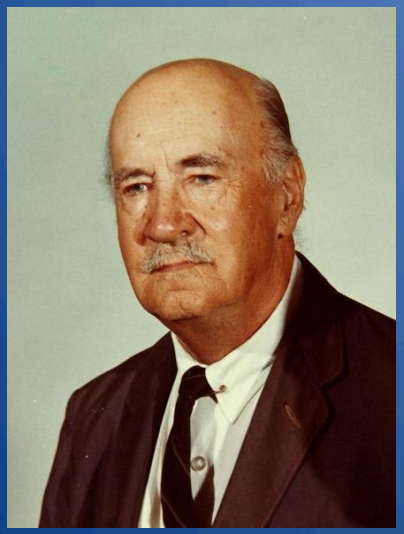

Banana Wars


PRESIDENT TAFT'S
DOLLAR DIPLOMACY
WINK WINK
TEDDY'S BIG STICK
U.S. STEEL
AT&T
U.S. RUBBER
GO INVEST IN LATIN AMERICA WITH THE FULL FAITH OF THE U.S. GOVERNMENT...
...AND ITS MILITARY.


Brito
Punta Gorda
km
0
75
150

September 14, 1939

- Igor Sikorsky invents the helicopter



World War II

- Fixed winged aircraft transported more than 1.4 million patients from front line hospitals to tertiary care centers
- Only 46 deaths en route
- First rotor-winged medical evacuation, Burma 1944- some use mentioned before
- Helo use limited overall

Flight nursing

Korean War

- Helicopters sturdier
- Rugged terrain best suited for rotor-wing transport
- Only 11 dedicated “Medevac”helicopters


Bell Model 47D-1 (OH-13E)
Scout/Medical Evacuation Helicopter
MFG: Bell

Bell Model 47D-1 (OH-13E)

Scout/Medical Evacuation Helicopter

MFG: Bell
First Produced: 1946
Powerplant: Franklin 0-335-5
Horsepower: 270
Rotor: 2 blade all metal
Service Ceiling: 3,600 ft.
Cruise: 80 mph
Top Speed: 100 mph
Range: 212 miles

Empty Weight: 1,435 lbs
Gross Weight: 2,350 lbs
Rotor Span: 33'
Length: 32'8"
Height: 9'4"
Armament: None
Number Built: 3,000 total
490 H-13E total

Service History

Delivered: 1946
AAF service records destroyed in fire.

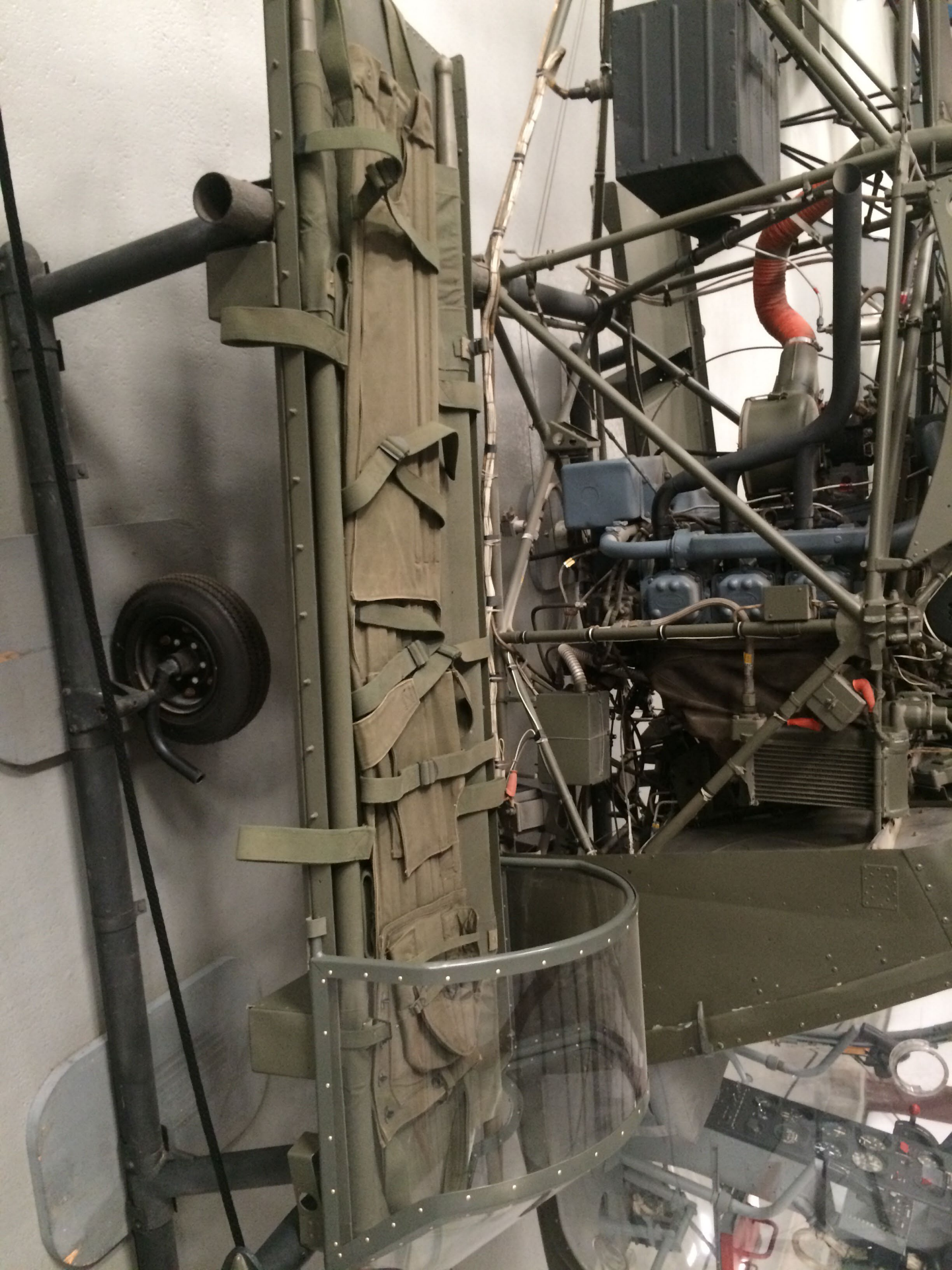
Since 1912, Lawrence D Bell worked in the aviation industry, he founded Bell Aircraft in 1935. The 47B model was the world's first certified commercial helicopter. This model was produced until 1973, longer than any helicopter in history. The 47D was also the second largest production helicopter model (6,283) behind the Bell UH-1 Huey.

The Scout is easily recognized by its bubble canopy and open lattice tail-boom and equipped with twin-skid landing gear with two retractable wheels for ground handling. This MASH-type helicopter has two stretcher pods for evacuating the wounded and was also available with pontoons.

Equipped for utility, wire-laying, evacuation and training the 47D, or OH-13E Sioux in US military service, was used by over 30 nations and countless civilian organizations and may still be seen in service today.

Acquired by Yanks in 1986.


N179JM



Vietnam War-Operation Dust-Off

First Civilian Medical Transports?

First Civilian Air Medical Transport

- Australian Royal Flying Doctor Service
- Started in 1928

Royal Flying Doctor Service

https://acesflyinghigh.wordpress.com/2016/10/16/the-royal-flying-doctor-service-of-australia/

First US Civilian Rescue 1945

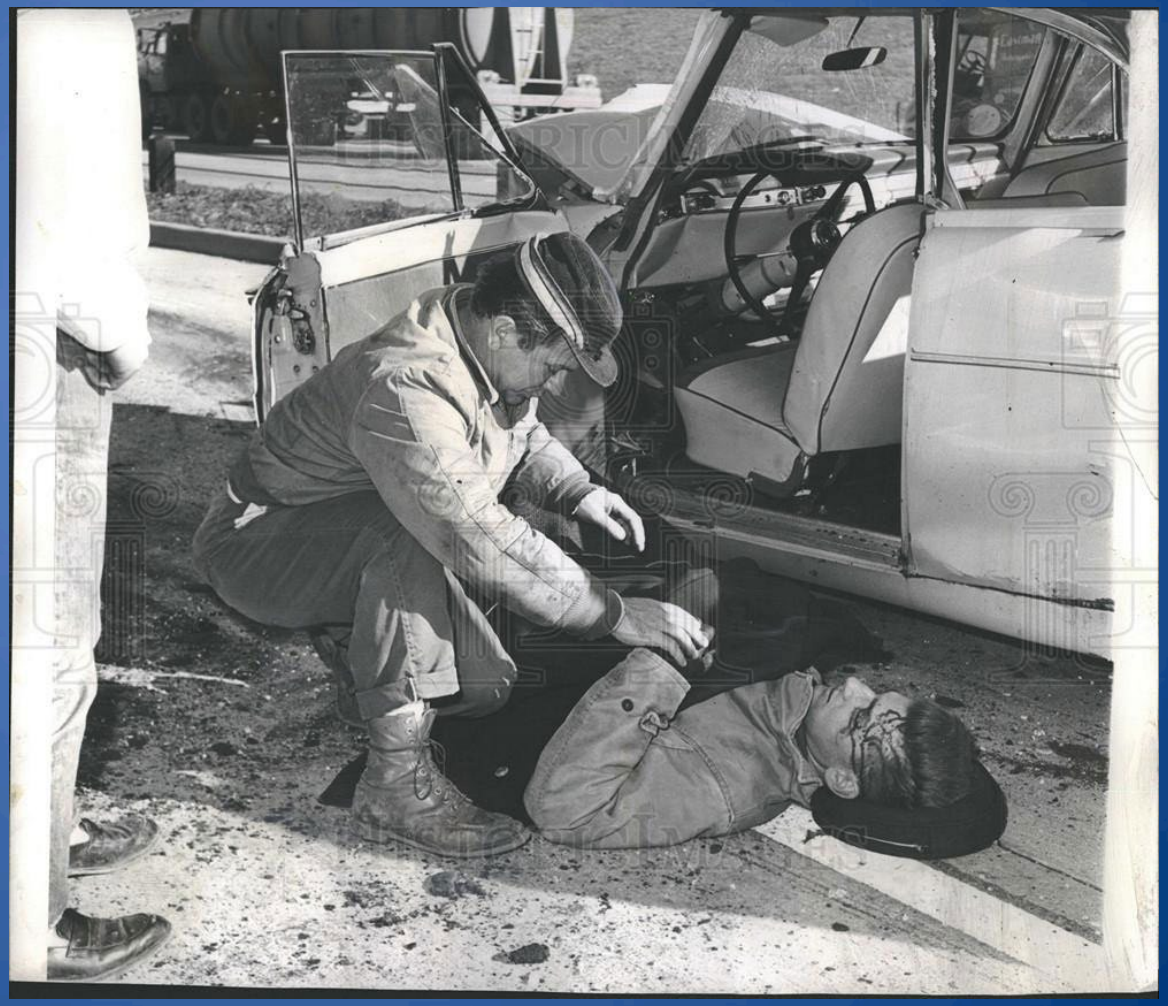
Late 1960s

COMBAT CORPSMAN

The Vietnam Memoir of a Navy SEALs Medic

"I wish I could make up anything as riotously wonderful yet starkly realistic as this book."
—H. Jay Riker, author of *The Silent Service: Virginia Class*

GREG McPARTLIN



“Civilian ambulances were no faster than taxis”

Rosen P, et al: Prehospital care: an integrated concept of emergency medicine. 1980 *Top Emerg Med* 1(4):19

Military Assistance to Safety and Traffic (MAST)

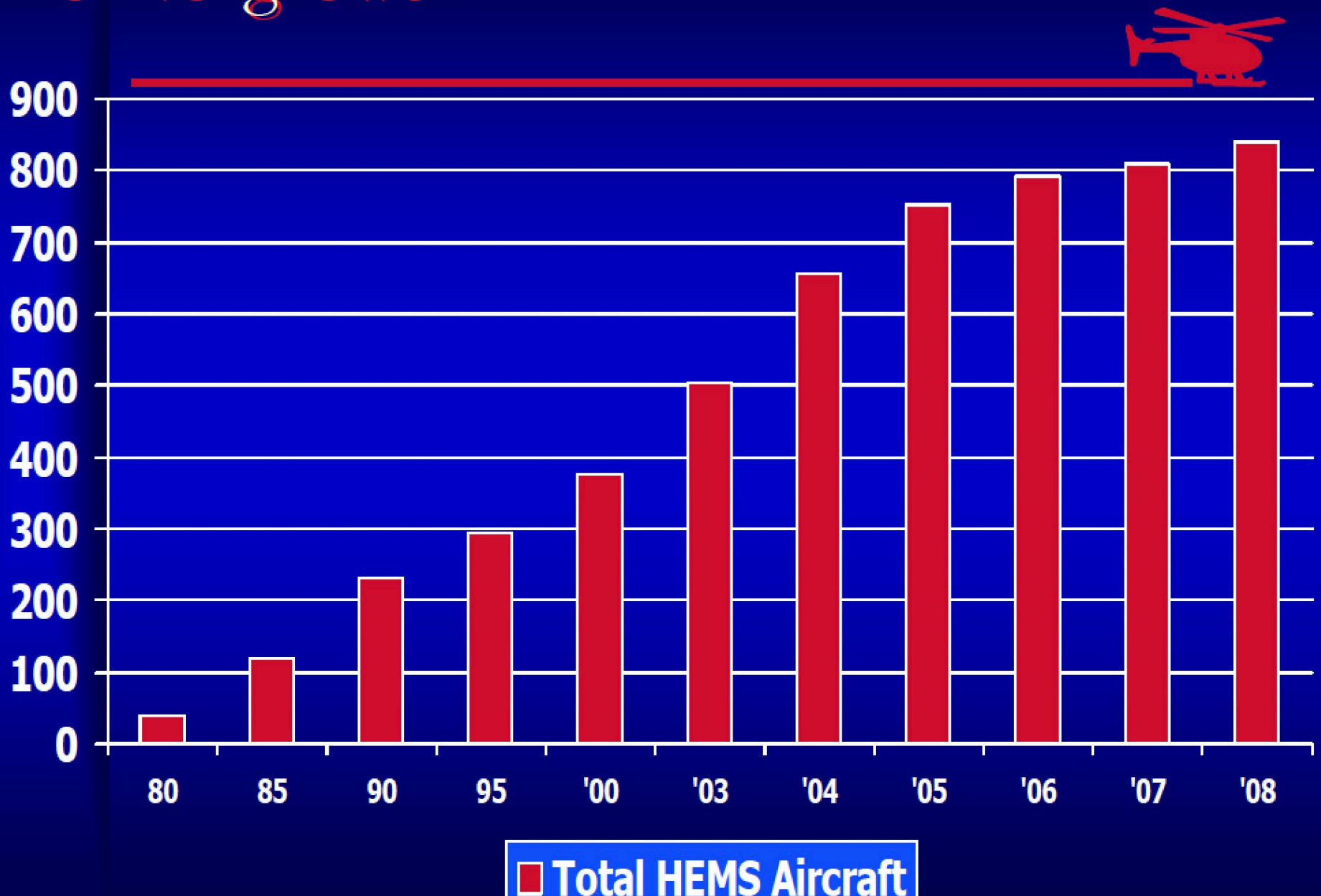
CREDIT: ARMY MEDICAL DEPARTMENT MUSEUM

Above: A San Antonio-based MAST crew loads a patient onto a medevac helicopter around 1970. The MAST program was designed to bring battlefield emergency medical techniques to civilians in the U.S.

Civilian Care Evolution

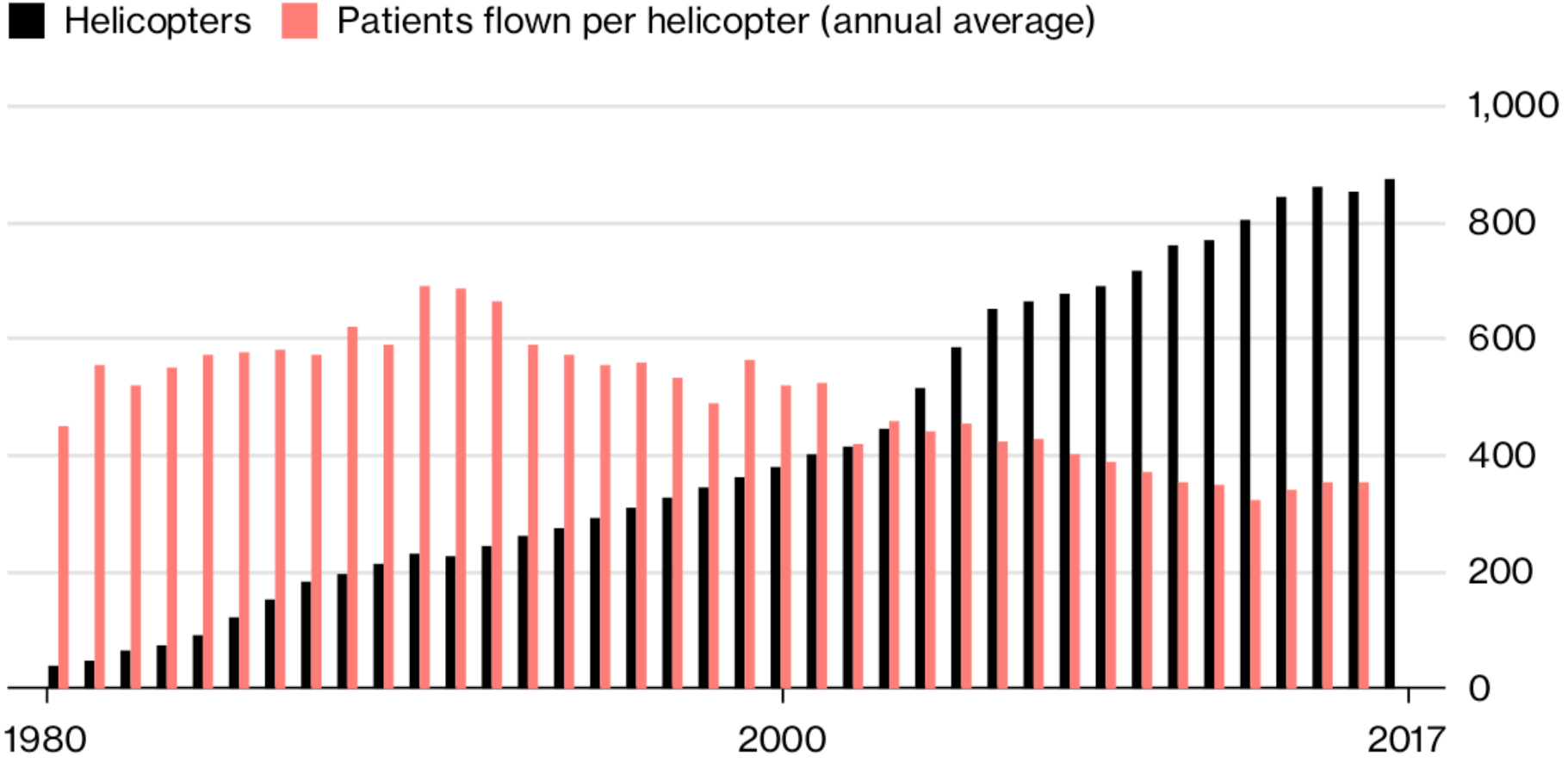
- 1969 Maryland State Police& University of Maryland Center for the Study of Trauma
  - Police pilot-paramedic teams for primary response role
- 1972 Loma Linda First medical institution to use helicopter solely for EMS
- 1972 St. Anthony's in Denver, CO-first hospital based helicopter program-EMS helicopter with acute care trained nurse capable of in-field stabilization

Risk vs. growth



Lift Off

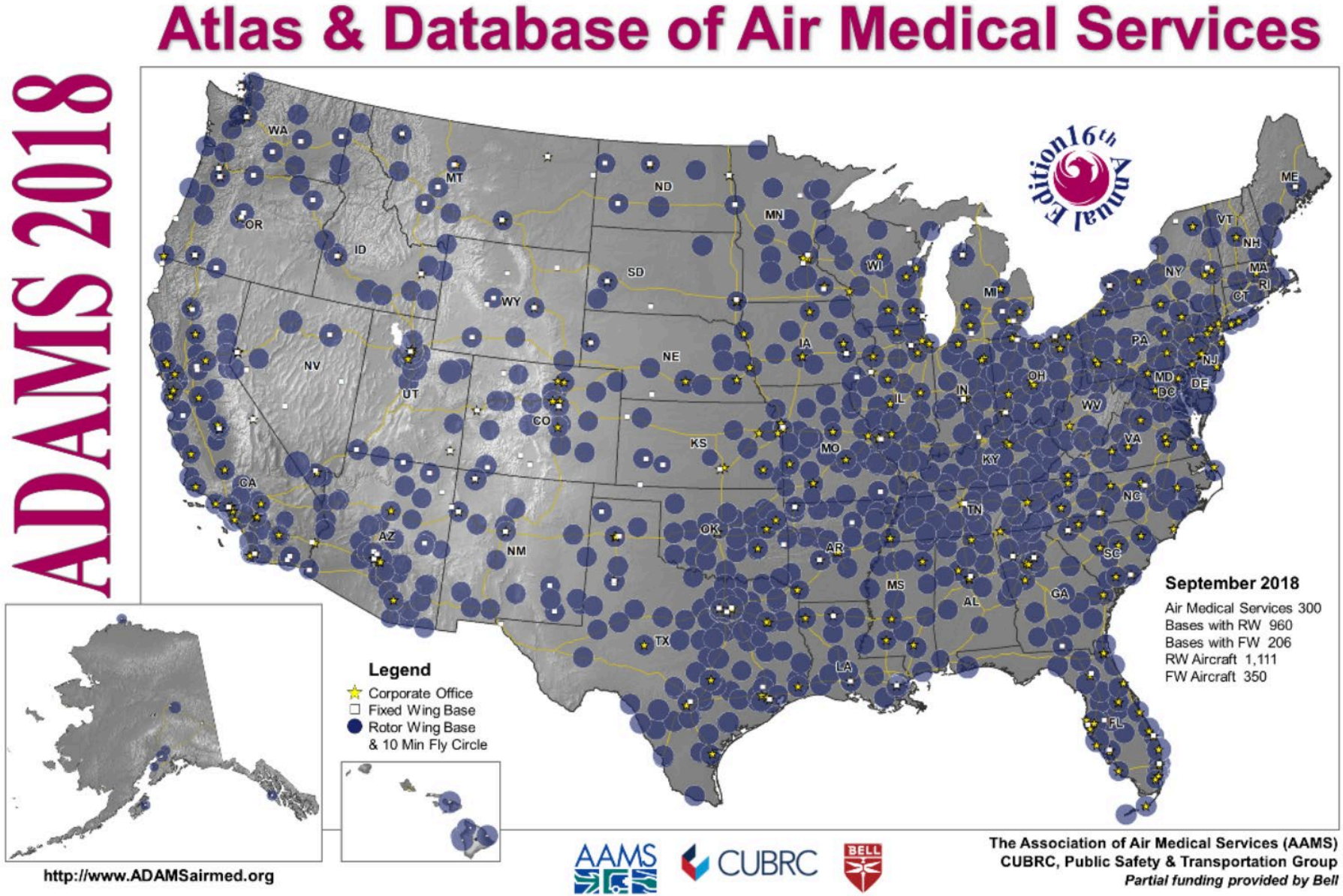
Air ambulances expanded faster than the number of patients they fly



Source: Data compiled by Ira Blumen, University of Chicago Medicine

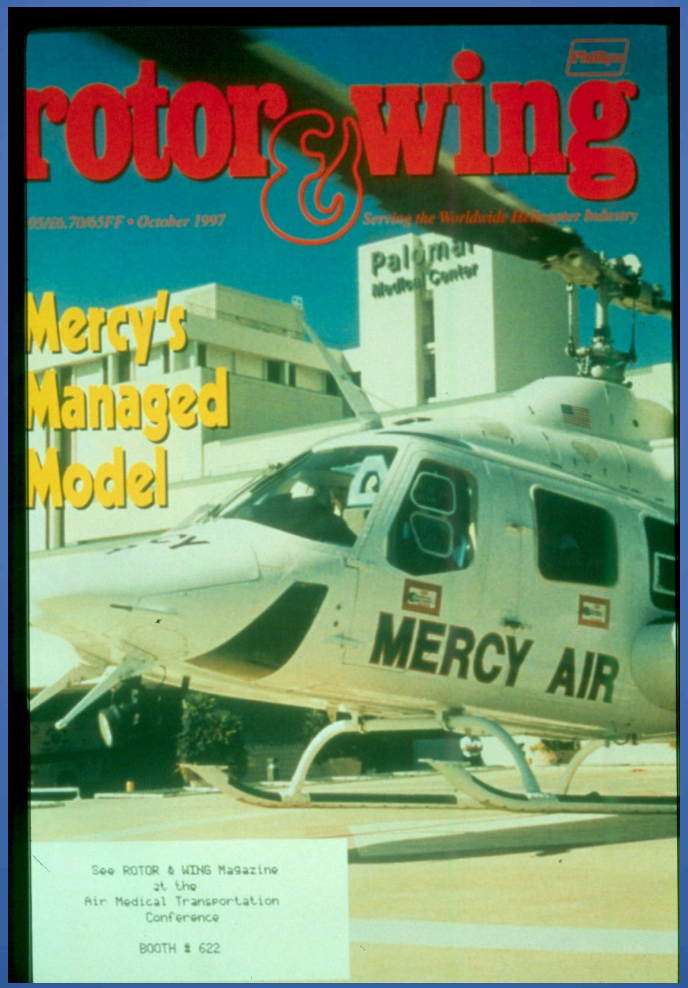
Bloomberg

National View of 15 Minute Rotor Wing Response Areas as of September 2018



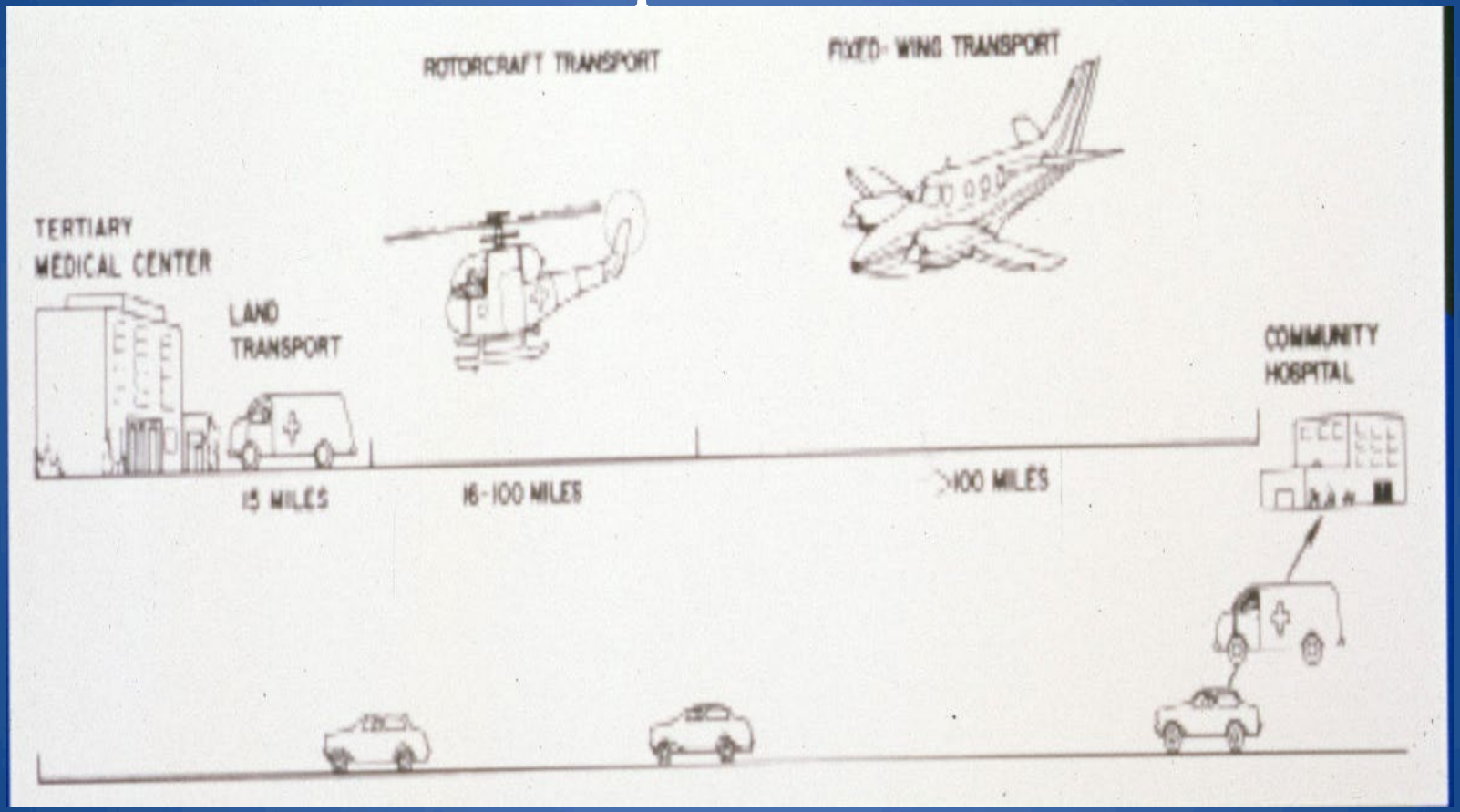
HEMS models

Why aeromedical transport?



Great Photo Ops?

Speed



From Baxt, *Trauma: The First Hour*

Also- Diaz MA, et. al. When is the Ground faster? a comparison of helicopter and ground ambulance transport times, Trauma 2005;58(1) 148-151

Helicopter vital data

Type	Cruise speed (mph)	Useful load (lbs)	Service ceiling (ft)	Range (miles)
Bell 206L-3	130	1950	20000	325
AStar 350d	140	1868	15000	379
TwinStar 355F1	147	2391	13120	368
Bell 22UT	152	3376	15800	380
MBB BK-117	160	2645	17000	368
EC-135	158	3208	20000	500

Radiology 101

…and you had to be rescued here…

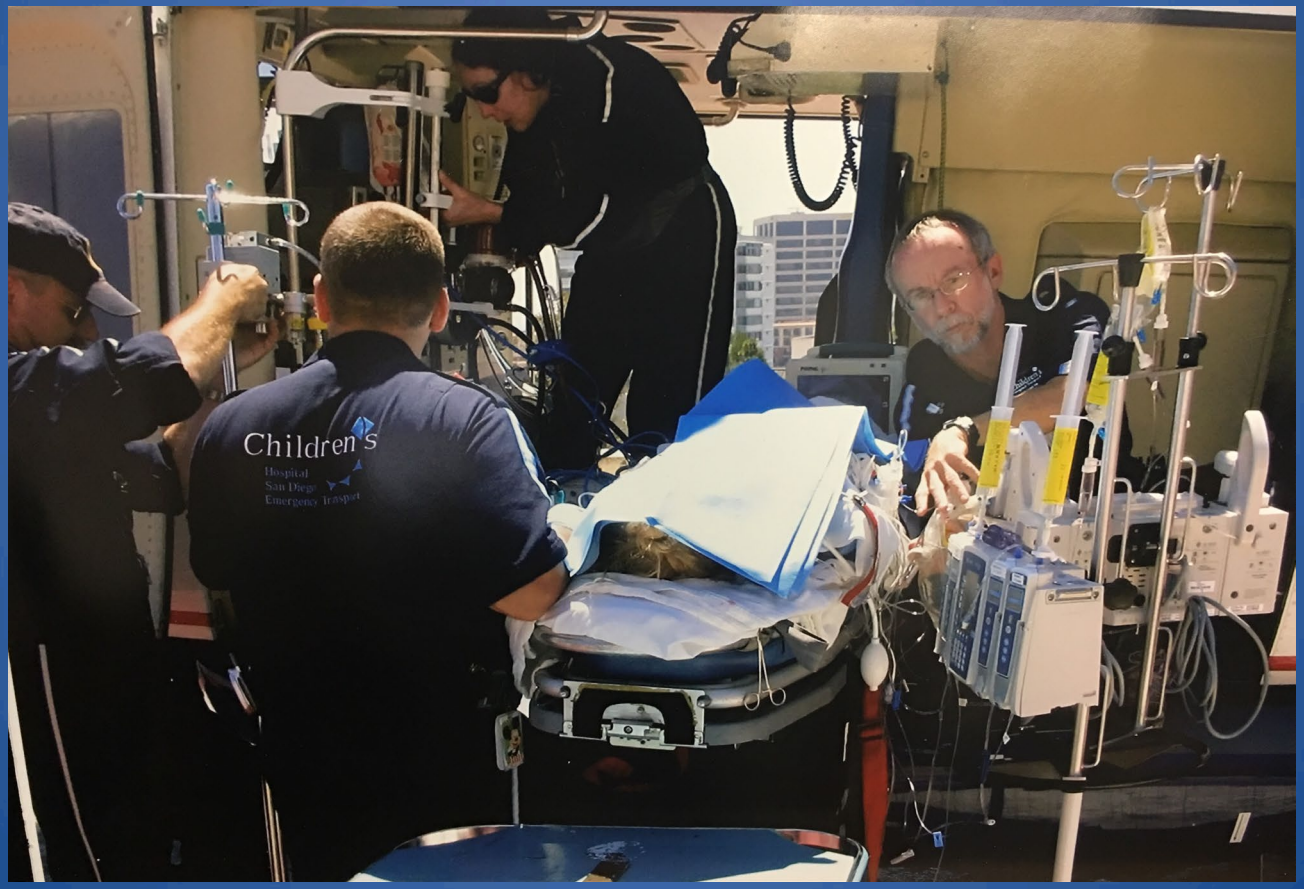
…and the only road out was here…

Distances over difficult terrain

Special Events


MERCY AIR

Pediatric specialty care



Neonatal Transport

Augment with ALS care

Quick response with multiple ALS resources to distant scenes

Multi-casualty incidents


MCI

THE JOURNAL OF EMERGENCY SERVICES

Emergency

San Ysidro Slaughter, The EMS Experience

VOL. 16 NO. 8, 131st EDITION
AUGUST 1984

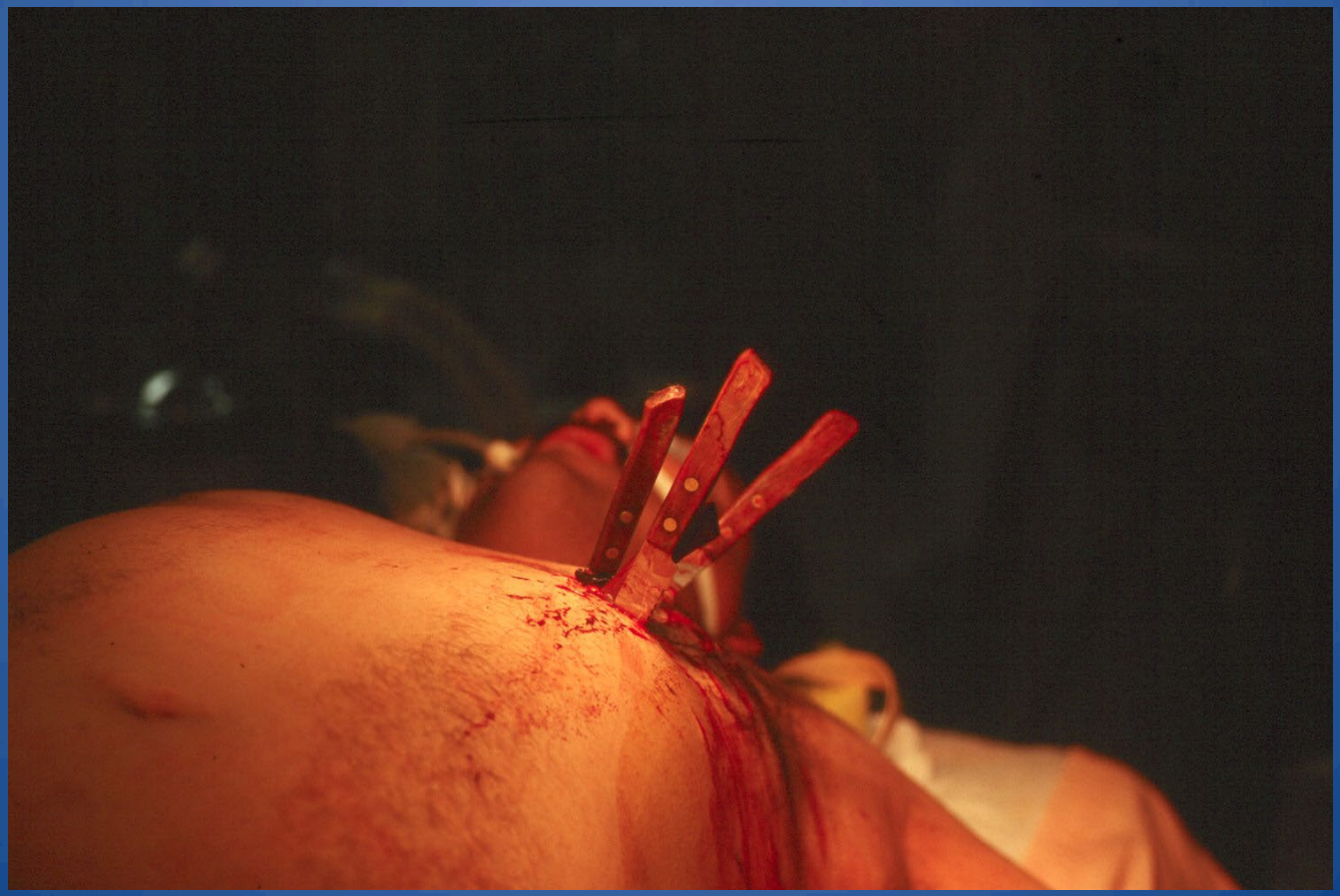
During Disaster Response

Inter-facility Critical Care Transport

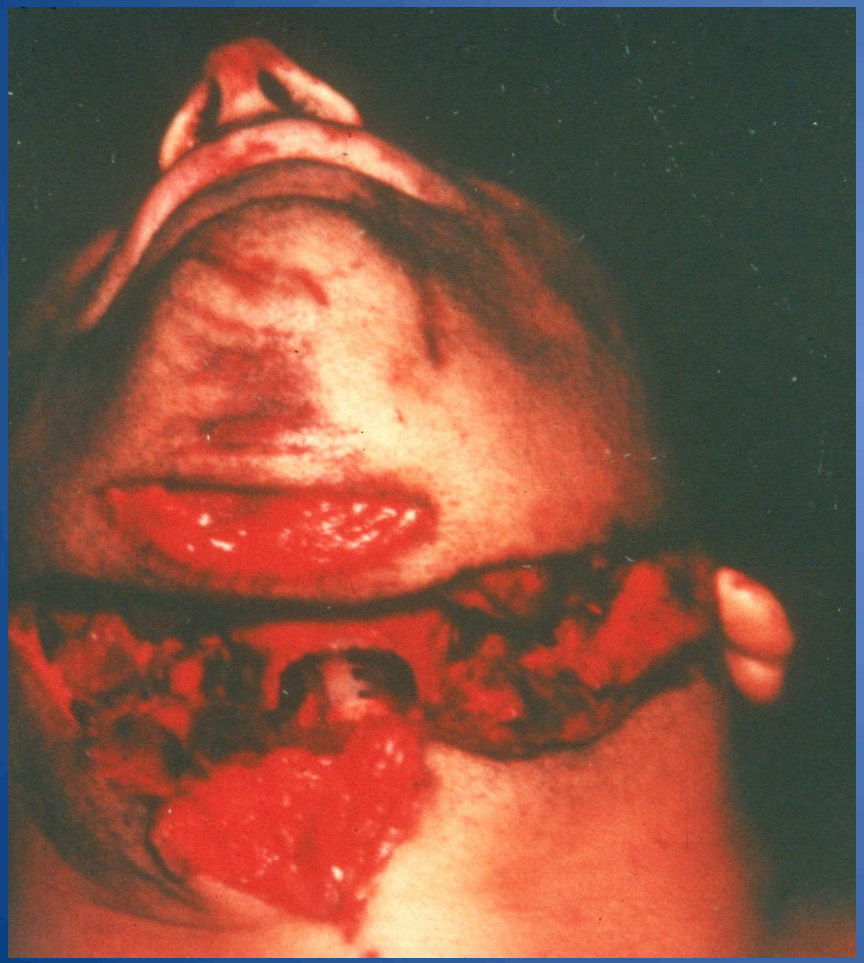
Truly a Mobile ICU

- Tube Thoracostomy
- Intubation/RSI
- Ventilator Management
- Cricothyrotomy
- Balloon Pump/Impella Device Mgmnt.
- Central Line Management
- Advanced Medications
- Blood/TXA

Needle Thoracostomy
Tube Thoracostomy



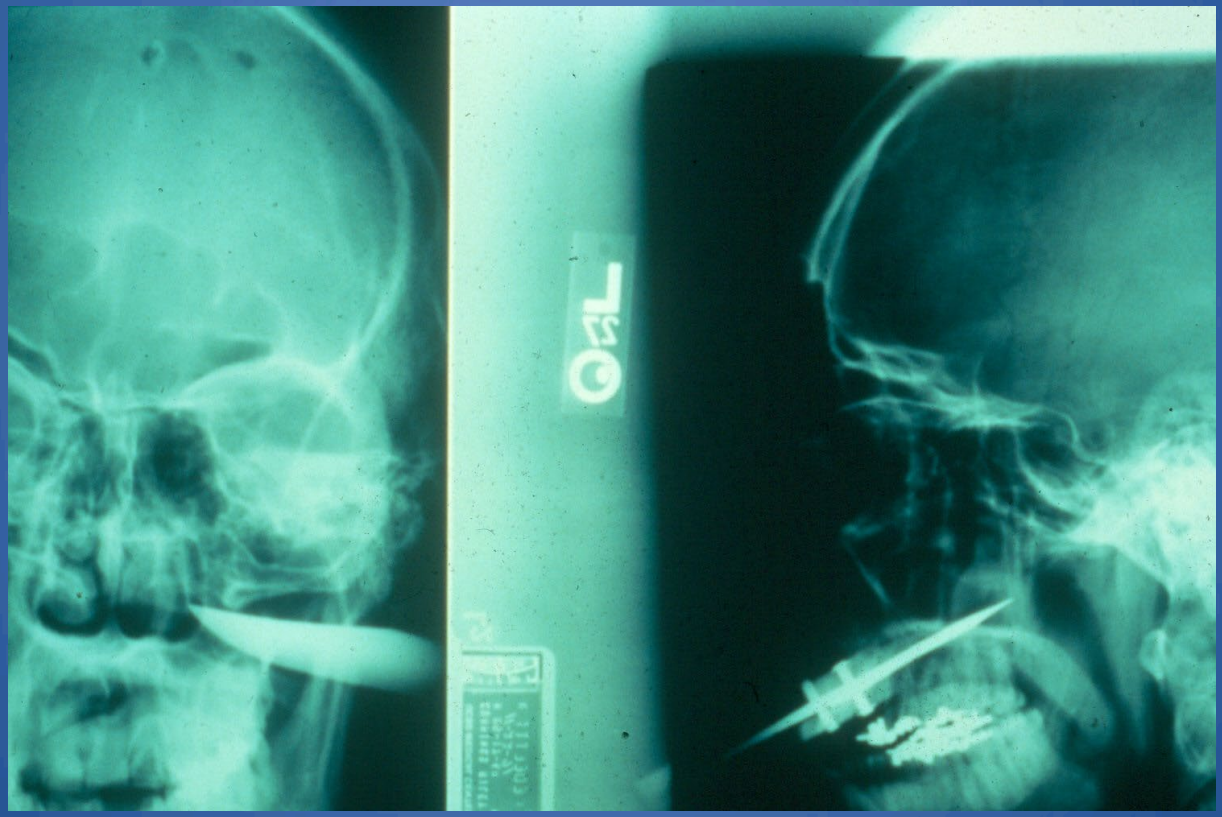
Advanced Airway Management



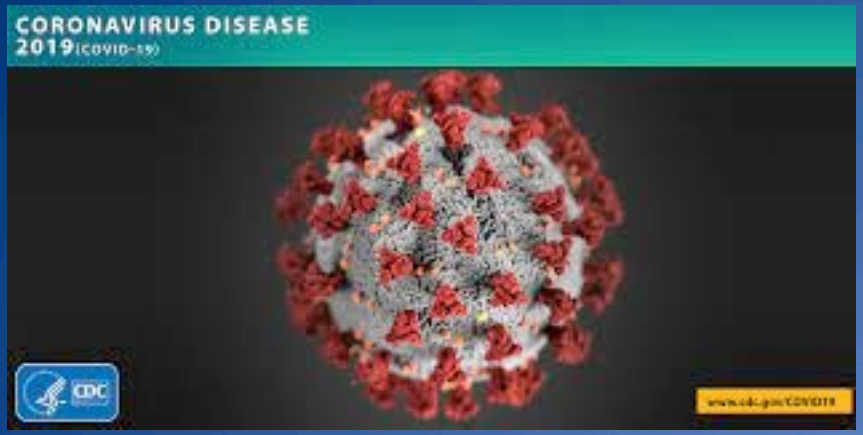
Pain Management

-Nothing too surprising-

No major parts injured



-Nothing too surprising-
No major parts injured


CORONAVIRUS DISEASE
2019 (COVID-19)
CDC

The NEW ENGLAND JOURNAL of MEDICINE

ESTABLISHED IN 1812 JULY 26, 2018 VOL. 379 NO. 4

Prehospital Plasma during Air Medical Transport in Trauma Patients at Risk for Hemorrhagic Shock

J.L. Sperry, F.X. Guyette, J.B. Brown, M.H. Yazer, D.J. Triulzi, B.J. Early-Young, P.W. Adams, B.J. Daley, R.S. Miller, B.G. Harbrecht, J.A. Claridge, H.A. Phelan, W.R. Witham, A.T. Putnam, T.M. Duane, L.H. Alarcon, C.W. Callaway, B.S. Zuckerbraun, M.D. Neal, M.R. Rosengart, R.M. Forsythe, T.R. Billiar, D.M. Yealy, A.B. Peitzman, and M.S. Zenati, for the PAMPer Study Group*

CONCLUSIONS

In injured patients at risk for hemorrhagic shock, the prehospital administration of thawed plasma was safe and resulted in lower 30-day mortality and a lower median prothrombin-time ratio than standard-care resuscitation. (Funded by the U.S. Army Medical Research and Materiel Command; PAMPer ClinicalTrials.gov number, NCT01818427.)

Research

JAMA | Original Investigation

Association of Prehospital Blood Product Transfusion During Medical Evacuation of Combat Casualties in Afghanistan With Acute and 30-Day Survival

Stacy A. Shackelford, MD; Deborah J. del Junco, PhD; Nicole Powell-Dunford, MD; Edward L. Mazuchowski, MD, PhD; Jeffrey T. Howard, PhD; Russ S. Kotwal, MD, MPH; Jennifer Gurney, MD; Frank K. Butler Jr, MD; Kirby Gross, MD; Zsolt T. Stockinger, MD

CONCLUSIONS AND RELEVANCE Among medically evacuated US military combat causalities in Afghanistan, blood product transfusion prehospital or within minutes of injury was associated with greater 24-hour and 30-day survival than delayed transfusion or no transfusion. The findings support prehospital transfusion in this setting.

JAMA. 2017;318(16):1581-1591. doi:10.1001/jama.2017.15097

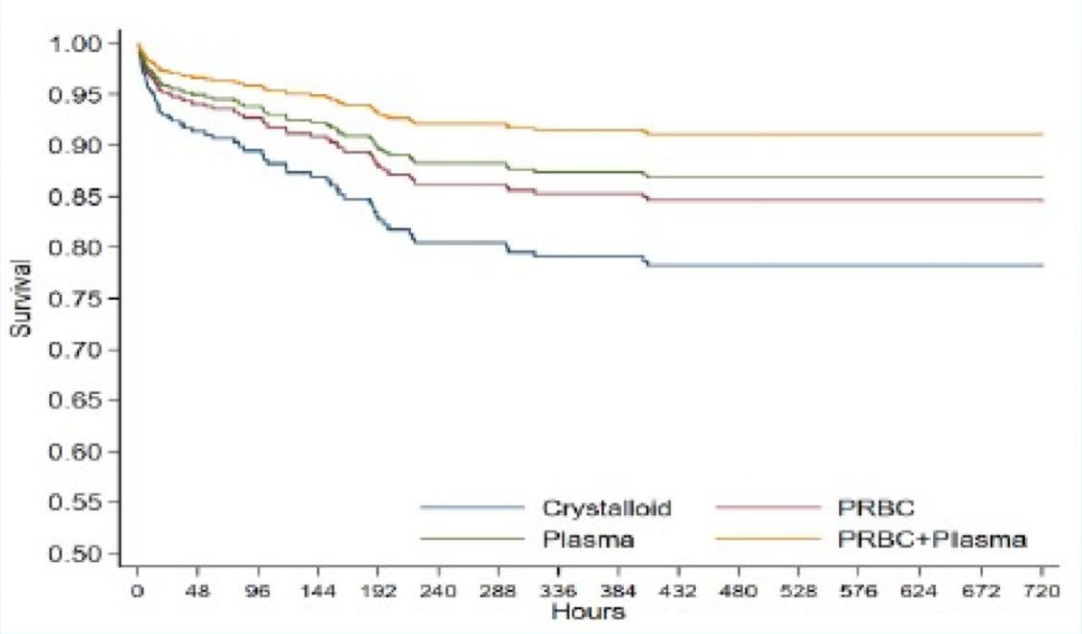
Pre-Trauma Center Red Blood Cell Transfusion Is Associated with Improved Early Outcomes in Air Medical Trauma Patients

Joshua B Brown, MD, Jason L Sperry, MD, MPH, FACS, Anisleidy Fombona, BS, Timothy R Billiar, MD, FACS, Andrew B Peitzman, MD, FACS, Francis X Guyette, MD, MPH

http://dx.doi.org/10.1016/j.jamcollsurg.2015.01.006
ISSN 1072-7515/15

Pamper Prehospital Blood Component Secondary Analysis

- Recent secondary analysis of PAMPer trial demonstrates patients receiving both PRBC + Plasma in the prehospital setting have highest adjusted survival rates
- All blood products given prehospital are shown to increase survival
- Crystalloid alone prehospital has highest mortality



Blood Administration

Policy and Procedure

Air Methods®

AMC Indications for PRBCs

- Acute hemorrhage with documented hemoglobin <7g/dl

- Signs of shock in the setting of acute hemorrhage:
  - Evidence of hypoperfusion including pallor and peripheral vasoconstriction: cool pale skin, delayed cap refill
  - Hypotension: SBP<90 mmHg
  - Tachycardia: HR> 100BPM

AMC Indications for Plasma

Acute uncontrolled hemorrhage typically from trauma with signs of shock:

- Clinical signs of acute hemorrhage that is uncontrolled
- Ongoing blood loss of >2ml/kg/min
- Loss of 50% blood volume with in 4 hrs
- Loss of 100% blood volume within 24 hrs

AMC PROCEDURE

- Select the appropriate blood product:
  - - Type A plasma.
  - - Males: Use O+ Packed Red Blood Cells (PRBCs).
  - - Females beyond child bearing age: use O+ PRBCs.
  - - Females of childbearing age or younger: use O - PRBCs (if available).

  - ***Be sure to notify the receiving facility if females have received O+ blood products***

Products Carried by Flight Teams

- 2 units PRBC's
- 1 or 2 units of liquid Plasma
  (never frozen)
- Type/Cross not possible prehospital, so only universal products carried

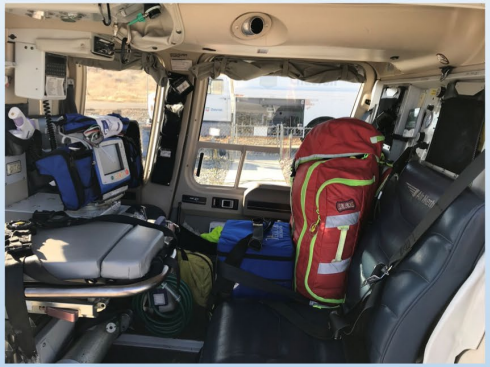
Base Storage

- Laboratory grade refrigerator
- Continuous redundant temp monitoring
- Log completed daily and each time product removed
- Storage and recording per American Red Cross guidelines

Transport Storage

VeriCor Cool Cube

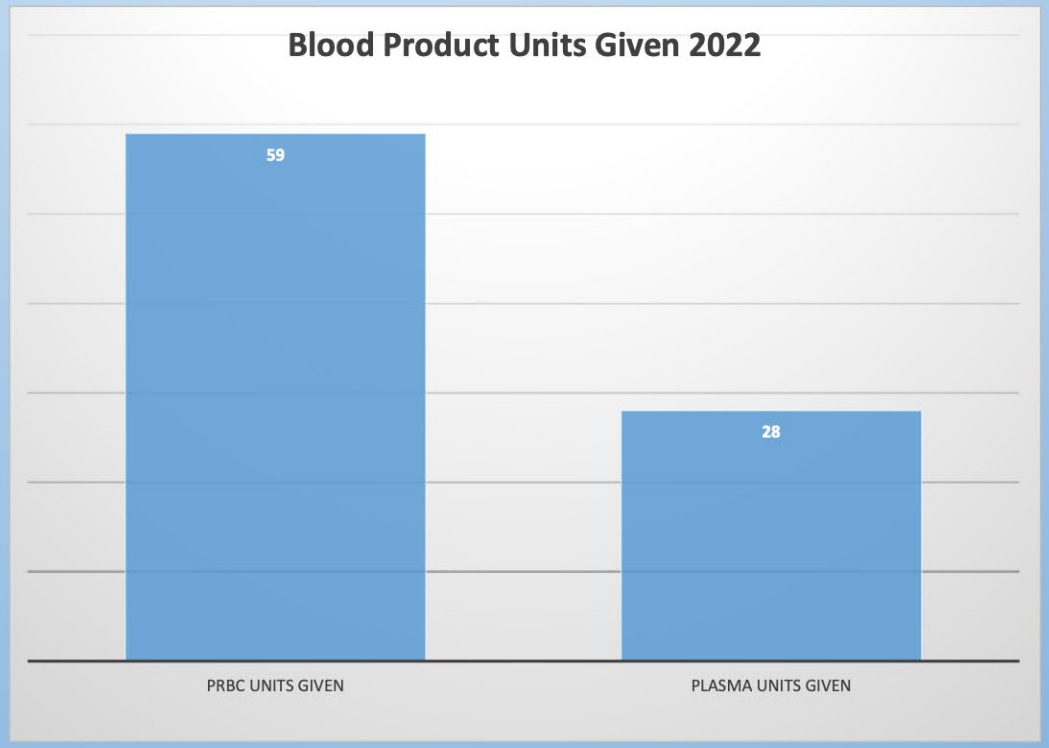
A laboratory validated cooler that utilizes PCM technology to keep product such as blood products, tissues, and organs 1-6°C for 39+ hours without the need for electricity, ice or buffering material.



Mercy Air 2021

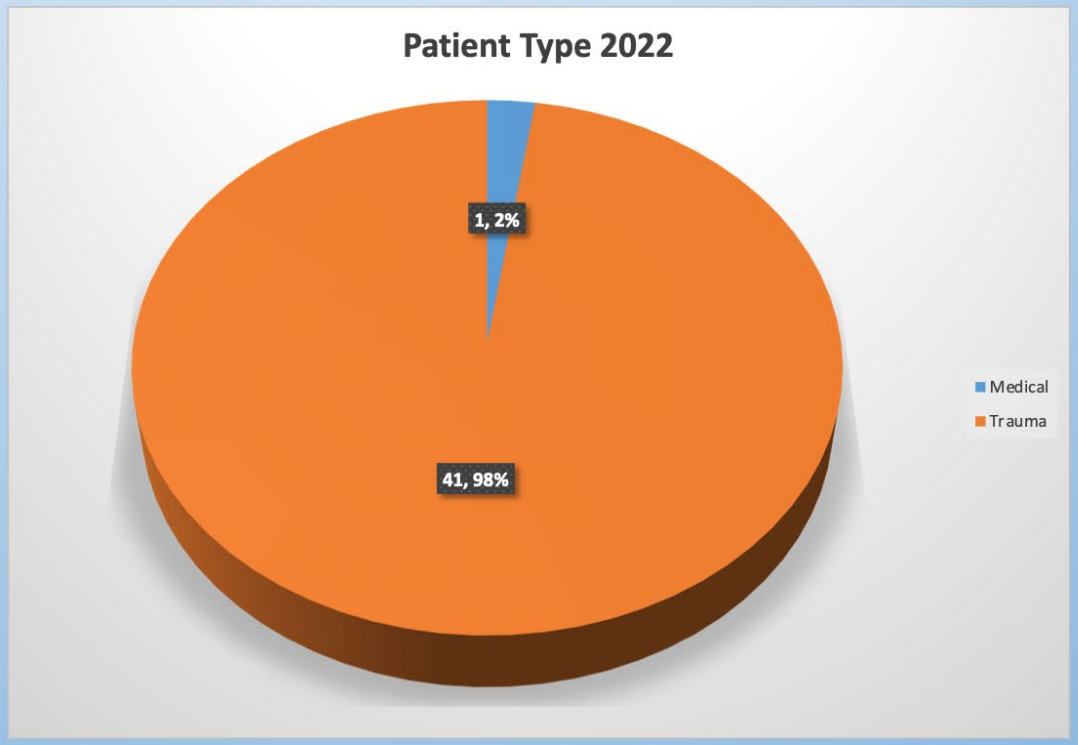
- 14 Base locations carrying blood
- 92 Patients given blood products prehospital
- 125 units PRBC
- 30 units plasma
- 1251 Scene Trauma Responses in 2021
- 7.35% rate of utilization

Units Given in 2022

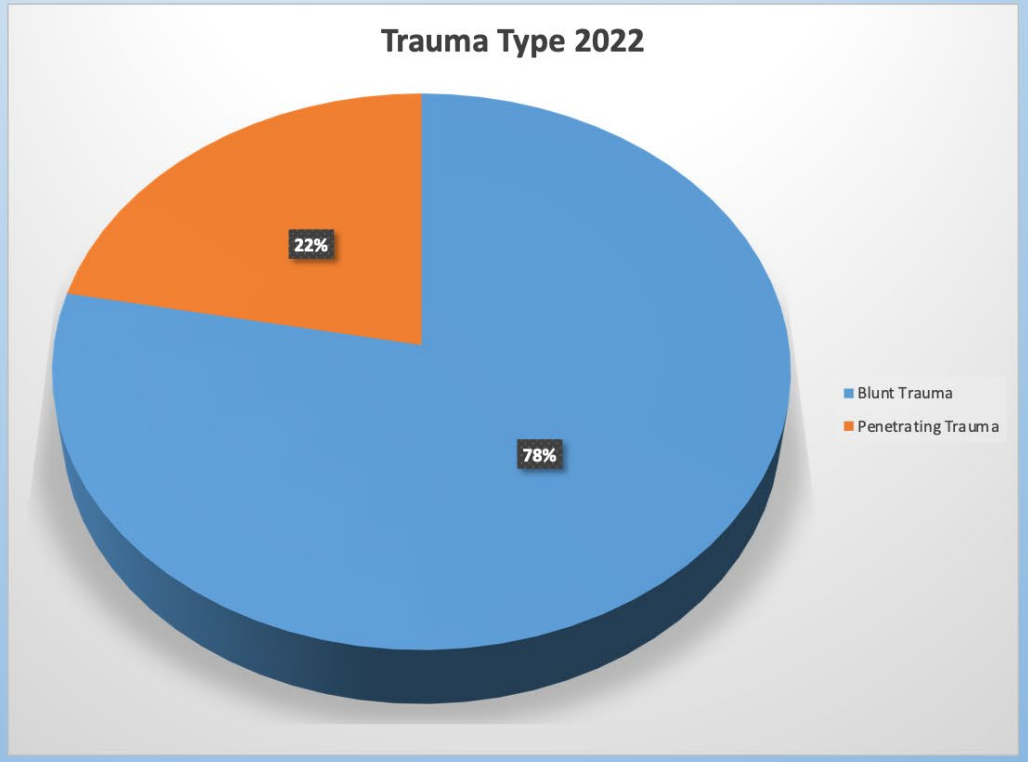


AirMethods®

Trauma vs Medical

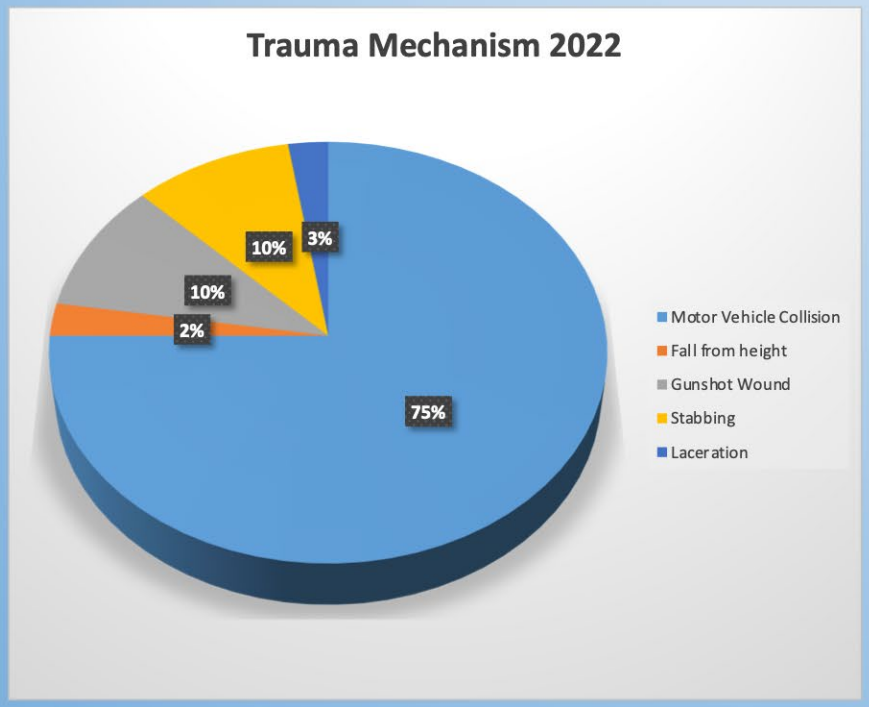


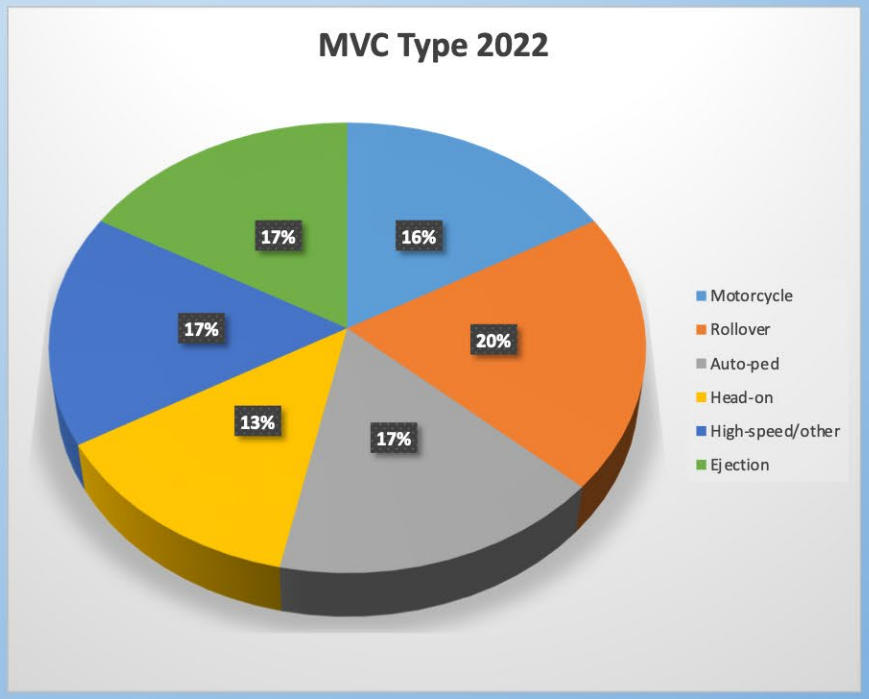
Trauma Type



AirMethods®

Mechanism

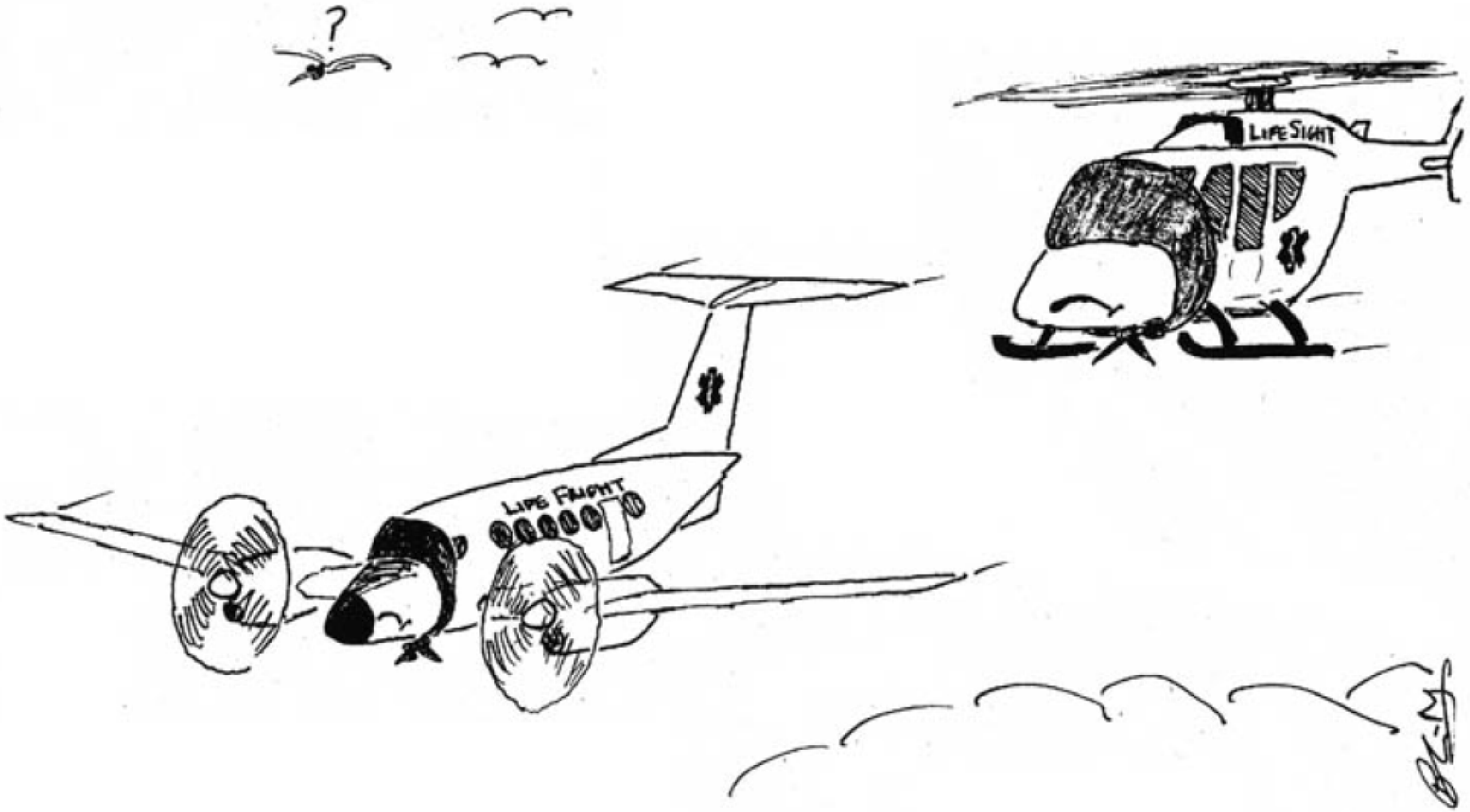

Trauma Mechanism 2022
10%
3%
10%
2%
75%
Motor Vehicle Collision
Fall from height
Gunshot Wound
Stabbing
Laceration


MVC Type 2022
17%
16%
17%
20%
13%
17%
Motorcycle
Rollover
Auto-ped
Head-on
High-speed/other
Ejection


BIG BUN
"WHERE'S THE BEEF?"

General Considerations for Method of Transport

- 1)Time Dependent medical illness or injury
- 2)Distance and time of transport, including local geography and traffic conditions
- 3)Needs of the patient matched to special skills of the transport medicine crew
- 4)Weather conditions
- 5)Cost



THE DOUBLE BLIND TRIAL BETWEEN FIXED AND ROTOR WING RESPONSES WAS NOT WITHOUT ITS PROBLEMS

Manipulate Time

- Traditional model- trauma medevac-military style- “A faster ambulance”
- Evolving models- critical care teams/transport- “A mobile ED/ICU”

- Traumatic Injury
- Acute Coronary Events
- Acute Stroke
- OB

Trauma

- Baxt and Moody, 1983- 52% reduction in predicted mortality Air vs. Ground- (note: time longer air vs ground)
- University of Rochester study, 2011- 75k patients, registry study- air patients had higher ICU admit rate, shorter transport times, shorter prehospital times, and increased rate of survival if ISS>15

Trauma continued

- Univ Maryland Study, 2012- 223k patients, helicopter associated with 16% increased rate of survival=65 patients transport to save a life
- Bulger et al, ROC trials, “CONCLUSION: There was no difference in the adjusted clinical outcome according to mode of transport. However, air medical transported more severely injured patients with more advanced life support procedures and longer prehospital time.”

Speed is not everything: Identifying patients who may benefit from helicopter transport despite faster ground transport

Xilin Chen, MPH, Mark L. Gestring, MD, Matthew R. Rosengart, MD, MPH, Timothy R. Billiar, MD, Andrew B. Peitzman, MD, Jason L. Sperry, MD, MPH, *and* **Joshua B. Brown, MD, MSc**, *Pittsburgh, Pennsylvania*

BACKGROUND: Helicopter emergency medical services (HEMS) have demonstrated survival benefits over ground emergency medical services (GEMS) for trauma patient transport. While HEMS speed is often-cited, factors such as provider experience and level of care may also play a role. Our objective was to identify patient groups that may benefit from HEMS even when prehospital time for helicopter utilization is longer than GEMS transport.

METHODS: Adult patients transported by HEMS or GEMS from the scene of injury in the Pennsylvania State Trauma Registry were included. Propensity score matching was used to match HEMS and GEMS patients for likelihood of HEMS, keeping only pairs in which the HEMS patient had longer total prehospital time than the matched GEMS patient. Mixed-effects logistic regression evaluated the effect of transport mode on survival while controlling for demographics, admission physiology, transfusions, and procedures. Interaction testing between transport mode and existing trauma triage criteria was conducted and models stratified across significant interactions to determine which criteria identify patients with a significant survival benefit when transported by HEMS even when slower than GEMS.

RESULTS: From 153,729 eligible patients, 8,307 pairs were matched. Helicopter emergency medical services total prehospital time was a median of 13 minutes (interquartile range, 6–22) longer than GEMS. Patients with abnormal respiratory rate (odds ratio [OR], 2.39; 95% confidence interval [CI], 1.26–4.55; $p = 0.01$), Glasgow Coma Scale score of 8 or less (OR, 1.61; 95% CI, 1.16–2.22; $p < 0.01$), and hemo/pneumothorax (OR, 2.25; 95% CI, 1.06–4.78; $p = 0.03$) had a significant survival advantage when transported by HEMS even with longer prehospital time than GEMS. Conversely, there was no association between transport mode and survival in patients without these factors ($p > 0.05$).

CONCLUSION: Patients with abnormal respiratory rate, Glasgow Coma Scale score of 8 or less, and hemo/pneumothorax benefit from HEMS transport even when GEMS transport was faster. This may indicate that these patients benefit primarily from HEMS care, such as advanced airway and chest trauma management, rather than simply faster transport to a trauma center. (*J Trauma Acute Care Surg.* 2018;84: 549–557.

LEVEL OF EVIDENCE: Therapeutic, level III.

KEY WORDS: Helicopter; air medical; emergency medical services; prehospital; triage.

Several authors report survival benefits of helicopter emergency medical services (HEMS) when compared to ground emergency medical services (GEMS) for transport of injured patients.[1–4] The mechanism underlying this benefit has been difficult to evaluate in prior studies. Many point to the time and speed benefit of HEMS over GEMS, with the predominant goal of bringing the patient to the trauma center as quickly as possible.[5]

Submitted: August 30, 2017, Revised: November 16, 2017, Accepted: November 27, 2017, Published online: December 15, 2017.

From the Division of Trauma and General Surgery, Department of Surgery (X.C., M.R.R., T.R.B., A.B.P., J.L.S., J.B.B.), University of Pittsburgh Medical Center, Pittsburgh, Pennsylvania; and Division of Acute Care Surgery, Department of Surgery (M.L.G.), University of Rochester Medical Center, Rochester, New York.

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This article was presented as an oral podium presentation at the 76th Annual Meeting of the American Association for the Surgery of Trauma, September 13-16th, 2017; Baltimore, MD.

Supplemental digital content is available for this article. Direct URL citations appear in the printed text, and links to the digital files are provided in the HTML text of this article on the journal's Web site (www.jtrauma.com).

However, one potential factor driving the benefit is the care provided by HEMS crews during transport. In some cases, HEMS provide prehospital interventions not available from advanced life support GEMS, such as advanced airway management and blood product transfusion.[6,7] Further, HEMS crews are often the most experienced prehospital providers and more frequently care for severely injured patients than any given GEMS crew. This embodies the concept of bringing the trauma center to the patient.

Likely, some combination of these factors results in the benefits that have been reported for HEMS transport. A subset of patients have time-sensitive injuries that require rapid transport, while some may benefit from advanced care regardless of any time savings.[8] In fact, there may be a subset of patients that benefit from immediate critical prehospital interventions even if GEMS transport to the trauma center would be faster. It remains unclear who these patients are, and how they may be identified in the field.

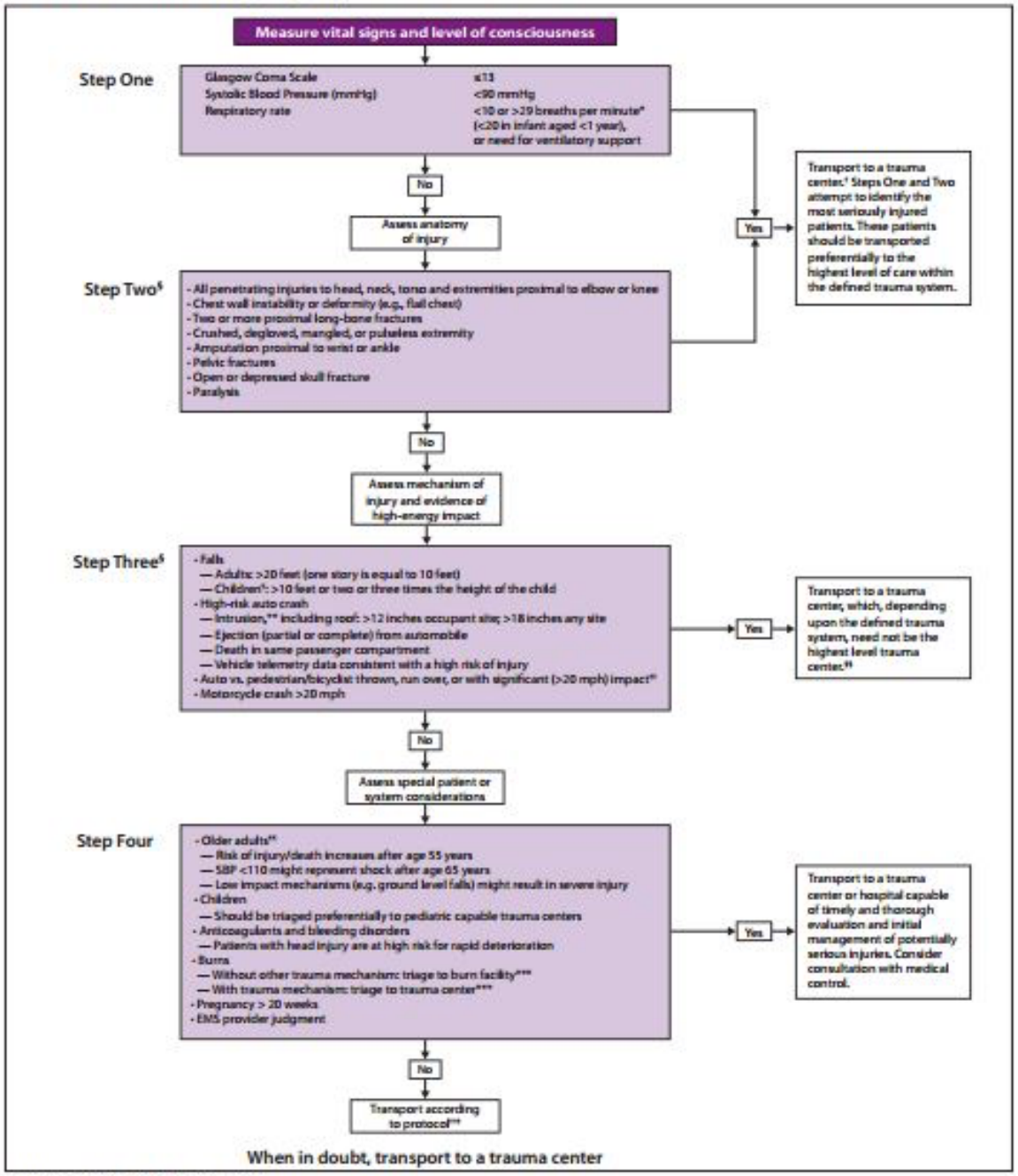
We hypothesized a subset of existing triage criteria would identify these patients that may benefit from HEMS transport even if GEMS transport would be faster. Therefore, it was our objective to determine if existing trauma triage criteria could

TABLE 3. Stratified Regression Results for Triage Criteria With Significant Interaction Between Criterion and Transport Mode

Criterion	AOR Survival HEMS vs. GEMS	95% CI	*p*
RR <10 or >29 bpm			
Present	2.39	1.26–4.55	0.01
Absent	1.16	0.93–1.44	0.20
GCS score ≤ 8			
Present	1.61	1.16–2.22	<0.001
Absent	1.16	0.84–1.61	0.37
Hemothorax or pneumothorax			
Present	2.25	1.06–4.78	0.03
Absent	1.16	0.93–1.45	0.19

Chen X, Gestring ML, Rosengard MR, et al. Speed isn't everything: identifying patients who may benefit from helicopter transport despite faster ground transport. J Trauma Acute Care Surg. 2017 Dec 14

FIGURE 2. Guidelines for field triage of injured patients — United States, 2011



See Figure 2 footnotes on the next page.

POSITION PAPER

NATIONAL ASSOCIATION OF EMS PHYSICIANS

GUIDELINES FOR AIR MEDICAL DISPATCH

David P. Thomson, MD, MS, Stephen H. Thomas, MD, MPH, for the 2002–2003 Air Medical Services Committee of the National Association of EMS Physicians

TABLE 1. Questions That Can Assist in Determining Appropriate Transport Mode

- Does the patient's clinical condition require minimization of time spent out of the hospital environment during the transport?
- Does the patient require specific or time-sensitive evaluation or treatment that is not available at the referring facility?
- Is the patient located in an area that is inaccessible to ground transport?
- What are the current and predicted weather situations along the transport route?
- Is the weight of the patient (plus the weight of required equipment and transport personnel) within allowable ranges for air transport?
- For interhospital transports, is there a helipad and/or airport near the referring hospital?
- Does the patient require critical care life support (e.g., monitoring personnel, specific medications, specific equipment) during transport, which is not available with ground transport options?
- Would use of local ground transport leave the local area without adequate emergency medical services coverage?
- If local ground transport is not an option, can the needs of the patient (and the system) be met by an available regional ground critical care transport service (i.e., specialized surface transport systems operated by hospitals and/or air medical programs)?

Table 1 Summary of the criteria for the primary deployment of the Rotterdam helicopter-transported medical team for trauma patients

Category	Criterion
General	Place difficult to reach for ambulances (> 20 min to reach injury scene)
	If, in professional opinion of dispatcher, the HMT provides additional value
Mechanism of trauma	Motor vehicle accidents with estimated speed of > 30 km/h
	Frontal collisions outside the built-up area of a town
	Fall from > 6 m or third floor
	Entrapment in vehicle
	Death of other occupant
	Ejected from vehicle
	Explosions
	Near drowning or diving accidents
	Exposure to toxic chemicals
	Inhalation trauma or severe burns
Patient condition	Penetrating injuries to head, neck or trunk
	Pelvic, spinal or femur fracture
	Comatose (Glasgow Coma Score of ≤ 8)
	Systolic blood pressure < 95 mmHg or pulse > 120 per min
	Major estimated blood loss (> 1 litre)
	Respiratory distress

Ambulances, while on scene, can always request assistance (secondary deployment). HMT, helicopter-transported medical team.

London HEMS

Fall >2m Entrap LOC Apnea Burns GSW/Stab Limb threat

COUNTY OF SAN DIEGO
HEALTH & HUMAN SERVICES AGENCY
EMERGENCY MEDICAL SERVICES

LIVE WELL SAN DIEGO

Chapter: COUNTY OF SAN DIEGO EMERGENCY MEDICAL SERVICES
Key Words: Policy/Procedure/Protocol

SUBJECT: Air Medical Support Utilization

POLICY NO: A-475
PAGE: 1 of 3
DATE: July 1, 2016

AUTHORITY: Health and Safety Code, Division 2.5, Sections 1797.204, 1797.206, 1797.218, and 1798; California Code of Regulations, Title 22, Division 9, Chapter 8; and San Diego County Ambulance Ordinance No. 10071

I. PURPOSE

To define criteria for patient tra
County of San Diego, Emergen

III. PROCEDURES

A. Utilization of Air Ambulance

Helicopter transportation of patients should be considered for cases that meet the following criteria:

1. Ground transport time to the appropriate hospital exceeds 30 minutes and the helicopter can deliver the patient to the hospital in a shorter time than the ground unit based on the time the patient is ready for transport, or a patient whose condition requires advanced skills not available on a paramedic unit.
2. Any one or more of the following patient conditions:
   a. Patients with critical traumatic injuries
   b. Uncontrolled hemorrhage
   c. Hypotensive/shock
   d. Critical burns
   e. Spinal cord injuries with neurologic dysfunction
   f. Vascular compromise in a limb or amputation
   g. Barotrauma (consider altitude)
   h. Snake bite with signs of significant envenomation
   i. Drowning
   j. Status epilepticus
   k. Cardiovascular instability
   l. Acute stroke with significant deficits less than six hours
   m. Critical respiratory patients
   n. Other injuries or medical problems in area inaccessible to (or with prolonged extrication or prolonged Estimated Time of Arrival (ETA) for ground units)
   o. Conditions subject to the approval of the Base Hospital Physician

B. Contraindications to Transport

1. When ground transport time is equal to or shorter than air transport time
2. Trauma resource patients (except in areas inaccessible to ground units)

C. Relative Contraindications to Transport

1. Adult patients in cardiac arrest
2. Potentially violent patients or those with behavioral emergencies
3. Stable patients (except in areas inaccessible to ground units)


Barona
MERCY AIR

Cardiovascular disease

- Studies initially suggested worst outcomes possibly due to elevated catecholamines during air transport
- Subsequent studies showed can be safely done (Straumann et al, Vukov et al, Fromm et al, Sinclair)
- Outcomes based studies focus on reduction of D2B times

Cardiac Arrest

- Studies don't show benefit
- Can't do CPR well
- Prolonged out of hospital time
- Non-cardiac arrest cases may benefit (drowning, electrocution)
- Direct scene response not likely to benefit
- ??Patients w ROSC, BLS only areas
- ??LUCAS/ECMO??

Neurologic

- Few studies
- Chalela et. al. showed could safely transport pts. w thrombolytics
- Time component critical with 4.5 TPA window, and longer for neurovascular intervention
- Olson called in to question benefit, showed no benefit, all 122 patients had already received fibrinolytics prior to t-fer negating time benefit

BEMI (Brain Emergency Management Initiative) Protocol

El Centro Regional Medical Center-UC San Diego Inter-Hospital Transfer Transfer Record

BEMI: As determined by UCSD Telestroke provider, a patient with stroke or ICH within 6 hours of last known well time, where a UCSD stroke code was called, who is in need of step up in care for subsequent stroke, neurocritical, neurosurgical or neurointerventional care.

Top Priority
ACTIVATE TRANSPORT !!

ACTIVATE UCSD TELESTROKE PATHWAY:

☐ Once UCSD Telestroke sees patient, verifies if bed available, and identifies case as BEMI, then activate BEMI protocol.

ACTIVATE BEMI PROTOCOL:

☐ Unit Secretary: Call Air Medical Services for "Early Activation" for a BEMI.

☐ Unit Secretary: Call UCSD Transfer Center *after* activating Air Medical Services.

NURSING:

☐ ECRMC RN: Gives in-air report to Air Medical RN if ETA > 15 minutes.

☐ ECRMC RN: Gives report to UCSD RN. *If unavailable, give report to UCSD charge nurse immediately*. DO NOT DELAY

PACKET PREPARATION (ECRCMC TEAM): *DO NOT COPY medical records, labs, imaging unless specifically requested by UCSD provider.*

☐ Informed consent for transfer (opposite page) ☐ Physician Certification (below)

☐ Facesheet

Physician Certification:

1. Department: ED or ICU (circle one)

This hospital is required by federal law to provide any presenting patient with a medical screening examination to determine whether an emergency medical condition exists and to provide necessary stabilizing care within its capabilities for emergency medical conditions without regard to means or ability to pay. This hospital does participate in Medicare and Medical.

2. Patient Condition: *The patient may be at risk for deterioration from or during transport. Based on my examination of the patient and the information available to me at the time of transfer, I certify that the risks of transfer are outweighed by the benefits reasonably anticipoted from proper care at the receiving facility.*

3. Reason for Transfer: *For services not available at this facility.*

4. Risks of Transfer: *All transfers have inherent risks of delays or accidents in transit, pain or discomfort upon movement, and limited medical capacity of transport units. In addition, the following risks have been identified:* _____

5. Benefits of Transfer: *Step up in stroke care and/or neurosurgical/neurointerventional/neurocritical expertise.*

6. Mode of Transport:

☐ Helicopter RN ☐ Fixed Wing-RN
☐ ALS Ambulance-RN
☐ ALS Ambulance-PM
☐ BLS Ambulance-EMT

7. Updated Status of patient's condition (immediately prior to departure with date/time below)

BP____HR___RR___T___SaO2___Pain Intensity (0-10) _____

MD Signature:_____Date:_____Time___

El Centro Regional Medical Center Current June 2016

Hospital Acceptance (filled out by ECRMC Unit secretary)

The Receiving Facility has available space and qualified personnel for treatment of the patient and has agreed to accept the transfer and to provide appropriate medical treatment.

Accepting Provider: _____

Accepting Facility: (circle one) UCSD Hillcrest or UCSD La Jolla

City, State: San Diego, CA

Accepted By: _____ _____
Point of Contact at UCSD Transfer Center *Time*

Number for Report:_____Room#_____

_____ _____
Signature of Personnel obtaining acceptance *Title*

_____
Name of Transferring Agency Contacted *Time*

Accepting hospital nursing report to: _____ Title: _____ Time: _____ Deferred due to delay

Dispo of patient's belongings: _____

ECRMC RN Signature: _____

Care Relinquished to: _____
AIR MEDICAL RN

Discharge Date:____/____/_____Time: _____

Patient Label:

Obstetric

- High risk women in labor require care in specialized settings and often have time dependent condition (esp in labor)
- Few studies look at this, risks comparable to non transport of these patients

Future Directions

- Trauma has decent body of literature to support general use, need to hone in on which ones
- Some evidence to suggest use in cardiac and neuro; question is- which ones most benefit?
- Other conditions not well studied

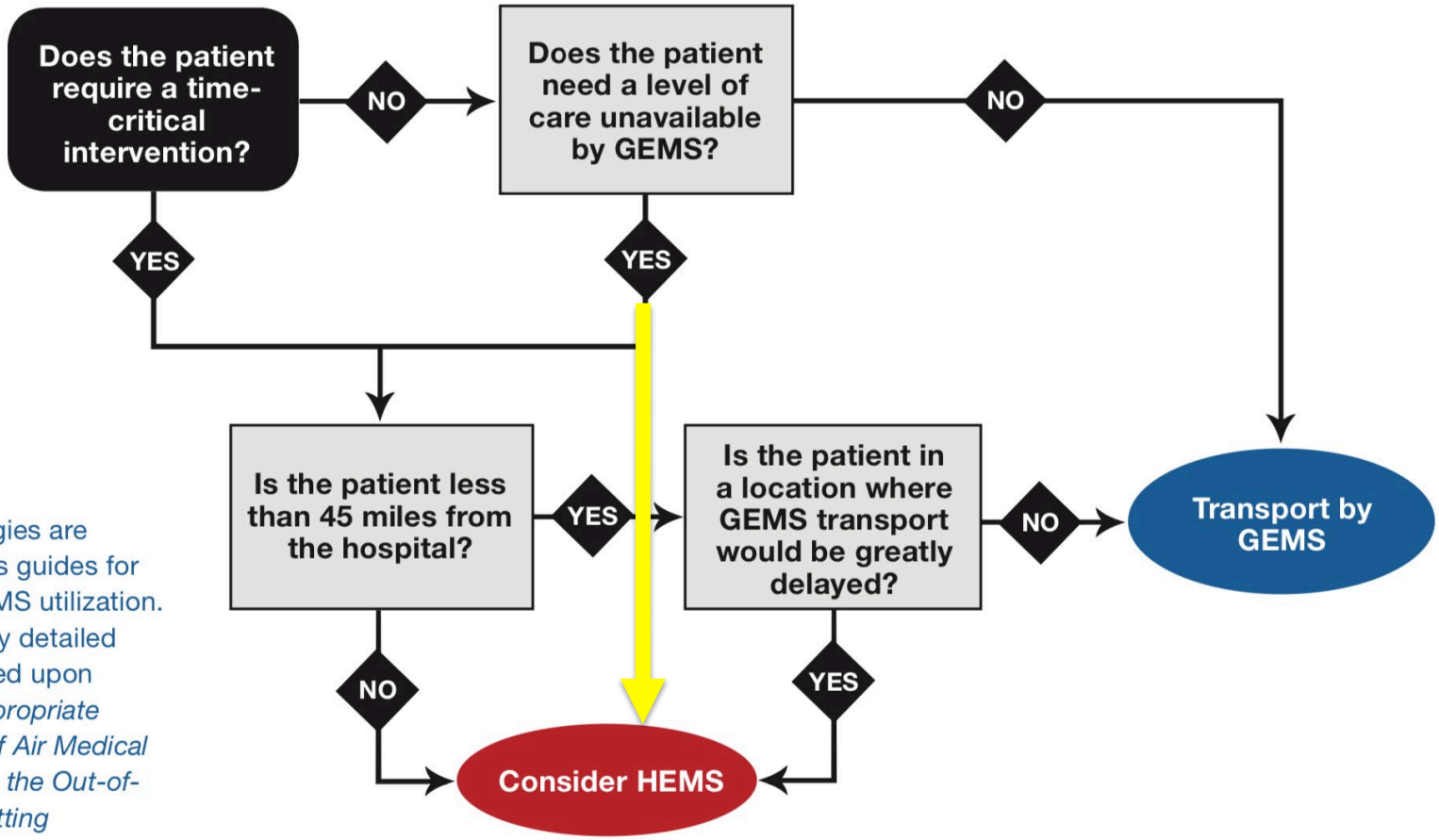
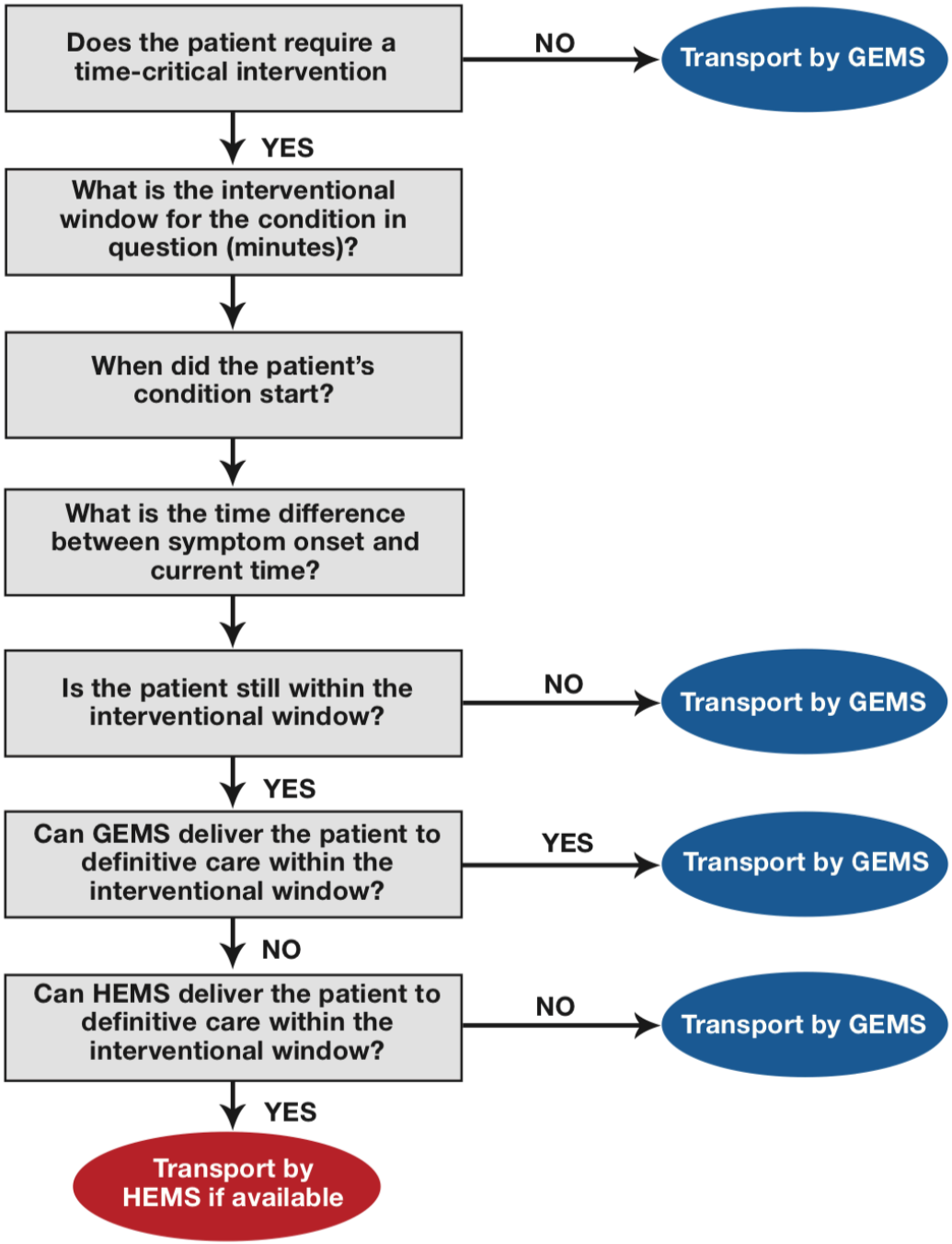


FIGURE 1

New strategies are emerging as guides for limiting HEMS utilization. The strategy detailed here is based upon ACEP's *Appropriate Utilization of Air Medical Transport in the Out-of-Hospital Setting*

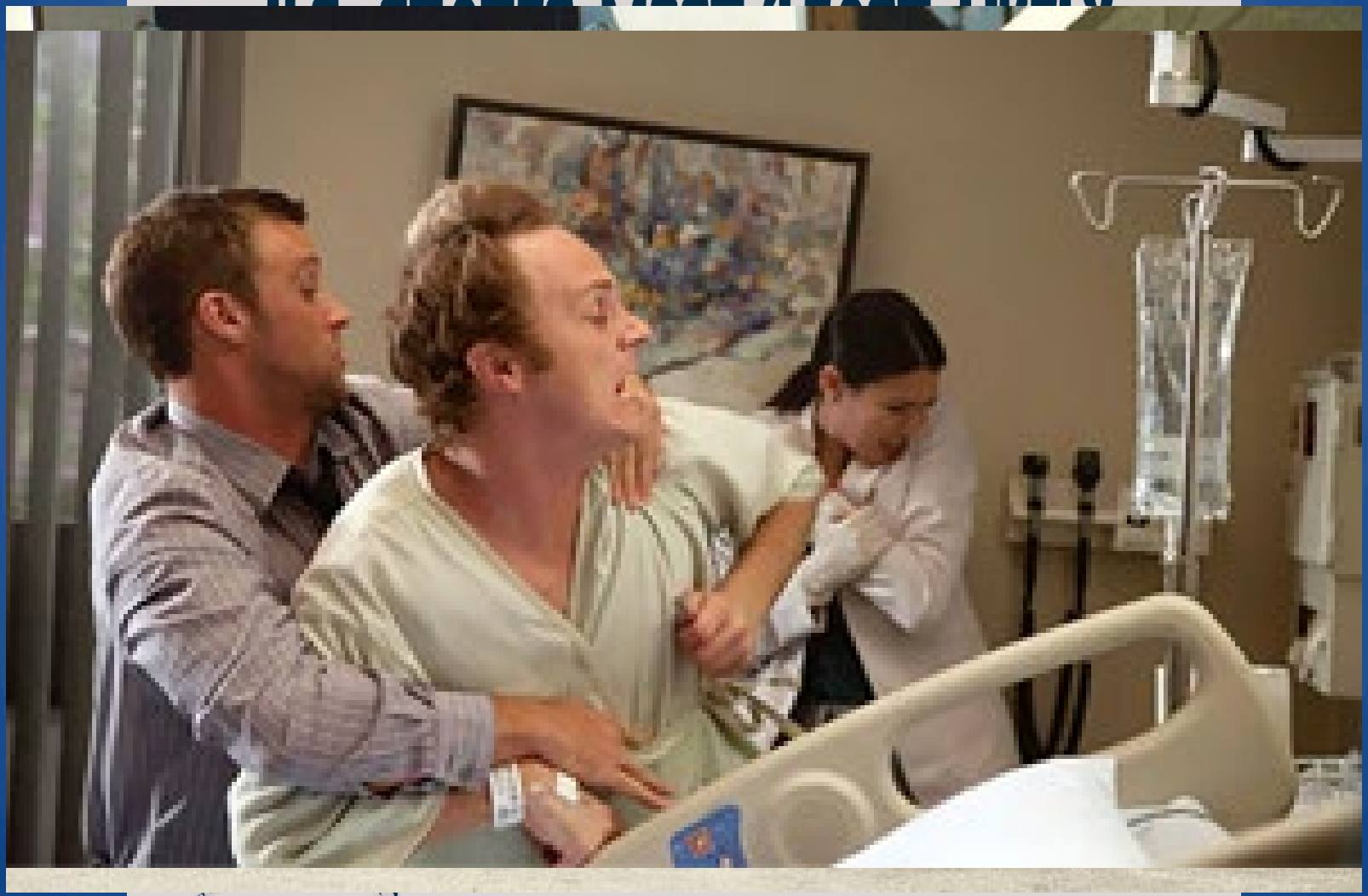
FIGURE 2

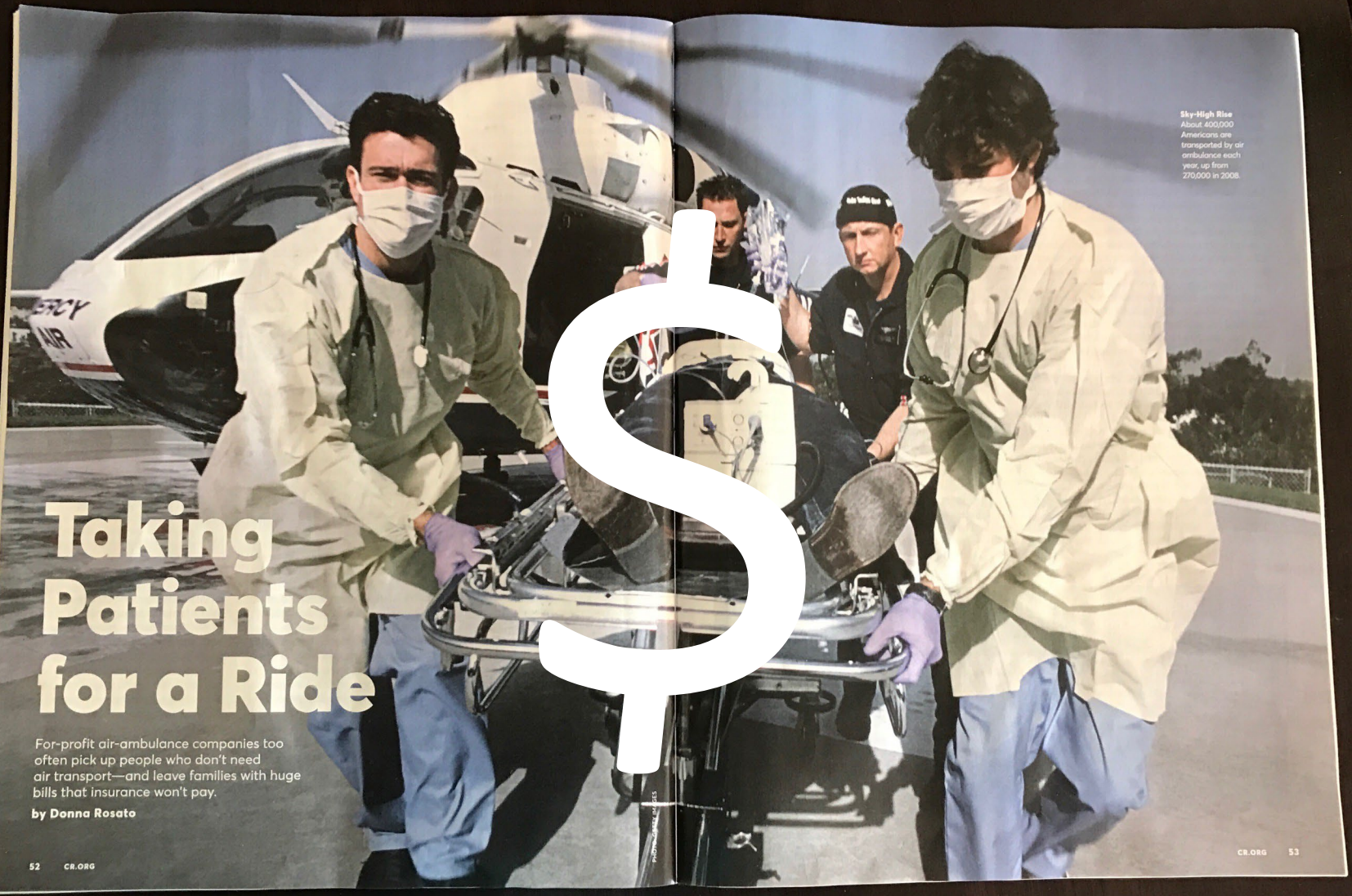

Does the patient require a time-critical intervention
NO
Transport by GEMS
YES
What is the interventional window for the condition in question (minutes)?
When did the patient's condition start?
What is the time difference between symptom onset and current time?
Is the patient still within the interventional window?
NO
Transport by GEMS
YES
Can GEMS deliver the patient to definitive care within the interventional window?
YES
Transport by GEMS
NO
Can HEMS deliver the patient to definitive care within the interventional window?
NO
Transport by GEMS
YES
Transport by HEMS if available

“Is it the H or the EMS in HEMS that has an impact on trauma patient mortality? …”

Daniel P Butler [1], Imran Anwar, Keith Willett
Emerg Med J, 2010 Sep;27(9):692-701.

Challenges





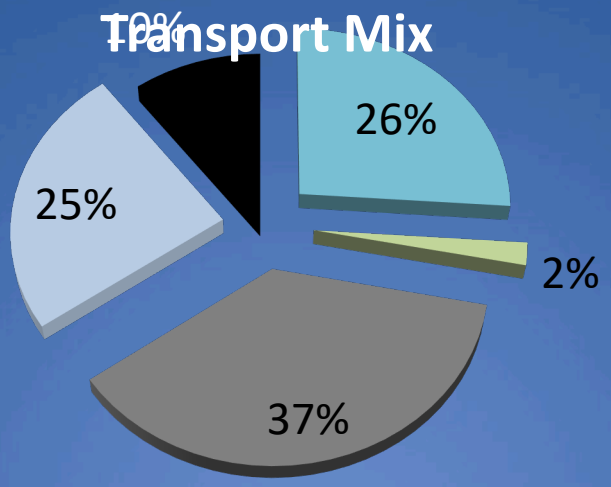
Taking Patients for a Ride

For-profit air-ambulance companies too often pick up people who don't need air transport—and leave families with huge bills that insurance won't pay.

by Donna Rosato

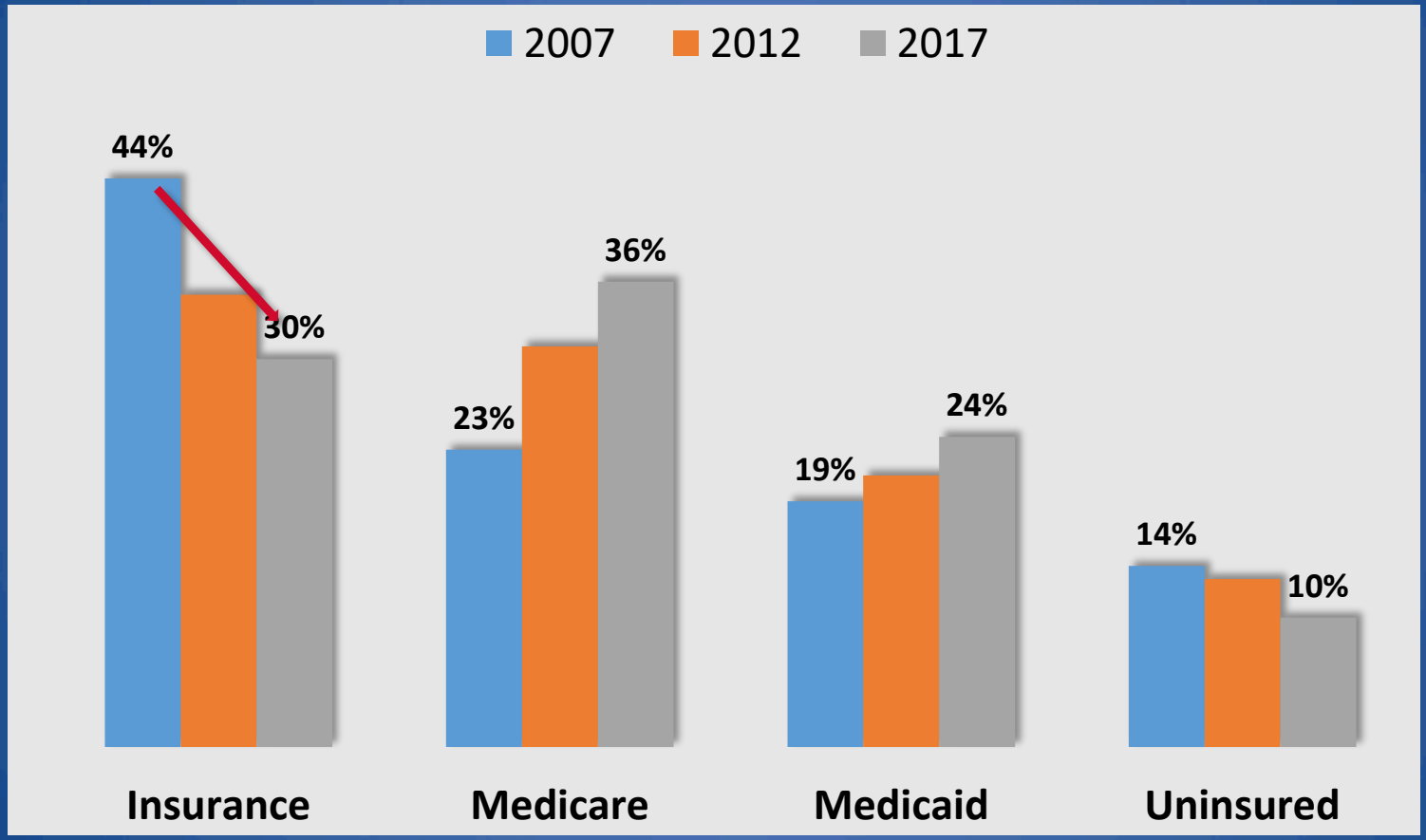
Sky-High Rise
About 400,000 Americans are transported by air ambulance each year, up from 270,000 in 2008.

“What” Does it Take to Provide Emergency Air Medical Transport Services?



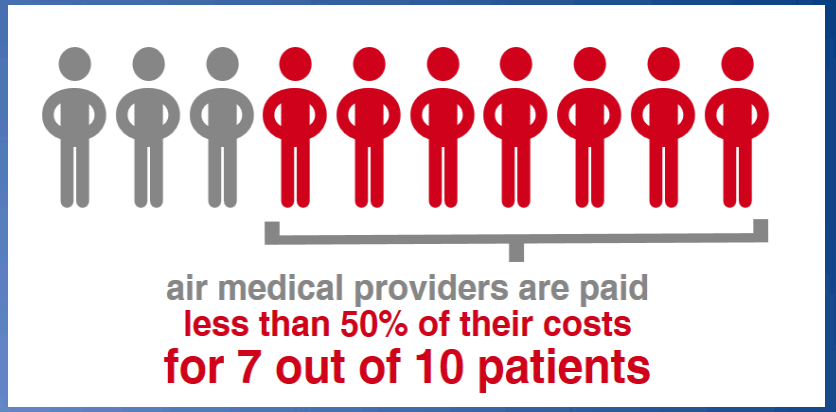
Transport mix ratios from Xcenda, LLC. 2017. Air Medical Services Cost Study Report. Association of Air Medical Services. www.AAMS.org. www.aams.org/aams-publishes-findings-air-medical-cost-study/

Dramatic Shift Over Past 10 Years In Who We Fly



*Sharp decline in privately insured transport mix over last 10 years

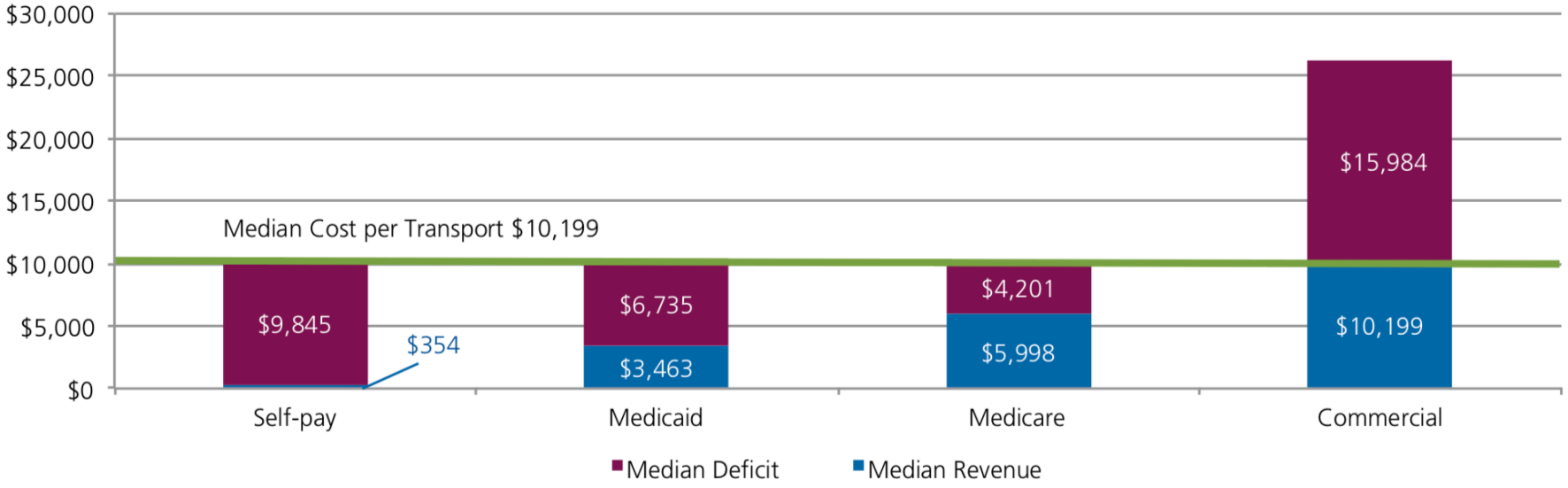
The Reimbursement Issue



- 70% of Reimbursements are either Medicare, Medicaid, other government programs
- These drastically under-reimburse, which creates an unsustainable cost-shift to the private sector or self insured.
- Insurers are increasingly setting rates arbitrarily or delaying/denying payments, putting further pressure on the health care system
- This unfairly leaves patients in the middle
- Reimbursement shortfall threatens access to all air medical services, particularly for rural communities

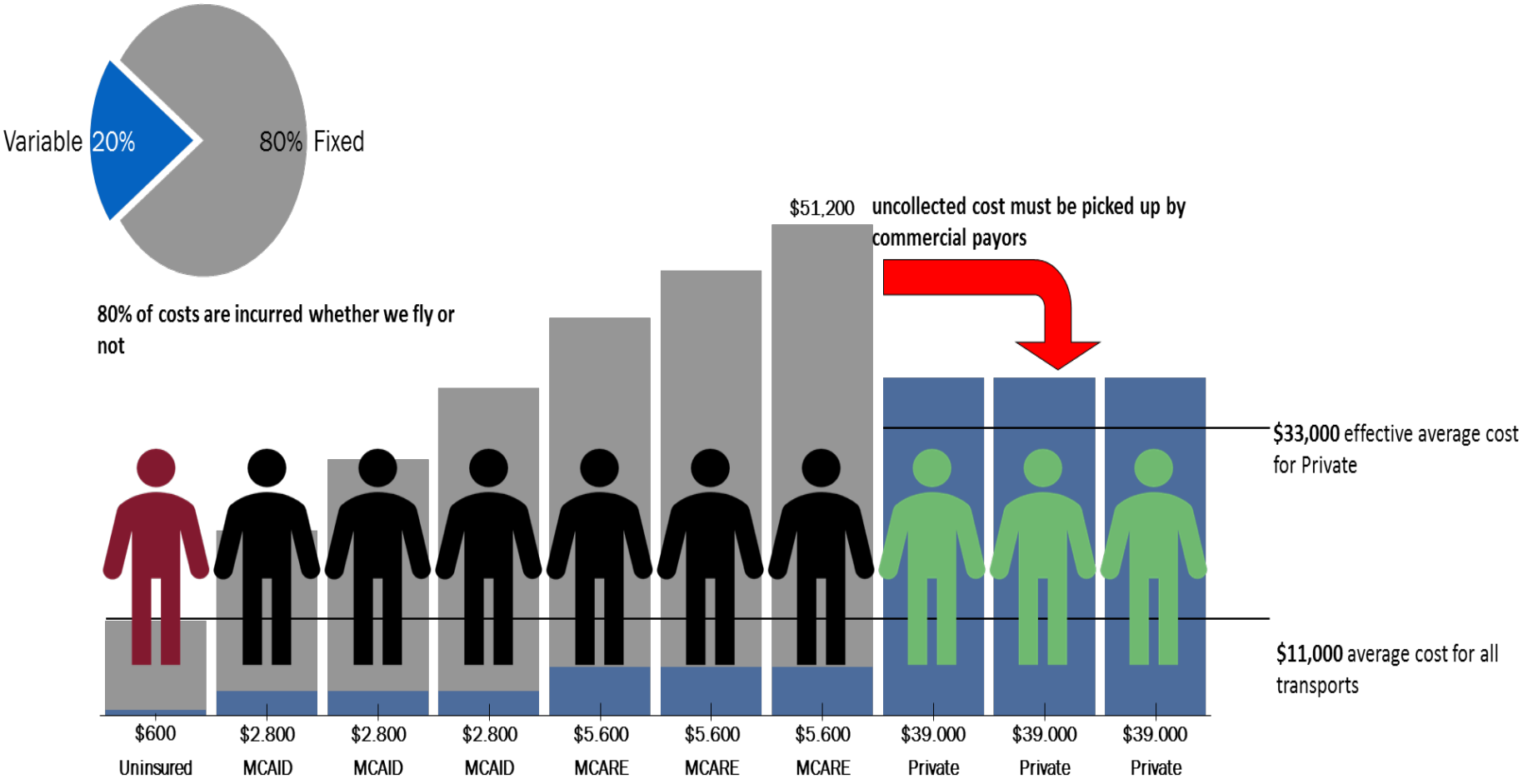
Payer mix data from Xcenda, LLC. 2017. Air Medical Services Cost Study Report. Association of Air Medical Services. www.AAMS.org. www.aams.org/aams-publishes-findings-air-medical-cost-study/

Figure 4. *Cost Deficit Illustration Experienced by Providers, Based on Reported Payer Mix*[a]



[a] Cumulative deficit shown for commercial insurance payers is based on the median cost deficit experienced by Medicare, Medicaid, and self-pay, weighted according to the overall study sample payer-mix. Analysis does not include other payers not shown (eg, Veterans Affairs).

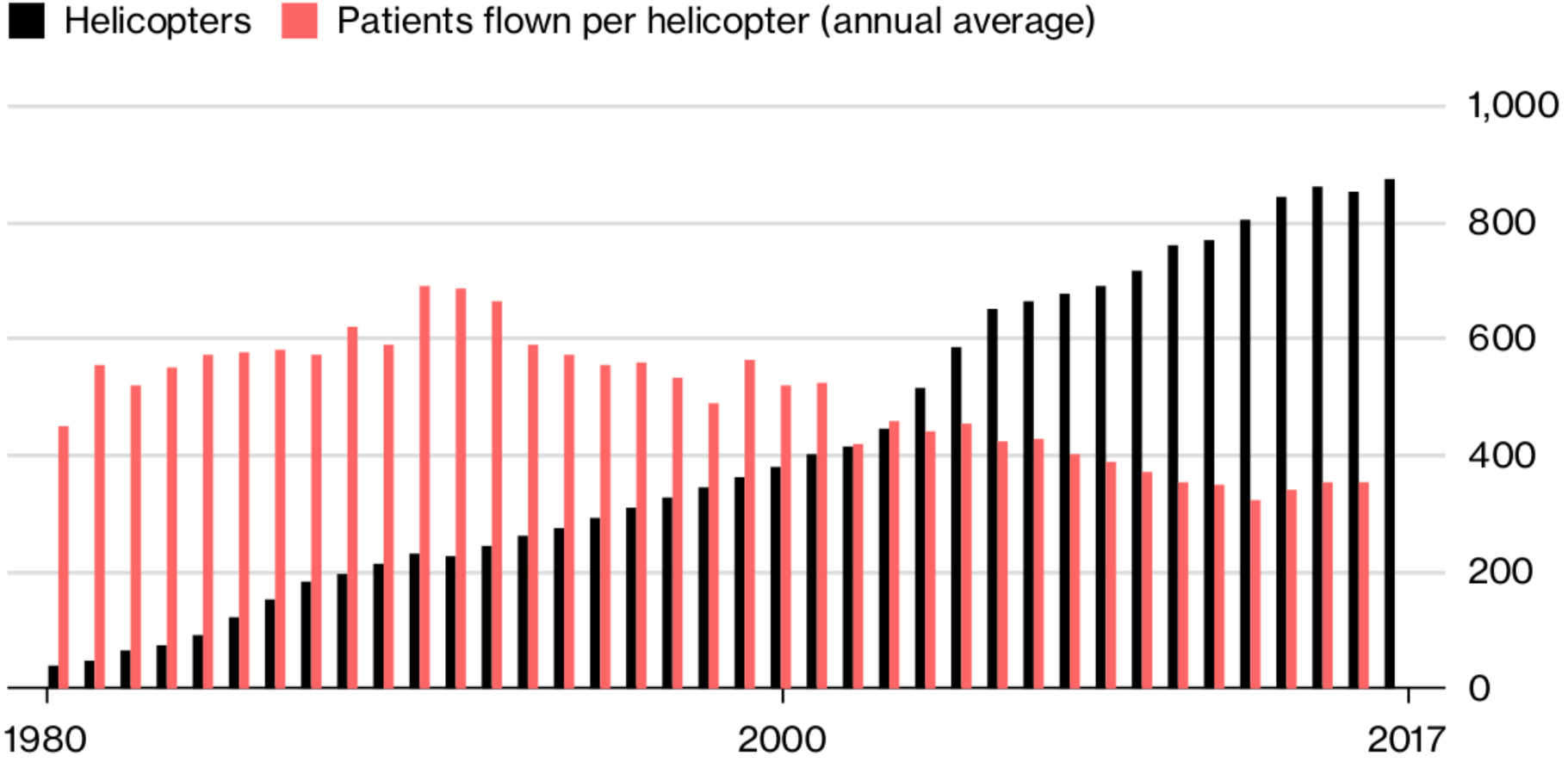
Cost shifting effect on price



**30% of transports (commercial) must recoup costs and generate margin for all flights*

Lift Off

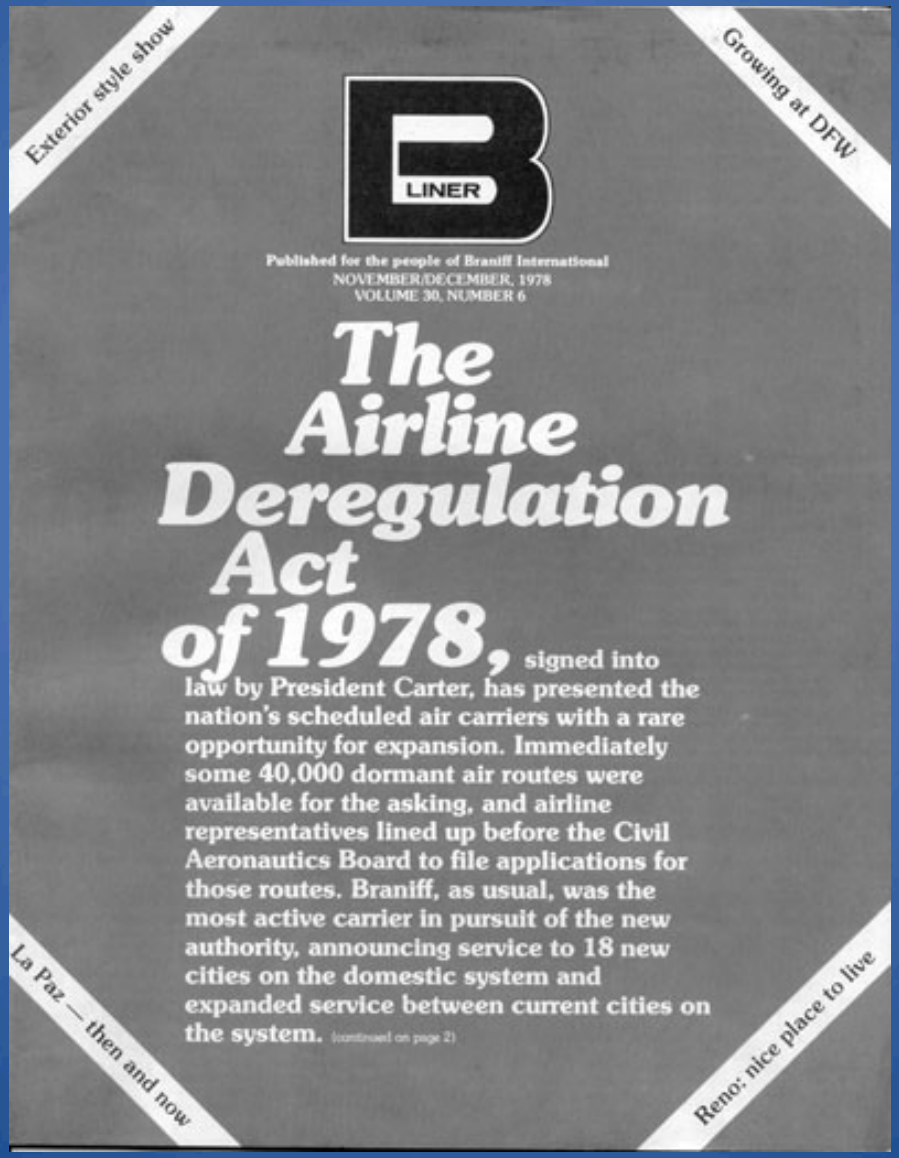
Air ambulances expanded faster than the number of patients they fly



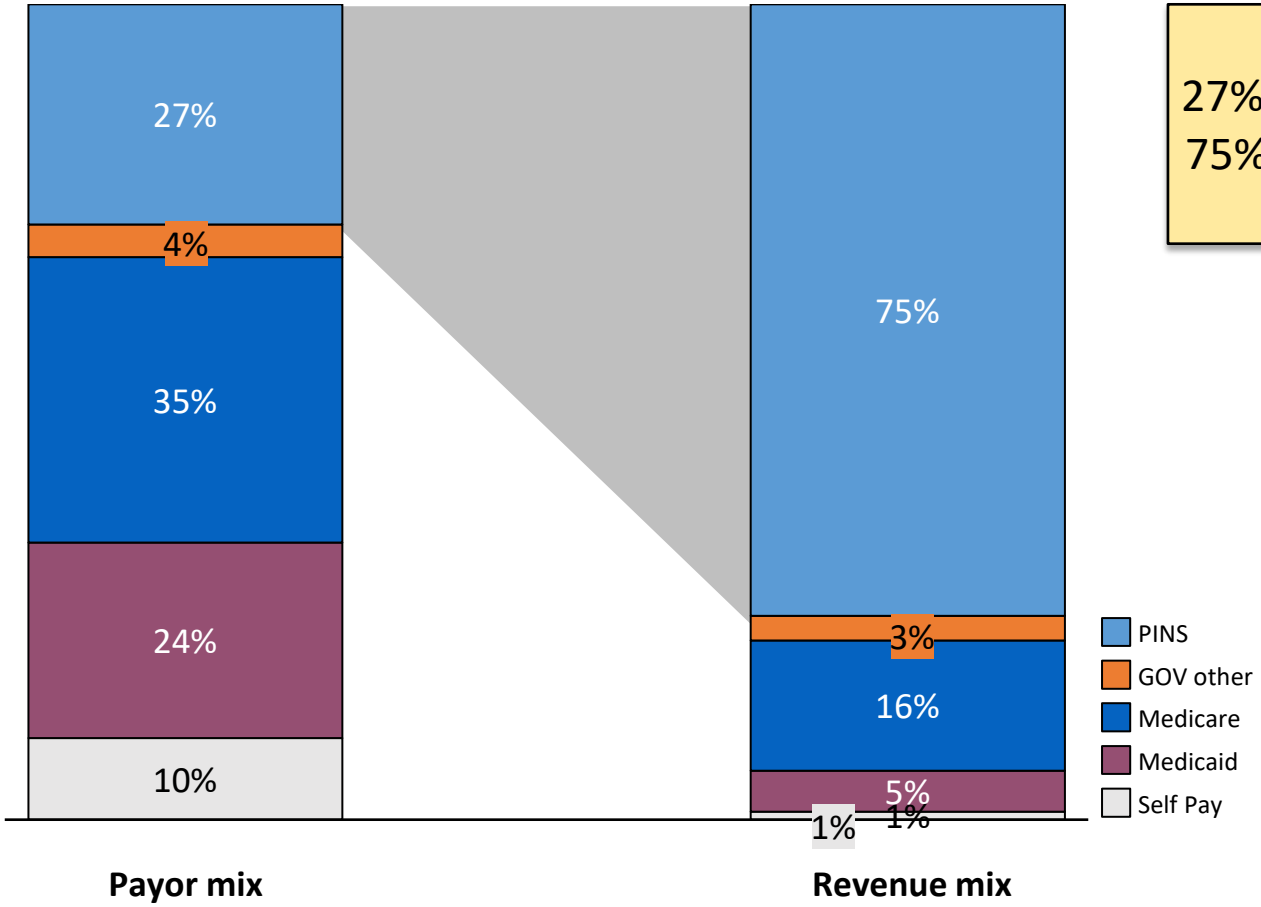
Source: Data compiled by Ira Blumen, University of Chicago Medicine

Bloomberg

Funding

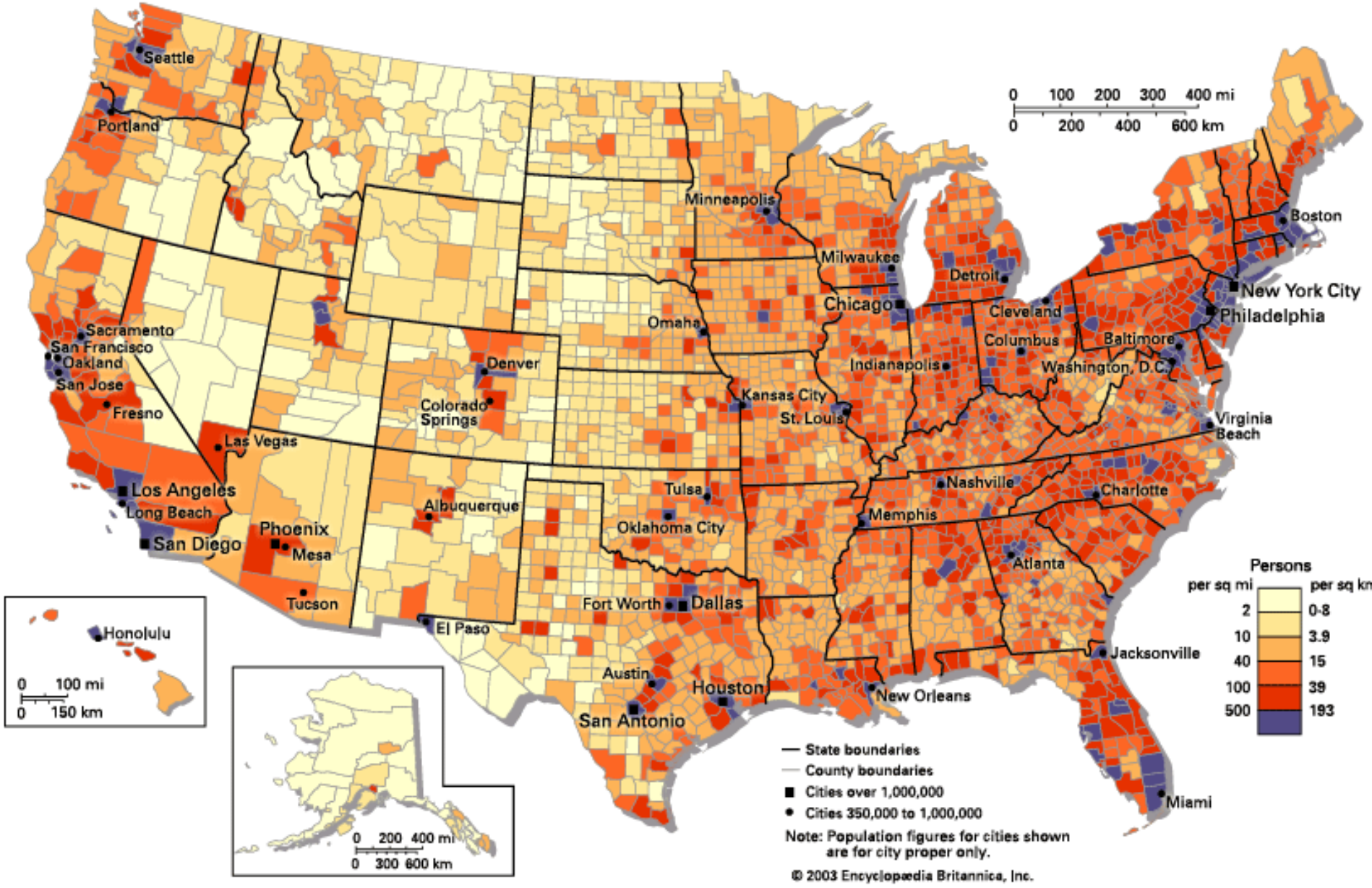

Exterior style show
Growing at DFW
LINER
Published for the people of Braniff International
NOVEMBER/DECEMBER, 1978
VOLUME 30, NUMBER 6
The Airline Deregulation Act of 1978, signed into law by President Carter, has presented the nation's scheduled air carriers with a rare opportunity for expansion. Immediately some 40,000 dormant air routes were available for the asking, and airline representatives lined up before the Civil Aeronautics Board to file applications for those routes. Braniff, as usual, was the most active carrier in pursuit of the new authority, announcing service to 18 new cities on the domestic system and expanded service between current cities on the system. (continued on page 2)
La Paz — then and now
Reno: nice place to live

Payor Mix and Revenue Mix



27% of transports drive
75% of reimbursement

Declining payor mix puts additional pressure on private insurance


Seattle
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San Diego
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Baltimore
Washington, D.C.
Philadelphia
New York City
Boston
Virginia Beach
Nashville
Charlotte
Memphis
Atlanta
Jacksonville
New Orleans
Miami
Honolulu
0 100 mi
0 150 km
0 200 400 mi
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0 100 200 300 400 mi
0 200 400 600 km
Persons
per sq mi
per sq km
2
0-8
10
3.9
40
15
100
39
500
193
State boundaries
County boundaries
Cities over 1,000,000
Cities 350,000 to 1,000,000
Note: Population figures for cities shown are for city proper only.
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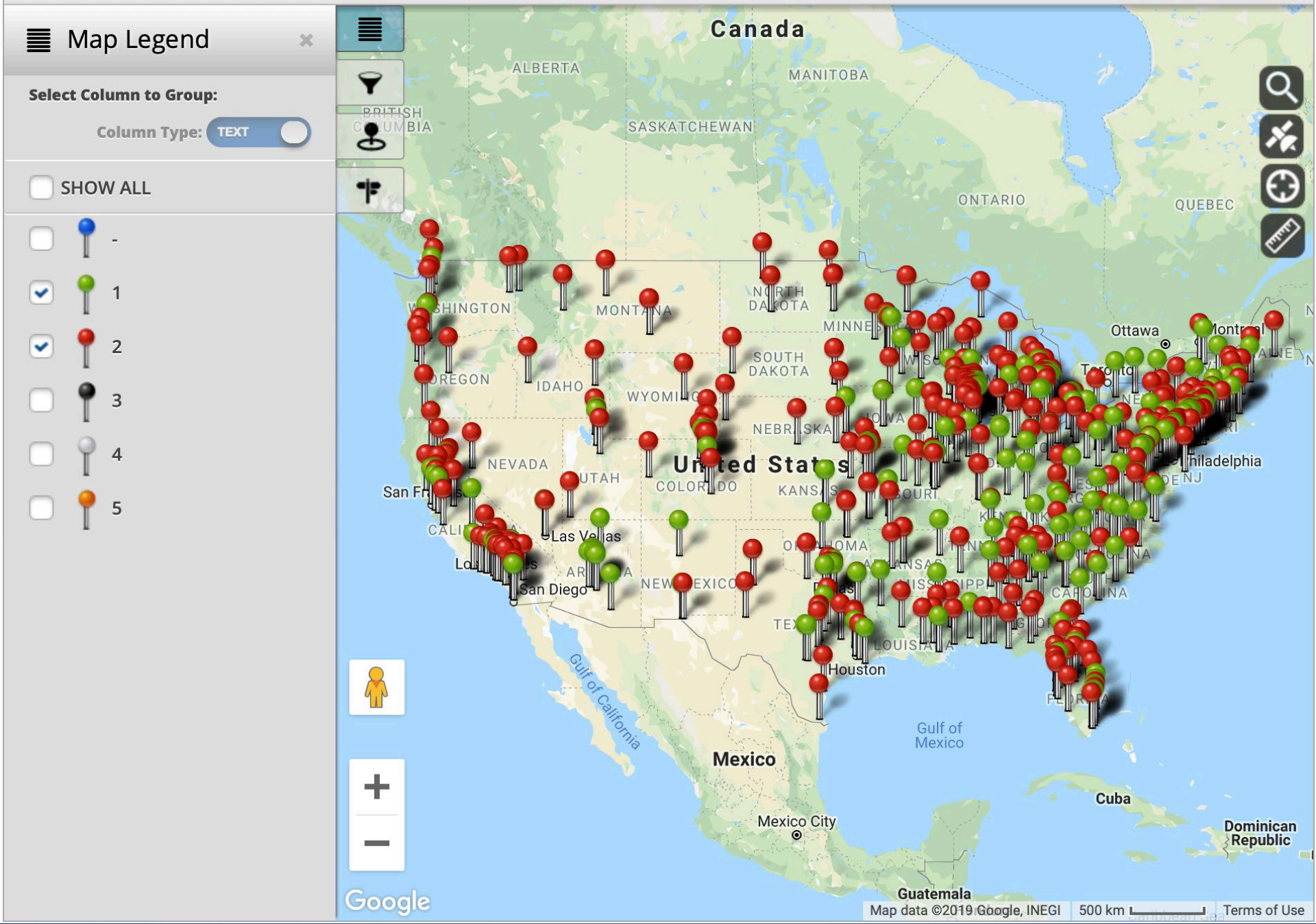
Find Your Local Trauma Center - Courtesy of the 2019 ATS-TIEP ➤ (Organized By State Designation Level)



ORIGINAL CONTRIBUTION

Access to Trauma Centers in the United States

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Context Previous studies have reported that the number and distribution of trauma centers are uneven across states, suggesting large differences in access to trauma center care.

Objective To estimate the proportion of US residents having access to trauma centers within 45 and 60 minutes.

Design and Setting Cross-sectional study using data from 2 national databases as part of the Trauma Resource Allocation Model for Ambulances and Hospitals (TRAMAH) project. Trauma centers, base helipads, and block group population were counted for all 50 states and the District of Columbia as of January 2005.

Main Outcome Measures Percentages of national, regional, and state populations having access to all 703 level I, II, and III trauma centers in the United States by either ground ambulance or helicopter within 45 and 60 minutes.

Results An estimated 69.2% and 84.1% of all US residents had access to a level I or II trauma center within 45 and 60 minutes, respectively. The 46.7 million Americans who had no access within an hour lived mostly in rural areas, whereas the 42.8 million Americans who had access to 20 or more level I or II trauma centers within an hour lived mostly in urban areas. Within 45 and 60 minutes, respectively, 26.7% and 27.7% of US residents had access to level I or II trauma centers by helicopter only and 1.9% and 3.1% of US residents had access to level I or II centers only from trauma centers or base helipads outside their home states.

Conclusion Selecting trauma centers based on geographic need, appropriately locating medical helicopter bases, and establishing formal agreements for sharing trauma care resources across states should be considered to improve access to trauma care in the United States.

JAMA. 2005;293:2626-2633 www.jama.com

THE SYSTEMS APPROACH TO THE delivery of trauma care is widely accepted as an effective strategy for reducing death due to injury.[1-3] A critical component of this systems approach is the designation or verification of trauma center hospitals equipped to treat more severely injured patients. Although the overall number of trauma centers has increased over the last decade, recent studies have shown that their geographic distribution varies widely across states. These studies suggest that in

46.7 million Americans have no access to Level 1 or 2 trauma centers within 1 hour

"Helicopters provide access for 81.4 million Americans who otherwise would not have been able to reach a trauma center within an hour."

- Average cost out of pocket- <$300
- Full impact to be determined
- Consolidation
  - Bases
  - Companies
- Some communities may lose access

Air Ambulance Bases Close Around The U.S., Citing Low Reimbursement Rates

By ESTHER HONIG • AUG 5, 2019

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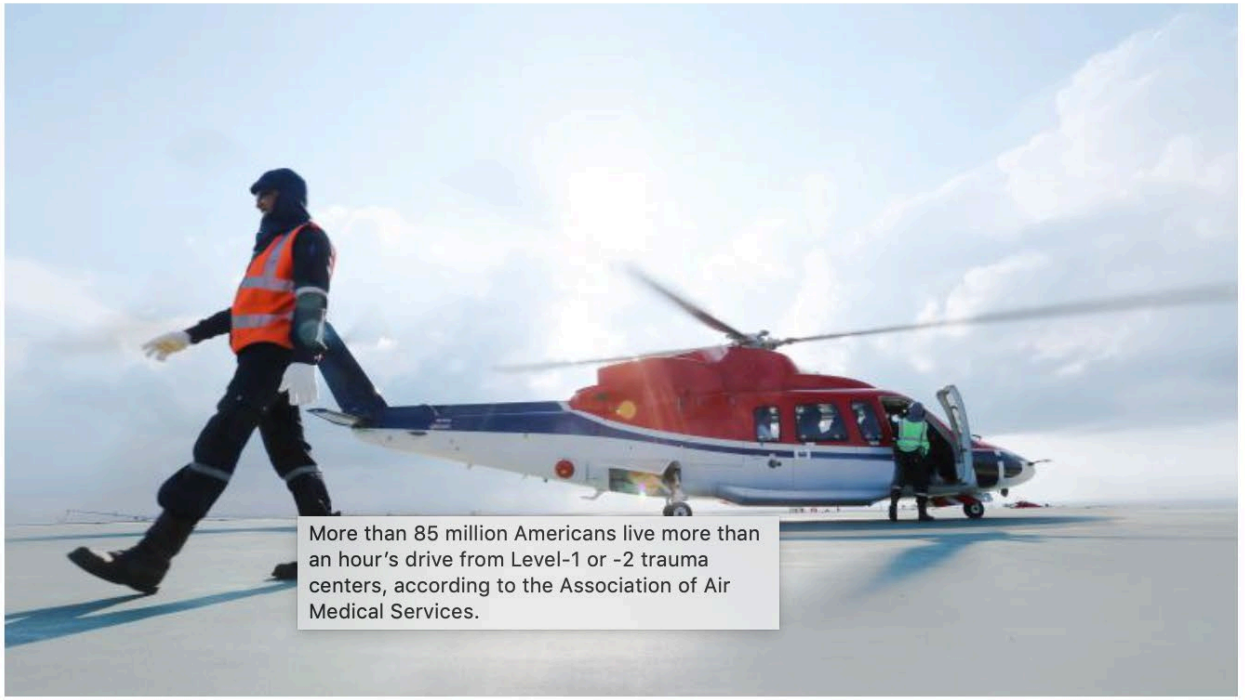
Email

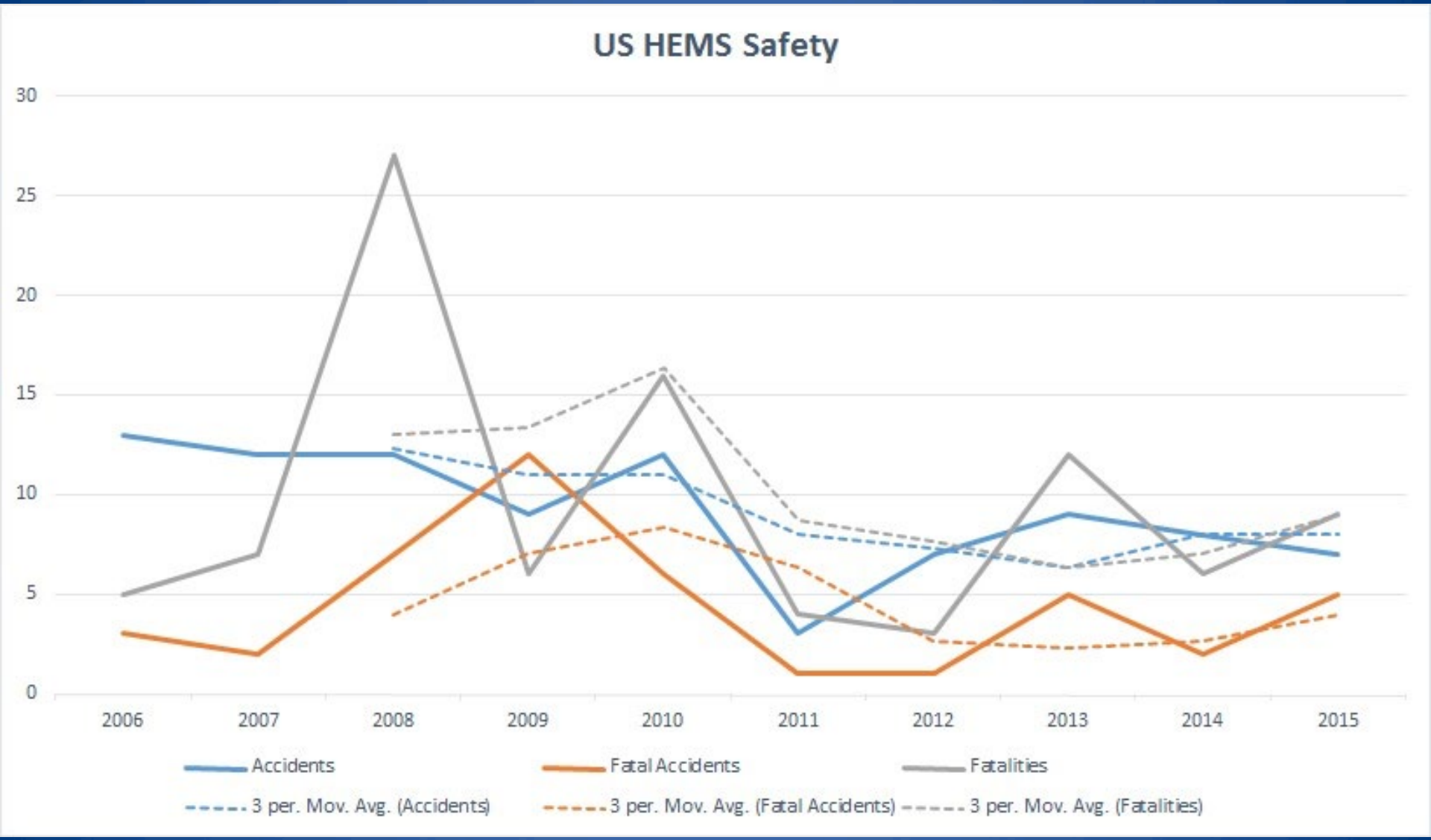


More than 85 million Americans live more than an hour's drive from Level-1 or -2 trauma centers, according to the Association of Air Medical Services.

SOAR

According to the Association of Air Medical Services, 35 air ambulance bases shut down across the U.S. in 2019. That


© AP



http://aerossurance.com/helicopters/us-hems-accident-2006-2015/

Hems and risk

In 1980, a HEMS crewmember had a 1 in 50 chance of being in a fatal accident; today that number is 1:850.

From 1972 to 2016 there were 342 helicopter EMS accidents…123 of those 342 resulted in at least one fatality. Some 1,053 personnel were involved in those accidents; 328 died, 116 sustained serious injuries, 136 had minor injuries and 473 were uninjured… [meaning] 68.8 percent survived

Unfettered competition has allowed the nation's HEMS fleet to mushroom from 151 aircraft in 1986 to 309 in 1996 to 648 in 2006 to 852 today. If you add in dual-purpose aircraft, the number is 979, and it could be as high as 1,048 if you count non-operational spares. [However] "This is the first year ever there has been a contraction in the number of helicopters," Blumen said.

…the average aircraft flew 800 hours in 1994 and 600 hours between 2003 and 2008, at which time flying dropped precipitously after the accidents of 2008 and the ensuing negative publicity. "People said, 'We are not sending our patients in helicopters,'" Blumen noted. Now the number of flight hours per helicopter is moving up again, averaging 490 in 2016.

Special Investigation Report on Emergency Medical Services Operations

Aviation Special Investigation Report

NTSB/SIR-06/01

PB2006-917001
Notation 4402E

National Transportation Safety Board
Washington, D.C.

Safety

- Improvements have been made
- NVG
- IFR AC AND PILOTS
- DUAL ENGINES
- Fire Resistant Fuel Tanks
- 3 to go, 1 to say NO

Training

- Expanded scope requires additional training
  - Cadaver labs
  - Sim man tube thoracostomy, crich labs
  - RSI labs
  - High Fidelity Simulation


BIG BEAR FIRE DEPT
MERCY AIR


MERCY AIR
VADA
AirMedStaff
KRISTIN WOODS
FLIGHT PARAMEDIC
AirMedStaff

HEAVEN CRITERIA

HYPOXEMIA
- DL faster if straightforward
- VL may be faster with anatomic difficulty

EXTREMES OF SIZE
- Extremely large patient: VL (out-to-in) → DL (in-to-out if not recognized
- Extremely small patient: DL with straight blade

ANATOMIC DISRUPTION / OBSTRUCTION
- VL (out-to-in) → DL (in-to-out) if not recognized
- DL if bloody

VOMIT / BLOOD / FLUID
- DL with strong lift

EXSANGUINATION
- DL faster, VL with anatomic difficulty

NECK MOBILITY / NEUROLOGIC INJURY
- Gentler VL

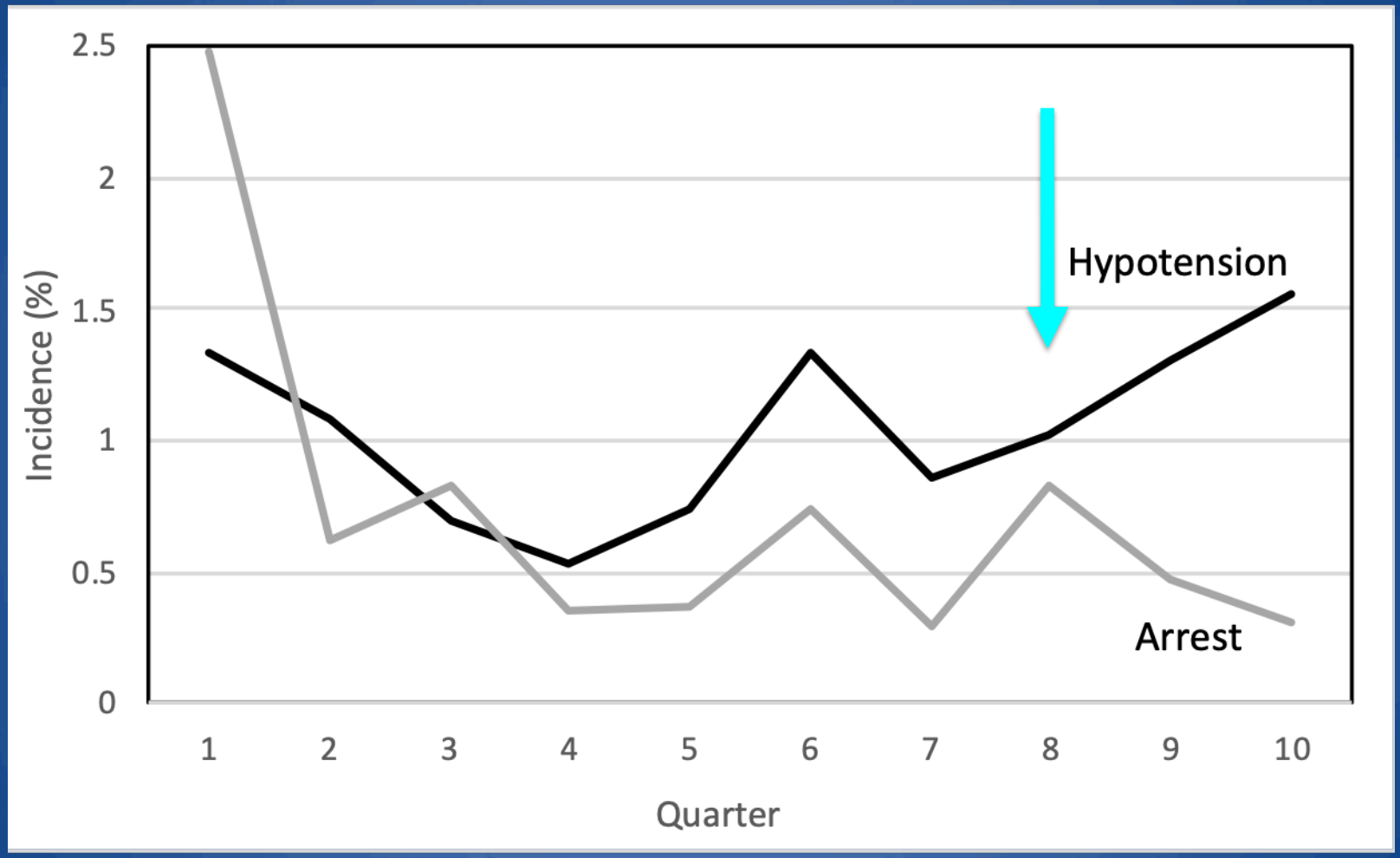
RSI CHECKLIST

PREPARATION/PLANNING
- ☐ AMC monitoring equipment in place
- ☐ **Consider fluid / blood resuscitation / tension pneumothorax**
- ☐ **NRB and Passive O2 (> 10 LPM via NC)**
- ☐ Consider OPA / NPA utilization
- ☐ HOB elevated 30-35 degrees
- ☐ **SpO2 < 93%?**
  - ○ BVM 2 thumbs-up w/ PEEP + ETCO2
- ☐ Open C-collar if present
- ☐ Any HEAVEN difficult intubation indicators?

EQUIPMENT
- ☐ Suction on and accessible
- ☐ CMAC on and warmed-up
- ☐ Induction agent and paralytics drawn and doses confirmed
- ☐ ETT, Bougie, and Alternate airways out and accessible

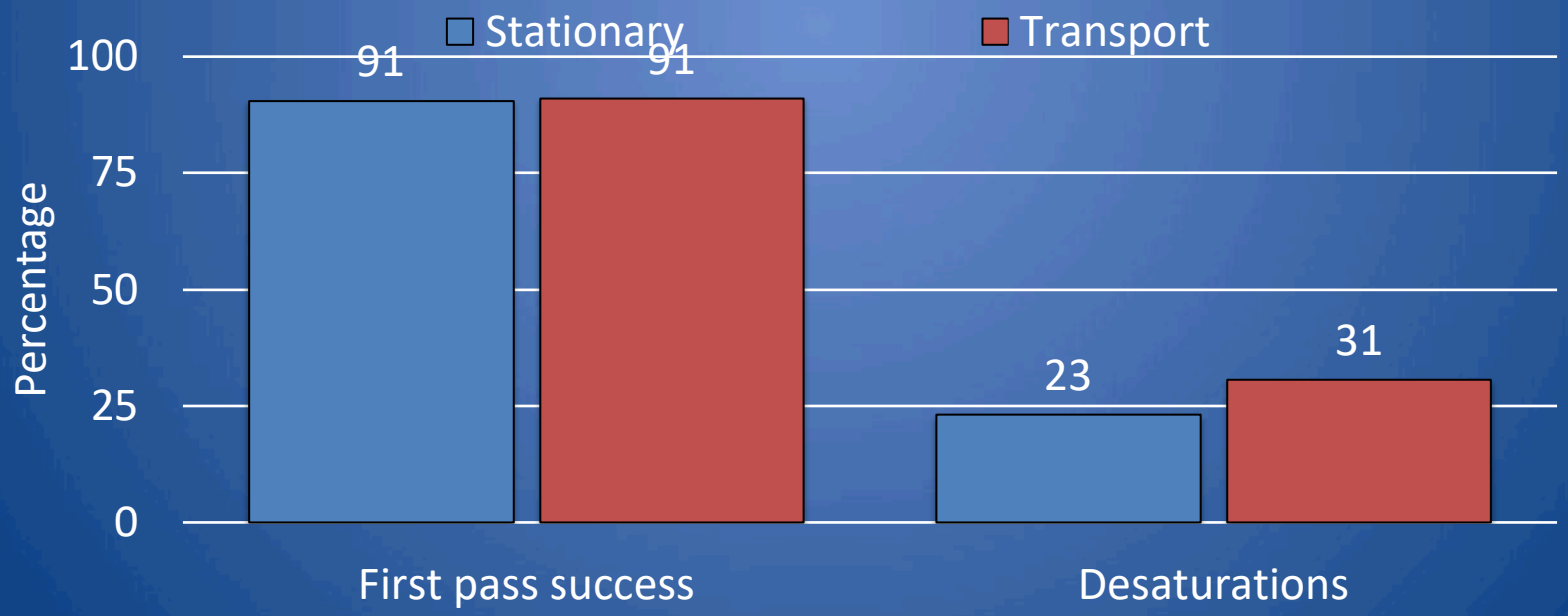
INDUCTION/INTUBATION
- ☐ Induction agent administered
- ☐ Paralytic administered
- ☐ **Suction prior to intubation attempt**
- ☐ Intubate
- ☐ ETT placement confirmed via
  - ○ Direct visualization
  - ○ ETCO2
  - ○ Breath sounds / No epigastric
- ☐ Tube secured and OG tube placed
- ☐ Post-intubation sedation

Research


2.5
2
1.5
1
0.5
0
Incidence (%)
Hypotension
Arrest
1
2
3
4
5
6
7
8
9
10
Quarter

Airway intubation stationary vs transport

- Intubation in total 3254 pts
- 90.6% first pass success rate, 97.6% overall success rate



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