Work With Us, Not Against Us!

Streamlining Helicopter Interactions

Kevin T Collopy, BA, FP-C, CCEMT-P, NREMT-P, WEMT

Performance Improvement & Education Coordinator

AirLink & VitaLink Critical Care Transport

Wilmington, NC

New Hanover Regional EMS
Critical Care Transport Team
AirLink • VitaLink

Introduction

54 year old male patient, 911 request for chest pain

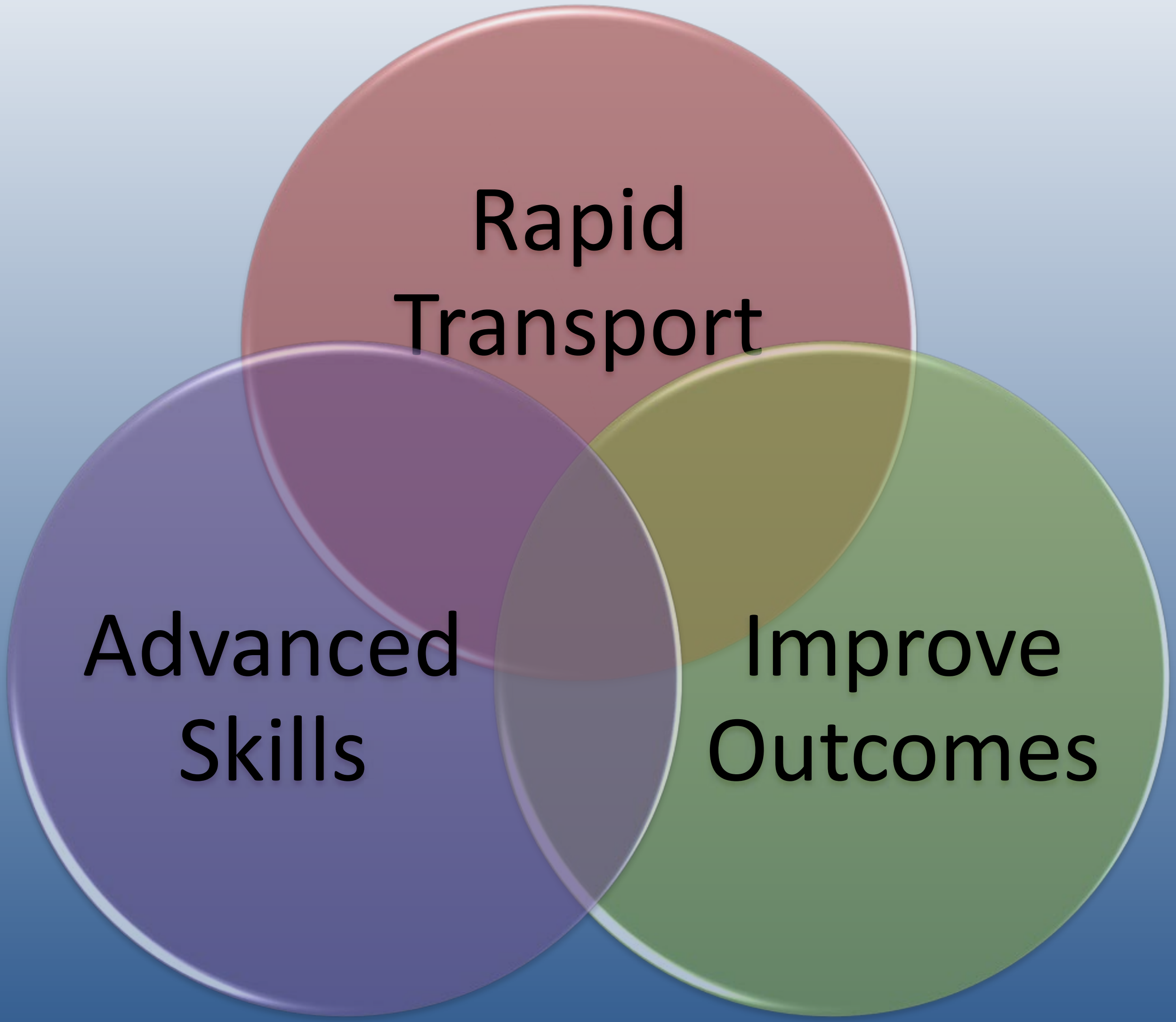
Location is 3 counties, 75 miles from PCI center

EMS Identifies STEMI & launches AirLink & activates NHRMC Cath Lab

AirLink intercept took 5 minutes

E2B 64 minutes

Why Call a Helicopter?



Objectives

1. Explore the HEMS trauma and medical scene response outcomes
2. Identify when helicopter transport is not beneficial
3. Describe best practices for early HEMS access and transition of care
4. Highlight patient care strategies that streamline EMS➔HEMS patient care hand off

Objective 1: What Does the Current Research Show?

Prehospital Factors Associated with Mortality in Injured Air Medical Patients

TABLE 1. Prehospital Criteria for Helicopter Transport to a Trauma Center

- Does the patient have two or more fractures of the humerus and/or femur?
- Does the patient have second- or third-degree burns over >10% total body surface area?
- Does the patient have abdominal tenderness or distention or a seat belt sign?
- Does the patient have an amputation proximal to the wrist and/or ankle?
- Does the patient have an arm and/or leg injury with neurovascular compromise?
- Is this an automobile–vs.–pedestrian and/or bicycle collision that involved either being thrown, being run over, or a speed >20 mph?
- Does the patient have one of the following comorbid conditions:
  - Bleeding disorder or taking anticoagulants
  - Diabetes
  - End-stage renal disease and on hemodialysis
  - Immunocompromised state
  - Pregnancy
- Does the patient have a crush injury of the head and/or neck and/or torso?
- Does the patient have a crush injury of the arm and/or leg?
- Is the patient failing to localize to pain?
- Does the patient have a falling level of consciousness?
- Did the patient have a fall >20 feet?
- Does the patient have a flail chest?
- Does the patient have a GCS ≤13?
- Was the patient in a high-risk automobile crash, defined as:
  - Death in the compartment
  - Ejection
  - Vehicle telemetry data show high risk of injury
- Did the patient have a loss of consciousness >5 minutes?
- Did this involve a motorcycle crash >20 mph?
- Does the patient need endotracheal intubation?
- Does the patient have evidence of a pelvic fracture?
- Does the patient have a penetrating injury that is proximal to the knee and/or elbow with neurovascular compromise?
- Does the patient have a penetrating injury to the head and/or neck and/or torso?
- Does the patient have a pulse rate >120 bpm with signs of shock?
- Does the patient have respirations <10 or >29/minute?
- Does the patient have significant burns of the face and/or feet and/or hands and/or genitals and/or airway?
- Does the patient have evidence of a spinal cord injury?
- Does the patient have a systolic blood pressure <90 mmHg?
- Does the patient have a tension pneumothorax?
- Geriatric criteria (70 years of age and older)
  - Was the patient in an MVC with one or more fractures of the humerus?
  - And/or femur?
  - Are there injuries of two or more body regions?
  - Was the pedestrian struck by a vehicle or fall with traumatic brain injury?
  - Does the patient have a systolic blood pressure <100 mmHg?

GCS = Glasgow Coma Scale score; MVC = motor vehicle crash.

Prehospital Factors Associated with Mortality in Injured Air Medical Patients

Measures of appropriate flight

- Death <24 hours
- ICU admission
- Surgical intervention
- Blood required

Prehospital predictors of mortality

- Abnormal V/S
- SBP <90mmHg
- Flail Chest
- GCS ≤ 13

TABLE 4. Factors Independently Predictive of Mortality on Univariate Analysis

Scene Variable	Odds Ratio	95% Confidence Interval	p-Value
Age >44 years*	2.72	1.07–6.92	0.04
EMS ETI	6.81	2.71–17.10	<0.0001
Any abnormal vital signs	16.52	6.44–47.37	<0.0001
SBP <90 mmHg*	25.14	7.87–80.31	<0.0001
Abnormal RR <10 or >29	13.11	4.49–38.27	<0.0001
HR >120 bpm	10.19	3.32–31.29	<0.0001
Spinal cord injury	3.95	1.25–12.49	0.02
≥2 Fractures of humerus/femur	4.81	1.30–17.83	0.02
Crush head injury	3.82	1.21–12.07	0.02
Failing to localize to pain	9.43	3.50–25.44	<0.0001
Falling LOC	6.49	2.54–16.64	<0.0001
Flail chest*	14.81	2.55–86.16	0.003
GCS ≤13*	16.10	5.98–43.28	<0.0001
LOC >5 minutes	3.17	1.23–8.19	0.02
Proximal penetrating injury	28.21	1.70–468.26	0.02

Conclusions. Very few prehospital criteria were associated with clinically important outcomes in helicopter-transported patients. Evidence-based guidelines for the most appropriate utilization of air medical transport need to be further evaluated and developed for injured patients. **Key words:** air medical transport; trauma; health outcomes; helicopter transport; predictors

Validity of Helicopter Emergency Medical Services Dispatch Criteria for Traumatic Injuries:

TABLE 3. Accuracy of Criteria for Appropriate Helicopter Emergency Medical Services Dispatch, Sorted by Level of Evidence

Reference*	Criterion	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	Level of Evidence
Rhodes et al., 1986[10]	Entrapment	43	45			III
	Physiologic	98	43			
	LOC	93	85			
	RR	52	77			
	P	43	75			
	BP	33	77			
Coats et al., 1993[9]	MOI group			27		III
Schoettker et al., 2001[11]	Ejection			59		III
Moront et al., 1996[12]	GCS	98	96			IV
	P + GCS	99	90			
Wuerz et al., 1996[13]	MOI + anatomy	87	20	32	23	V
	Physiologic	56	86	76	30	
	Age + comorbidity	56	45	23	10	
	Triage scheme	97	8	47	22	

*For full reference citations, see the reference list.
BP = blood pressure; GCS = Glasgow Coma Scale score; LOC = loss of consciousness; MOI = mechanism of injury; NPV = negative predictive value; P = pulse; PPV = positive predictive value; RR = respiratory rate; III = cohort study; IV = case–control study; V = case series.

Conclusion

This systematic review of the literature shows that there are few studies describing the validity of criteria defining appropriate HEMS dispatch, and that the results from these studies lack general applicability. At least one HEMS dispatch criterion, loss of consciousness, seems promising, but further assessment of its use is required using more rigorous methodology. Mechanism-of-injury criteria lack accuracy and will inevitably lead to significant overtriage. The first HEMS dispatch categories needing revision are mechanism of injury and age/comorbidity. Efforts should be made to achieve results that are comparable and universally applicable. This study shows that it is important that local and regional authorities prospectively evaluate their triage criteria, thereby striving to modify their guidelines based on a continuous assessment.

With 2009 available data few studies demonstrate HEMS Benefit

PREHOSPITAL EMERGENCY CARE 2009;13:28–36

REDUCED MORTALITY IN INJURED ADULTS TRANSPORTED BY HELICOPTER EMERGENCY MEDICAL SERVICES

TABLE 2. Adjusted Odds Ratios of In-Hospital Mortality in Injured Adults Aged ≥18 Years Transported by Ground or Air Ambulance, Controlling for Gender, Age, Injury Severity Score, and Revised Trauma Score—National Trauma Data Bank National Sample Program, 2007

	Adults ≥18 Years			Adults 18–54 Years			Adults ≥55 Years		
Characteristic	AOR	95% CI	p-Value	AOR	95% CI	p-Value	AOR	95% CI	p-Value
Gender									
Male	1.231	1.097–1.380	0.0004	1.166	0.995–1.370	0.0592	1.420	1.200–1.683	<0.0001
Female	*Reference*	*Reference*		*Reference*	*Reference*		*Reference*	*Reference*	
Age*	1.040	1.037–1.043	<0.0001	1.016	1.010–1.022	<0.0001	1.071	1.062–1.081	<0.0001
ISS†	1.080	1.075–1.084	<0.0001	1.073	1.068–1.078	<0.0001	1.098	1.090–1.107	<0.0001
RTS‡	0.464	0.45–0.477	<0.0001	0.457	0.442–0.471	<0.0001	0.488	0.463–0.515	<0.0001
Transport mode									
Air§	0.607	0.535–0.688	<0.0001	0.513	0.439–0.599	<0.0001	0.916	0.740–1.133	0.4173
Ground	*Reference*	*Reference*		*Reference*	*Reference*		*Reference*	*Reference*	

*Odds of mortality per each year of age

Conclusion. The use of HEMS for the transport of adult trauma patients was associated with reduced mortality for patients aged 18–54 years. In this study, HEMS did not improve mortality in adults aged ≥55 years. Identification of additional variables in the selection of those patients who will benefit from HEMS transport is expected to enhance this reduction in mortality. **Key words:** helicopter; mortality; National Trauma Data Bank; severity; transport

Mortality reduced pt ages 18-54
Not reduced age>54

PREHOSPITAL EMERGENCY CARE 2011;15:295–302

Air Versus Ground Transport of the Major Trauma Patient: A Natural Experiment

TABLE 1. Baseline Characteristics*

	Air Transport Group(Group 1)	Clinical Accept–Aviation Abort Ground Transport Group(Group 2)	All-Other Ground Transport Group(Group 3)
Mean age (years)	41.6	43.4(p = NS)	46.6(p = 0.0001)
Gender (% male)	78.1	78.9(p = NS)	75.1(p = NS)
Mean ISS	23.8	24.2(p = NS)	19.9(p = 0.001)
% Blunt trauma	90.4	94.7(p = NS)	89.8(p = 0.001)
% Penetrating trauma	4.5	0(p = 0.02)	8.5
% Burn	5	5.3	1.7
% Head or neck injury (% AIS >3)	39.8	35.1(p = NS)	43.0(p = NS)
% Scene missions	20.4	7	58.4
Average minutes from injury to arrival TTC	407.4	359.2(p = NS)	621.2

lar in the two groups. Per 100 patients transported, 5.61 more lives were saved in the air group vs. the clinical accept–aviation abort ground transport group (Z = 3.37). As per

PREHOSPITAL EMERGENCY CARE 2010;14:45–50

Factors at the Scene of Injury Associated with Air versus Ground Transport to Definitive Care in a State with a Large Rural Population

Table 2. Distribution of Patient Characteristics and Factors at the Scene of Injury for Ground and Helicopter Transports Greater than 35 Miles from the Trauma Center

	Helicopter	Ground
N	1,970	429
%	82%	18%
Time from EMS call to arrival at trauma center—mean (±SD), minutes	82 (±24)	84 (±24)
Gender—female	30%	34%
Age—mean (±SD), years	36 (±18.5)	41 (±21.6)*
Age <5 or >55 years	18%	26%*
Scene GCS <14	36%	16%*
Scene HR <50 or >100 beats/min	45%	34%*
Scene SBP <90 mmHg	9%	7%
Scene RR <10 or >29 breaths/min	11%	5%*
Anatomic criteria	15%	10%*
Blunt injury	92%	90%
Weekend	38%	35%
Rush hour	14%	16%
Dark when transported	39%	38%
Etiology		
Motor vehicle crash—rollover, ejection, extrication	44%	27%*
Motor vehicle crash—without rollover, ejection, extrication	17%	20%
Motorcycle or pedestrian incident	14%	12%
Firearm, stabbing, or other incident	18%	24%*
Fall	7%	17%*
Basic or intermediate ground EMS agency	70%	64%*
Trauma center region Oklahoma City	47%	27%*

Table 3. Distribution of Patient Characteristics and Factors at the Scene of Injury for Ground and Helicopter Transports 16 to 35 Miles from the Trauma Center

	Helicopter	Ground
N	547	1,163
%	32%	68%
Time from EMS call to arrival at trauma center—mean (±SD), minutes	57 (±16)	59 (±21)
Gender—female	31%	37%*
Age—mean (±SD), years	36 (±19.5)	41 (±22.8)*
Age <5 or >55 years	20%	30%*
Scene GCS <14	40%	17%*
Scene HR <50 or >100 beats/min	50%	35%*
Scene SBP <90 mmHg	14%	8%*
Scene RR <10 or >29 breaths/min	15%	12%
Anatomic criteria	14%	7%*
Blunt injury	92%	92%
Weekend	38%	33%*
Rush hour	17%	16%
Dark when transported	41%	42%
Etiology		
Motor vehicle crash—rollover, ejection, extrication	38%	24%*
Motor vehicle crash—without rollover, ejection, extrication	21%	24%
Motorcycle or pedestrian incident	14%	12%
Firearm, stabbing, or other incident	21%	22%
Fall	7%	19%*
Basic or intermediate ground EMS agency	49%	37%*
Trauma center region Oklahoma City	39%	29%*

PREHOSPITAL EMERGENCY CARE 2011;15:193–202

Factors at the Scene of Injury Associated with Air versus Ground Transport to Definitive Care in a State with a Large Rural Population

Table 4. Distribution of Patient Characteristics and Factors at the Scene of Injury for Ground and Helicopter Transports Less than 16 Miles from the Trauma Center

	Helicopter	Ground
N	219	5,879
%	4%	96%
Time from EMS call to arrival at trauma center—mean (±SD), minutes	48 (±21)	38 (±16)*
Gender—female	29%	31%
Age—mean (±SD), years	33 (±18.1)	40 (±21.4)*
Age <5 or >55 years	15%	25%*
Scene GCS <14	45%	22%*
Scene HR <50 or >100 beats/min	51%	43%*
Scene SBP <90 mmHg	18%	12%*
Scene RR <10 or >29 breaths/min	17%	15%
Anatomic criteria	13%	15%
Blunt injury	88%	79%*
Weekend	36%	34%
Rush hour	19%	14%*
Dark when transported	44%	52%*
Etiology		
Motor vehicle crash—rollover, ejection, extrication	41%	15%*
Motor vehicle crash—without rollover, ejection, extrication	16%	17%
Motorcycle or pedestrian incident	18%	15%
Firearm, stabbing, or other incident	18%	33%*
Fall	7%	21%*
Basic or intermediate ground EMS agency	36%	3%*
Trauma center region Oklahoma City	41%	39%*

Conclusion

Distance is the main factor in deciding whether to use air or ground EMS to transport a trauma patient from the scene of injury to a trauma center. With the exception of GCS <14, injury etiology was more strongly and consistently associated with the decision to transport by air than were patient related-factors. Identifying factors influencing the field transport decision will help develop transport guidelines that make efficient use of EMS resources.

PREHOSPITAL EMERGENCY CARE 2011;15:193–202

Reduction in Mortality as a Result of Direct Transport From the Field to a Receiving Center for Primary Percutaneous Coronary Intervention

Table 3 In-Hospital Clinical Outcomes and Mortality at Follow-Up

Outcomes	Field to PCI-Capable Hospital (n = 822)	Field to Non–PCI-Capable Hospital (n = 567)	p Value
Death	25 (3.0)	46 (8.1)	<0.0001
Reinfarction	11 (1.3)	7 (1.2)	1.00
Stroke	6 (0.7)	7 (1.2)	0.40
Death, reinfarction, or stroke	41 (5.0)	55 (9.7)	0.0007
Cardiogenic shock	31 (3.8)	43 (7.6)	0.002
Stent thrombosis	9 (1.1)	7 (1.2)	0.80
Bleeding			
Non-CABG major	25 (3.1)	30 (5.6)	0.04
Non-CABG minor	53 (6.7)	66 (12.2)	0.0005
Non-CABG major or minor	78 (9.8)	96 (17.7)	<0.0001
Any major	32 (3.9)	35 (6.2)	0.06
Blood transfusion	37 (4.5)	42 (7.4)	0.03
Revascularization procedures			
Repeat PCI	16 (2.0)	9 (1.6)	0.62
Noninfarct-related artery PCI	98 (11.9)	58 (10.2)	0.34
Bypass surgery	26 (3.2)	26 (4.6)	0.19
Length of stay, days	4 (3–6)	4 (3–7)	0.36
Death at follow-up			
At 30 days	29/800 (3.2)	43/558 (7.7)*	0.001
At 180 days	39/779 (5.0)	63/550 (11.5)	<0.0001

1,389 STEMI patients reviewed

- 882 direct to PCI
  - 5% mortality rate
- 557 to local ED
  - 11.5% mortality rate

(J Am Coll Cardiol 2012;60:1223–30)

Air Versus Ground Transport for Patients With ST-Elevation Myocardial Infarction: Does Transport Type Affect Patient Outcomes?

TABLE 6
Postdischarge status by transport type, all hospitals

	N	Yes	%	Ground (%)	Air (%)
Infarction within 30 d	195	29	17.0	17.5	10.7
Stroke within 30 d	195	7	3.6	4.2	2.7
Mortality within 30 d	195	9	4.6	5.8	2.7

Results: Although the observed differences were not statistically significant because of the sample size, the study showed that at 30 days after discharge a larger percentage of ground transport patients had experienced an infarction (17.5% vs 10.7%), stroke (4.2% vs 2.7%), or died (5.8% vs 2.7%) compared with air transport patients. The analyses should be considered relative to the clinical and operational importance of the results, particularly with regard to postdischarge status.

JOURNAL OF EMERGENCY NURSING
VOLUME 39 • ISSUE 5 **September 2013**

Paramedic Contact to Balloon in Less than 90 Minutes: A Successful Strategy for ST-Segment Elevation Myocardial Infarction Bypass to Primary Percutaneous Coronary Intervention in a Canadian Emergency Medical System

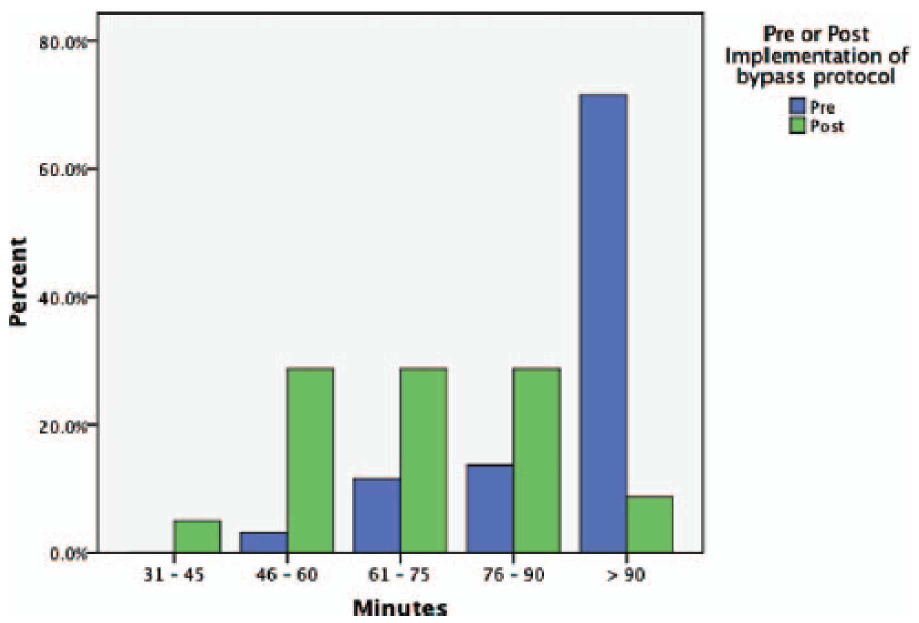


FIGURE 2. Percentages of patients in each category of time from emergency medical services (EMS) contact to balloon inflation (E2B).

TABLE 2. Prehospital Time Intervals in Minutes for ST-segment Elevation Myocardial Infarction Patients in the After Phase of the Study

Time Interval	*N*	Median (95% CI)	IQR	90th Percentile
9-1-1 call to EMS arrival on scene	94	8 (7, 8)	5	13
9-1-1 call to first ECG	97	16 (14, 17)	7	25.2
EMS arrival at patient to first ECG	93	5 (4, 6)	6	14
9-1-1 call to diagnostic ECG	95	17 (15, 18)	9	27
Diagnostic ECG to interventionalist notified	80	7 (6, 9)	10	18.8
Symptom onset to diagnostic ECG	89	35 (31, 44)	51	156.0
EMS scene time	95	18 (16, 19)	9	27
9-1-1 call to first device	79	78 (72, 83)	22	104

ECG = electrocardiogram; EMS = emergency medical services; IQR = interquartile range.

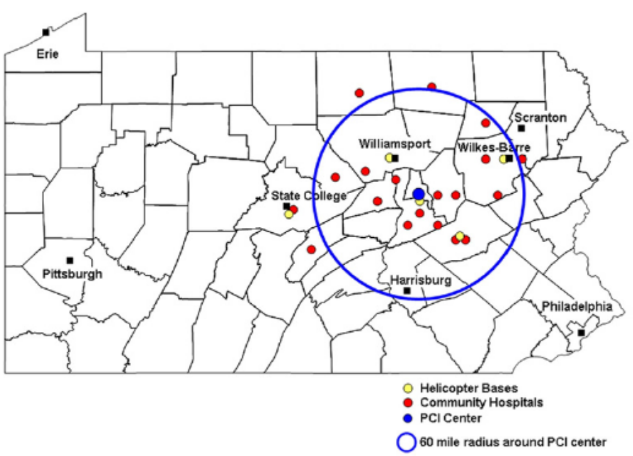
TABLE 1. Median and Interquartile Ranges of Time Intervals in Minutes in the Before and After Phases of the Study

	Before Phase			After Phase			
Time Interval	*N*	Median (95% CI)	IQR	*N*	Median (95% CI)	IQR	p-Value
EMS contact to balloon (E2B)	95	107 (99, 110)	30	80	70 (63, 75)	24	<0.001*
PCI center door to balloon (D2B)	95	83 (79, 89)	34	80	35 (31, 36)	19	<0.001*
EMS contact to arrival at PCI center (E2D)	95	21 (20, 22)	8	97[†]	32 (30, 35)	17	<0.001*

PREHOSPITAL EMERGENCY CARE 2011;15:490–498

Door-to-Balloon Times Under 90 Min Can Be Routinely Achieved for Patients Transferred for ST-Segment Elevation Myocardial Infarction Percutaneous Coronary Intervention in a Rural Setting

	2004 (n = 109)	2005 (n = 136)	2006 (n = 144)	2007 (n = 118)	2008 (n = 180)	p Value
Onset of chest pain to arrival at referring hospital	75 [45, 126]	93 [60, 165]	84 [50, 150]	90 [50, 139]	96 [56, 192]	0.14*
Arrival at referring hospital to arrival at PCI hospital	92 [75, 125]	81 [64, 107]	75 [59, 94]	67 [54, 91]	67 [49, 85]	<0.001*
Arrival at referring hospital to ECG time	6.5 [3, 15]	7 [3, 13]	6 [1, 12]	4 [0, 11]	3 [0, 9]	0.012*
ECG to helicopter dispatch time	20.5 [12.5, 42]	18 [11, 31]	16 [10, 24]	12 [6, 19]	12 [6, 18]	<0.001*
Helicopter dispatch to arrival at PCI hospital	53 [44, 68]	49 [38, 63]	49 [38, 61]	47 [38, 61]	47 [35, 62]	0.003*
Arrival at PCI hospital to balloon inflation	82 [60, 108]	32 [25, 44]	27 [21, 36]	25 [20, 31]	22 [15, 28]	<0.001*
Arrival at PCI hospital to catheterization laboratory	46 [30, 62]	11 [6, 23]	7 [5, 12]	6 [4, 9]	4 [3, 8]	<0.001*
Arrival at catheterization laboratory to balloon inflation†	36 [26, 47]	20 [13, 27]	17.5 [13, 23.5]	19 [14, 23.5	17 [12, 21]	<0.001*
Door-to-balloon time (arrival at referring hospital to balloon inflation)†	189 [146, 219]	113 [94, 147]	104.5 [86, 124.5]	95 [79, 125]	88 [71.5, 110]	<0.001*
Door-to-balloon time <90 min, %	1%	19%	28%	43%	53%	<0.001‡
Door-to-balloon time <120 min, %	12%	57%	70%	74%	83%	<0.001‡



Conclusions

A program of rapid triage, transfer, and treatment of STEMI patients presenting to non-PCI hospitals can reduce in-hospital mortality and produce progressive improvements in door-to-balloon time such that median door-to-balloon times under 90 min are feasible.

(J Am Coll Cardiol 2011;57:272–9)

Objective 2: Knowing When Its OK to Say ***No*** to HEMS!

Common Complaints

What can they do that I can't?

If there's a cloud in the sky, the heli won't fly

They sit on scene forever

Our boss said not to give up the transports to them

It takes too long to get a helicopter here

I can get to the hospital faster

I don't want my patient to pay for something they don't need

AIR TRANSPORTS IN THE AGE OF STEMI SYSTEM REGIONALIZATION

Methods: Included were STEMI patients from 01/01/2008 to 09/30/2010 transported for primary percutaneous coronary intervention (PCI) by ground (n=110) or by helicopter (n=140) from an 8 hospital referral system within 25 to 50 miles of the PCI hospital.

Results: The median time at the STEMI referral hospital for ground transports was 31.5 minutes compared to 42 minutes for air transports ($p<0.0001$). As expected, the median transport time was significantly faster by air than by ground (35 minutes vs 50 minutes, $p<0.0001$). Time from arrival at the PCI hospital to reperfusion was consistent - 15 minutes for ground and 17 minutes for air ($p=0.37$). The median time from first-door-to-reperfusion was 97.5 minutes by ground and 95 minutes by air ($p=0.12$). There was no difference in the percent of patients achieving first-door-to-reperfusion within 90 minutes (37% ground, 41% air; $p=0.60$) or within 120 minutes (79.6% ground, 87.1% air; $p=0.12$). Median length of stay was 3.0 days for both groups ($p=0.40$) and unadjusted mortality was not statistically different (2.7% ground, 6.4% by air; $p=0.24$).

Conclusion: Time to reperfusion for both methods of transport was equal and exceeded national performance levels. Length of stay and mortality were also comparable suggesting that additional factors such as criticality of the patient, time of day/traffic, ambulance availability, safety, and cost will need to be evaluated to determine if mature regionalization of STEMI care transfer protocols for primary PCI warrant the need for an air transport option within 50 miles of a PCI hospital

JACC April 5, 2011
Volume 57, Issue 14

Part 10: Acute Coronary Syndromes: 2010 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care

possible; in the case of STEMI, this recognition also allows for prompt notification of the receiving hospital and preparation for emergent reperfusion therapy. Potential delays to therapy occur during 3 intervals: from onset of symptoms to patient recognition, during prehospital transport, and during emergency department (ED) evaluation.

Patient-based delay in recognition of ACS and activation of the emergency medical services (EMS) system often constitutes the longest period of delay to treatment.[5] With respect to the prehospital recognition of ACS, numerous issues have been identified as independent factors for prehospital treatment delay (ie, symptom-to-door time), including older age,[6] racial and ethnic minorities,[7,8] female gender,[9] lower socioeconomic status,[10,11] and solitary living arrangements.[7,12]

Triage and Transfer

Prehospital Triage and EMS Hospital Destination

In approximately 40% of patients with a myocardial infarction, the EMS provider establishes first medical contact.[82,83] In these patients, the ability to identify STEMI in the prehospital setting allows for the consideration of specific hospital destination. Direct triage from the scene to a PCI-capable hospital may reduce the time to definitive therapy and improve outcome. In a large historically controlled clinical trial, the mortality rate was significantly reduced (8.9% versus 1.9%) when transport time was *less than 30 minutes*.[84] Increased out-of-hospital times with longer EMS-initiated diversion to a PCI-capable hospital may worsen outcomes. If PCI is the chosen method of reperfusion for the prehospital STEMI patient, it is reasonable to transport patients directly to the nearest PCI facility, bypassing closer EDs as necessary, in systems where time intervals between first medical contact and balloon times are <90 minutes and transport times are relatively short (ie, <30 minutes) (Class IIa, LOE B).

Circulation 2010;122;S787-S817

Distance to PCI

American Heart Association
Learn and Live

Nallamothu B et al. Circulation 2006;113:1189-1195 camts

9th EDITION ACCREDITATION STANDARDS

01.11.00 UTILIZATION REVIEW

01.11.01 Management ensures an appropriate utilization review process through trending and tracking requests. There is evidence of feedback to the requesting agents and feedback from the patients' receiving facilities. Utilization review may be prospective, concurrent, or retrospective.

n. Who are served by an inappropriate aircraft in consideration of time, distance, speed considerations, etc. (RW/FW)

What does this mean?

- Ambulance drive time <30 minutes
- The wait for helicopter + transport time exceeds drive time

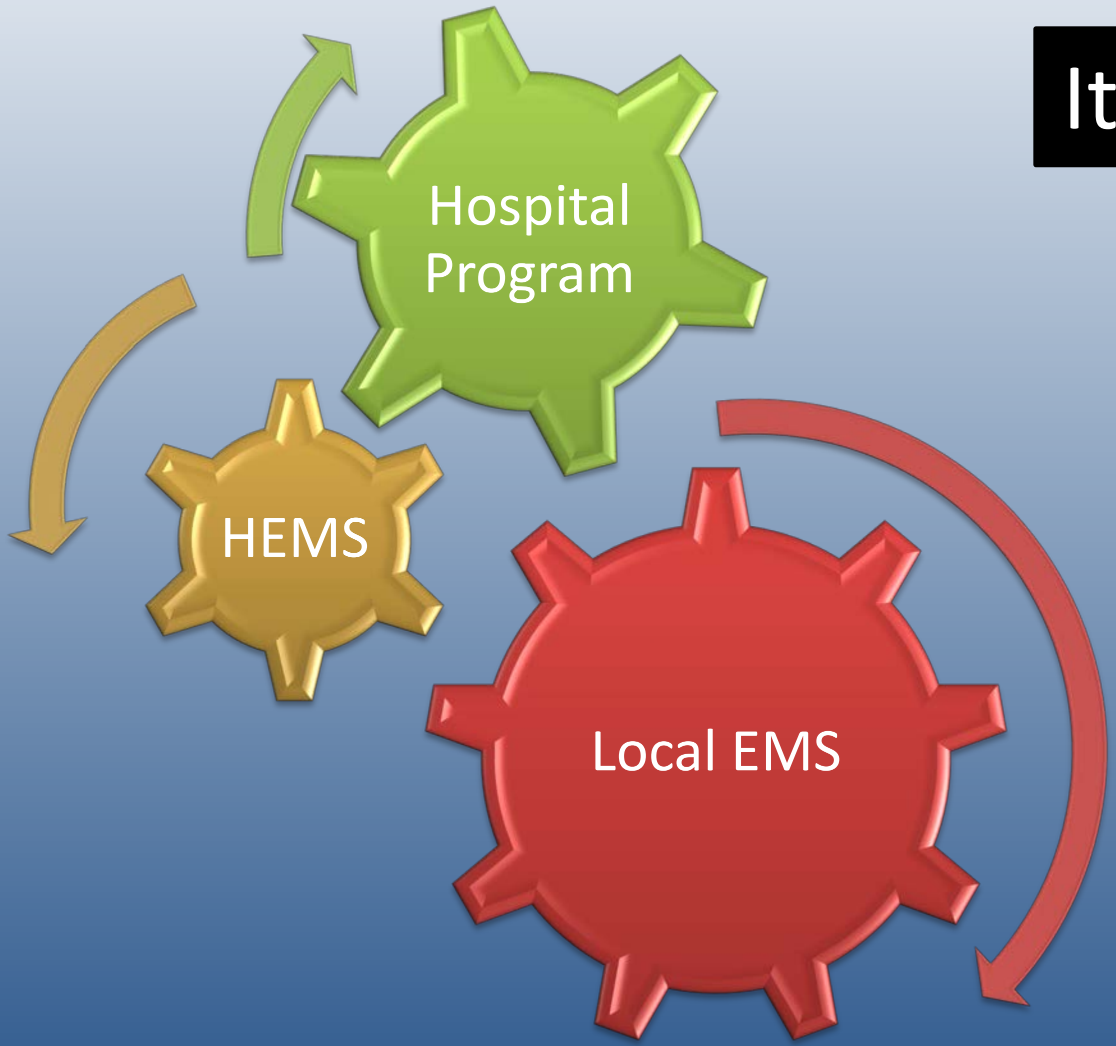
How Does This Look?

What about the Weather?

It isn't our job do evaluate the weather

Establish a process for activation and let the expert (pilot) make the determination

Objective 3: Developing Best Practices



It takes a team

1. Remember We are 1 Team, Collaboration is Key

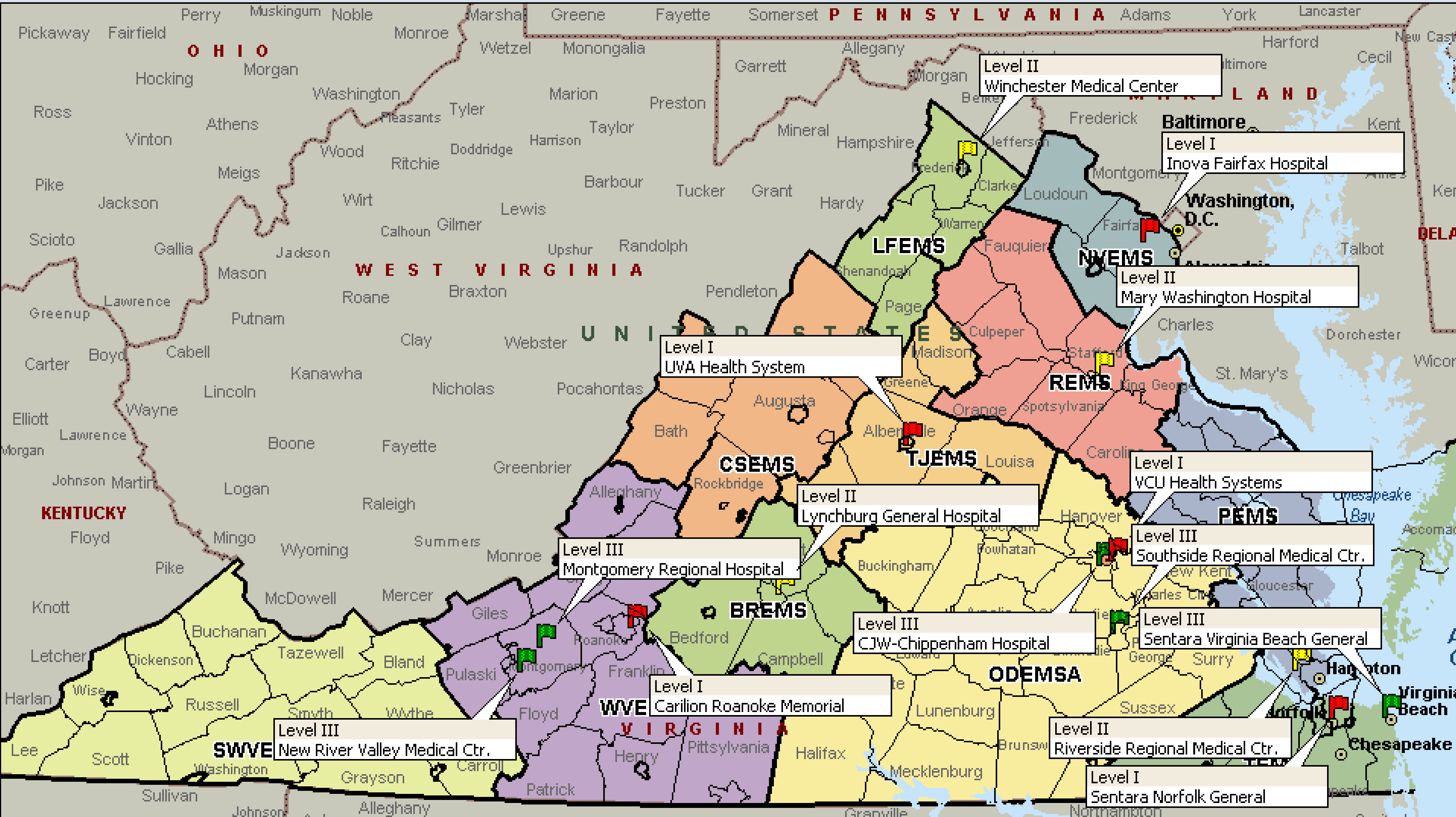
Helicopters should be taking patients to the most appropriate hospital

You have influence over patient destination

We share the plan together

In the end its about our patient

Identify Your Closest Trauma Centers



Helicopter Scene Response for a STEMI Patient Transported Directly to the Cardiac Catheterization Laboratory

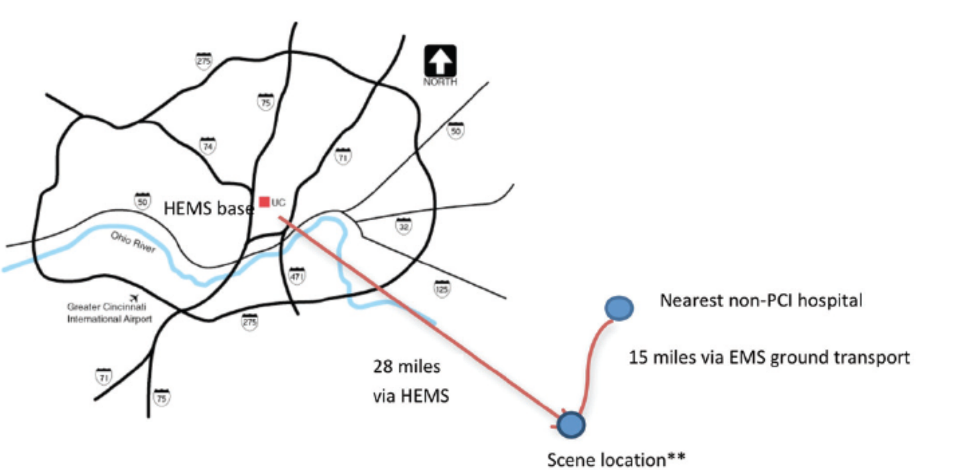
At 2:10 pm, a 40-year-old Caucasian woman with no known medical history called 911 complaining of substernal, crushing chest pain that had started 2 to 3 hours before she called emergency medical services (EMS). EMS arrived at 2:24 pm and obtained a 12-lead electrocardiogram (ECG) diagnostic of ST-segment elevation myocardial infarction (STEMI) at 2:36 pm. University Air Care was requested by local EMS at 2:42 pm to respond directly to the cardiac scene in rural Ohio for rapid transport to a facility capable of performing percutaneous coronary intervention (PCI). The closest PCI-capable facility was approximately 35 minutes away by ground or 13 minutes by air. The closest non-PCI hospital was approximately 20 minutes away by ground (Fig. 1).

Table 2. Actual and Proposed Times for HEMS Scene STEMI Case

Actual Air Care MC2B time	87 minutes
Proposed MC2B time for EMS ground transport to nearest PCI hospital	112 minutes
Proposed MC2N time for EMS ground transport to nearest non-PCI hospital	62 minutes

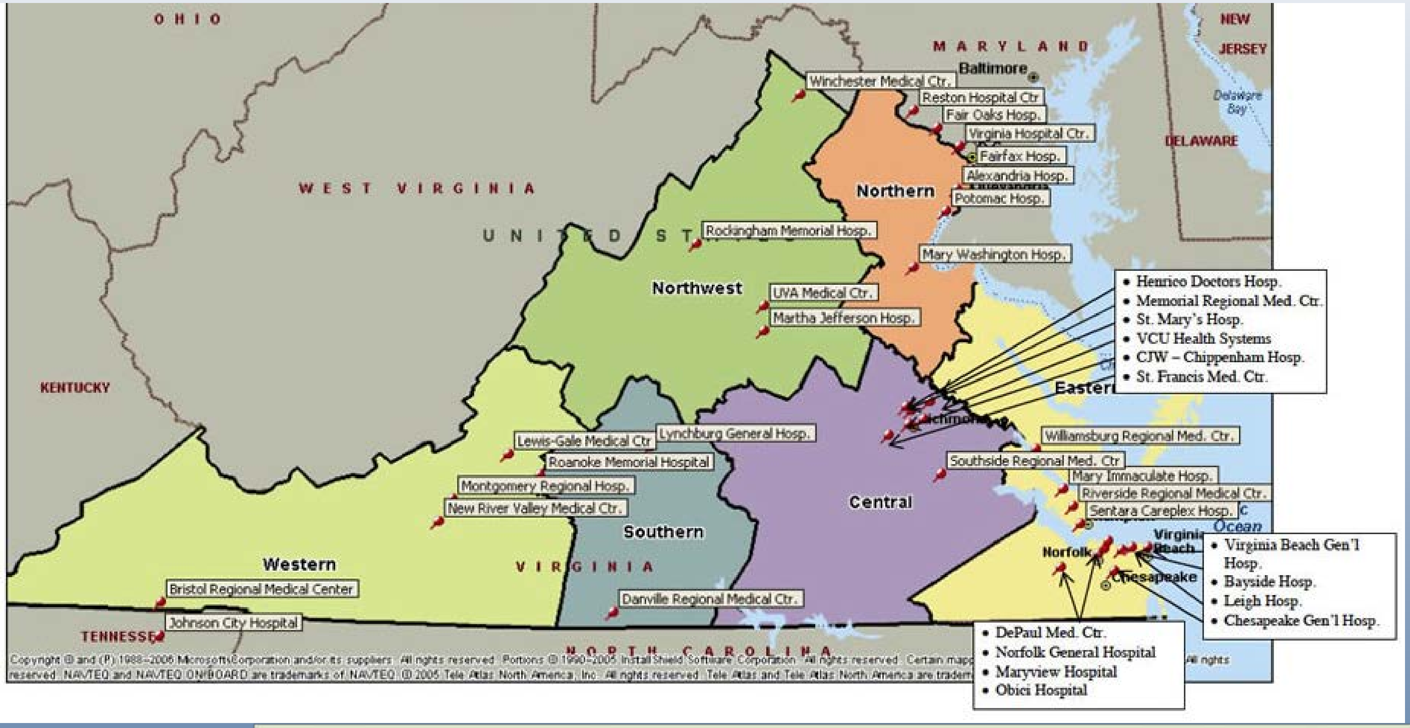
MC2B = medical contact-to-balloon, PCI = percutaneous coronary intervention, MC2N = medical contact-to-needle, EMS = emergency medical services

University Hospital - Cincinnati (UC); Helicopter Emergency Medical Services (HEMS); Percutaneous Coronary Intervention (PCI); Emergency Medical Services (EMS)



In conclusion, HEMS scene transport of suspected STEMI patients directly to the cardiac catheterization laboratory is feasible but will require extensive community collaboration. This may be an alternative strategy to reduce MC2B times. More research is necessary in this area to further elucidate whether this tactic will save time and improve outcomes.

Identify Your Closest PCI Centers



- Build a working relationship
- Determine process for Cath Lab activation

Hospital Process Intervals, not EMS Time Intervals, are the Most Important Predictors of Rapid Reperfusion in EMS Patients with ST-Segment Elevation Myocardial Infarction

Table 2. EMS and Hospital Intervals and Scene-Arrival-to-Reperfusion Time ≤90 Minutes

	Scene-to-Balloon Time >90 Minutes $n = 116$	Scene-to-Balloon Time ≤90 Minutes $n = 72$	p-Value
Patient demographics			
Age—mean ± SD, yr	66 ± 14 (69)	61 ± 12 (62)	0.016†
Gender—male	62 (53%)	52 (72%)	0.010†
Shift			
Midnights	41/104 (39%)	17/68 (25%)	0.050
Weekends	39/104 (37.5%)	21/68 (31%)	0.37
Interval			
Scene time	21 ± 7	16 ± 5	< 0.0001†
Transfer time	17 ± 10	13 ± 6	0.0091†
D2Page	7 ± 20	−3.7 ± 9	< 0.0001†
P2Lab	31 ± 11	23 ± 8	< 0.0001†
L2B	44 ± 16	30 ± 8	< 0.0001†
Prearrival MI team activation (EMS activation)	42/116 (37%)	47/72 (65%)	0.0001†
D2Page ≤20 minutes	92/112 (82%)	72/72 (100%)	0.0001†
P2Lab ≤30 minutes	54/110 (49%)	58/72 (81%)	< 0.0001†

dictors D2B ≤90 minutes. **Conclusions.** In our study, hospital process intervals (EMS activation, door to page, page to laboratory, and laboratory to reperfusion) are key covariates of rapid reperfusion for EMS STEMI patients and should be used when assessing STEMI care. **Key words:** STEMI; pre-

PREHOSPITAL EMERGENCY CARE 2012;16:115–120

Early Cardiac Catheterization Laboratory Activation by Paramedics for Patients with ST-segment Elevation Myocardial Infarction on Prehospital 12-Lead Electrocardiograms

TABLE 1. Summary of Time Data (Hours:Minutes)

Date (Mo/Day/Yr)	STEMI Alert Time	ED Arrival Time	Catheterization Laboratory Activation Time	Patient Departure Time	Time Savings (STEMI Alert Time – Activation Time)
7/13/08	17 : 28	17 : 34	17 : 35	18 : 02	0:07
7/27/08	21 : 47	21 : 57	21 : 58	22 : 24	0:11
8/4/08	20 : 01	20 : 04			False positive
9/2/08	22 : 30	22 : 52	22 : 52	23 : 11	0:22
9/10/08	16 : 13	16 : 15	16 : 35	17 : 20	0:22
9/27/08	23 : 53	0 : 00	0 : 06	0 : 25	0:13
9/28/08	19 : 24	19 : 28	19 : 35	20 : 08	0:11
9/29/08	11 : 27	11 : 33	11 : 35	11 : 50	0:08
10/25/08	14 : 38	14 : 45	15 : 00	15 : 12	0:22
11/12/08	10 : 43	10 : 44	10 : 52	11 : 18	0:09
11/13/08	1 : 29	1 : 34	1 : 40	2 : 02	0:11
12/1/08	17 : 21	17 : 44	17 : 50	17 : 59	0:29

Range 7–29 minutes.
Mean 15 minutes (SD ±7.4).
Median 11 minutes.
ED = emergency department; SD = standard deviation; STEMI = ST-segment elevation myocardial infarction.

Paramedic 12-lead interpretation is essential

Conclusion. Important reductions in time to reperfusion seem possible by activation of the catheterization laboratory by EMS from the scene, with an acceptably low false-positive rate in this small sample. This type of clinical research can inform multidisciplinary policies and bring about meaningful clinical practice changes. **Key words:** STEMI; emergency medical services; electrocardiogram; heart catheterization

PREHOSPITAL EMERGENCY CARE 2010;14:153–158

EMS Activation of the Cardiac Catheterization Laboratory Is Associated with Process Improvements in the Care of Myocardial Infarction Patients

TABLE 1. Patient Characteristics and Main Results

	EMS Activations	EMS Nonactivations
n	38	47
Age—mean (±SD), years	61 (± 11)	67 (± 15)
Gender—male, n (%)	26 (68%)	29 (62%)
Ethnicity, n (%)		
White	28 (74%)	36 (77%)
Black or African American	6 (16%)	3 (6%)
Hispanic	2 (5%)	7 15%)
Asian	2 (5%)	1 (2%)
D2B time—mean (±SD), min	37 (± 17)	87 (± 40)*
Compliance with 90-minute benchmark	100%	72%†
E2B/9-1-1 time—mean (±SD), min	78 (± 22)	126 (± 42)‡
E2B/on-scene time—mean (±SD), min	71 (± 21)	122 (± 41)§

Build a working relationship

Determine process for Cath Lab activation

Establish EMS activation

PREHOSPITAL EMERGENCY CARE 2013;17:293–298

2. Pre Planning Transport

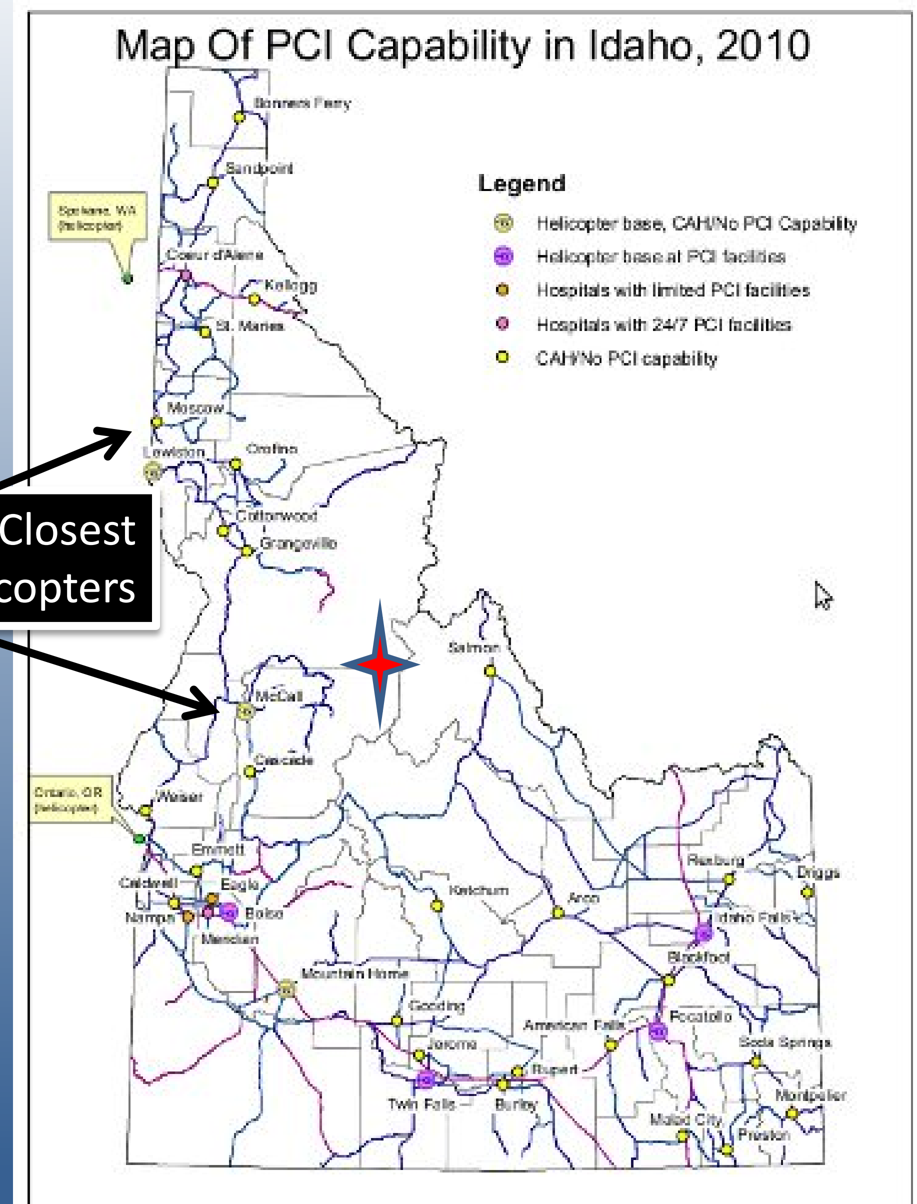
Identify when not to use Helicopters

- Transport time <30 min
- Planned helicopter unavailable

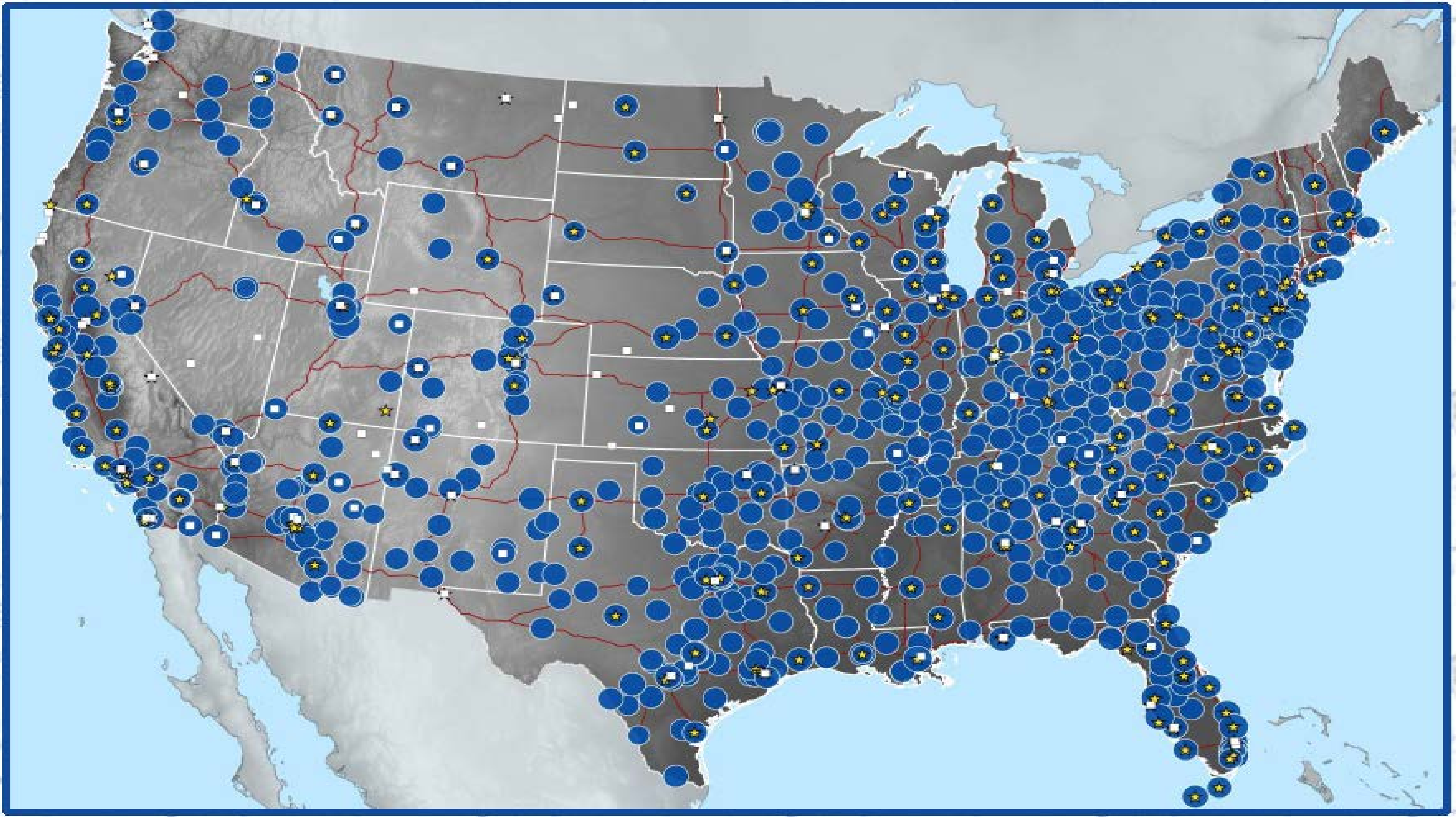
Know what specifically which helicopter should come

- Closest from right direction

Closest helicopters

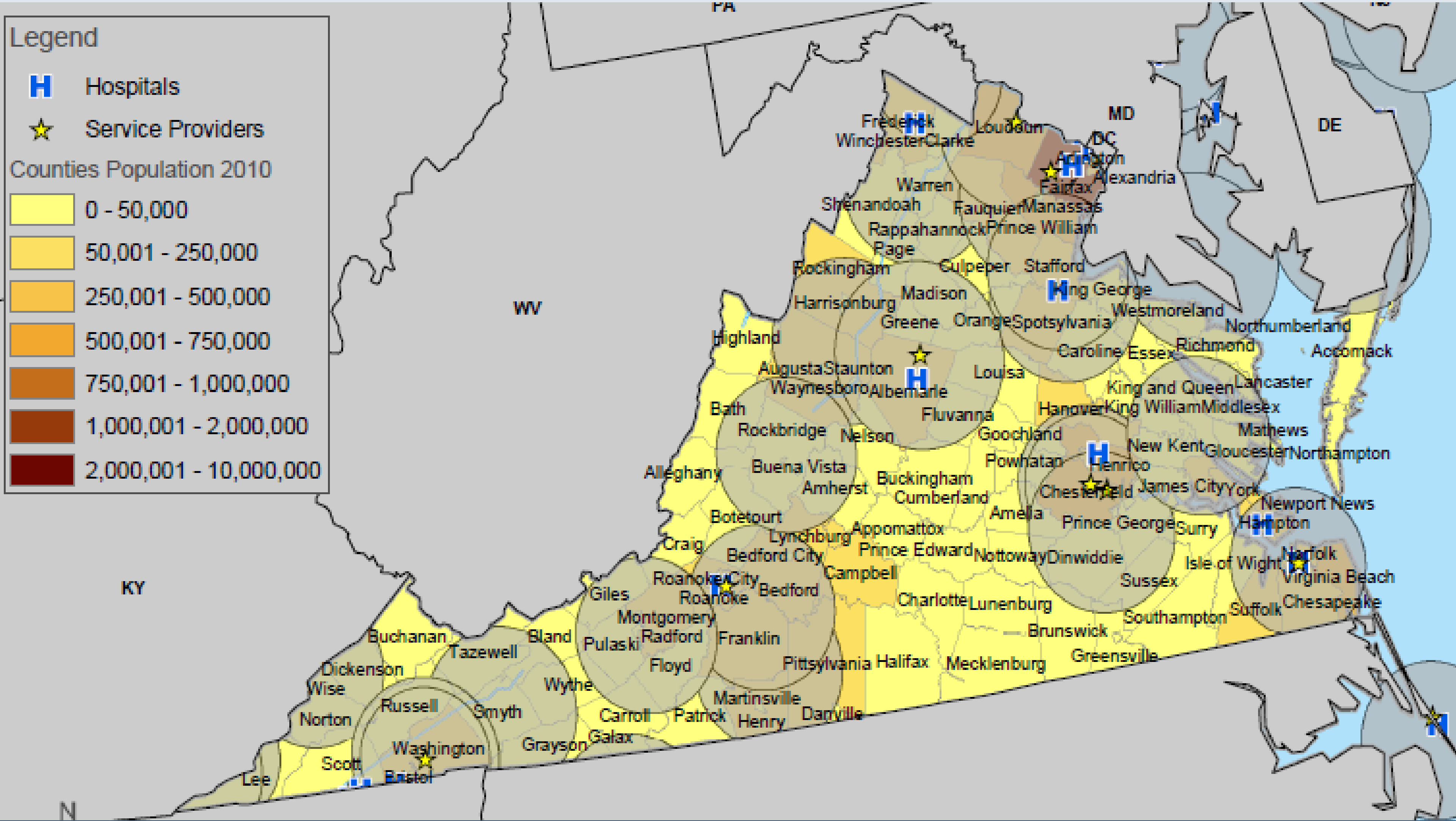


HEMS Programs in the US

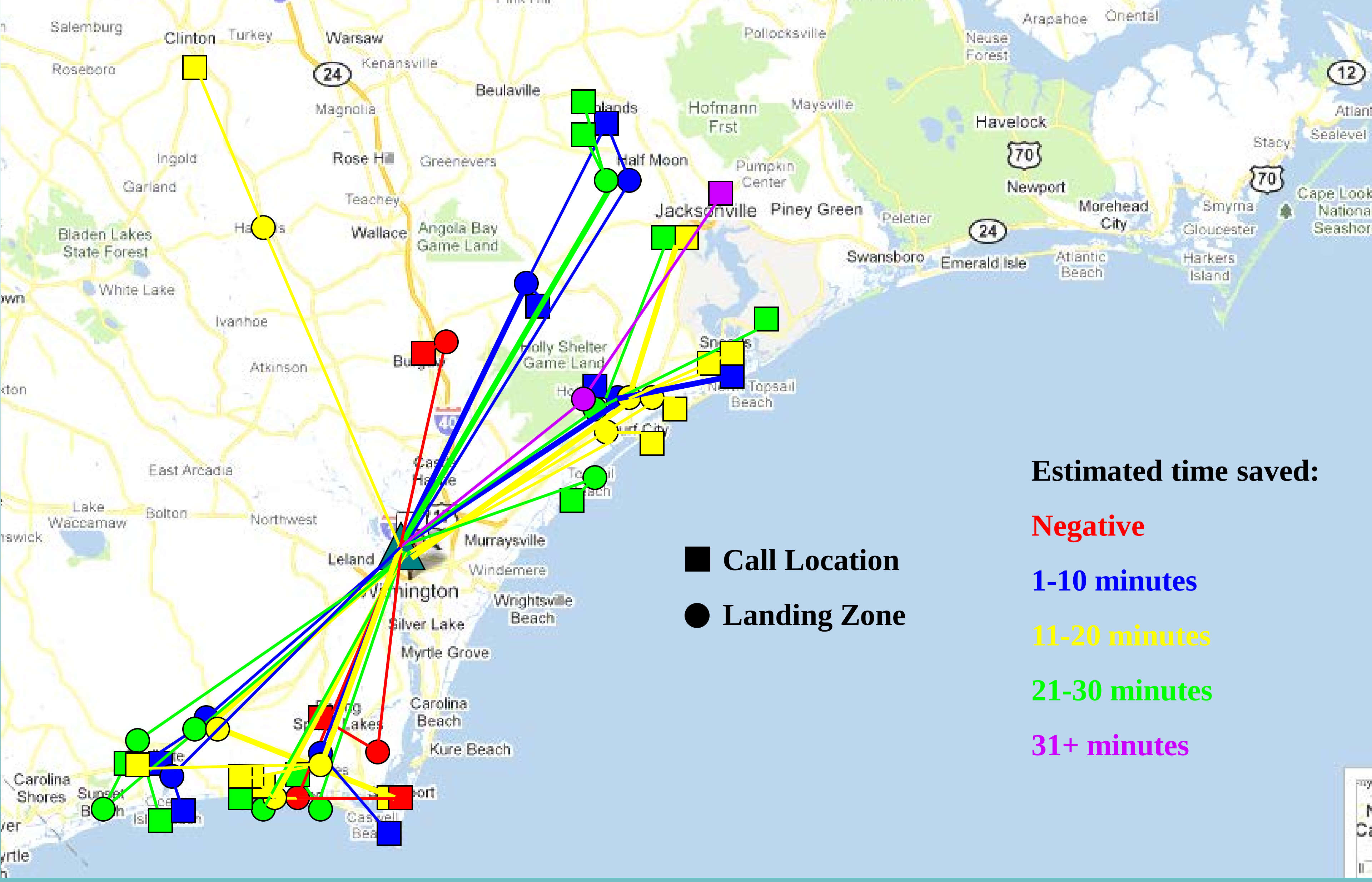


ADAM 2013 National GIS database

Virginia HEMS Programs



How Does This Work For Us?



2. Early Notification

Utilize a Standardized Triage Dispatch

- Dispatch codes
- Chief complaints/EMD history

Dispatch Runs the Show

- Early HEMS Notification
- Determine helicopter availability
- Has defined criteria for next closest helicopter
- Avoids helicopter shopping

Early Dispatch

- Auto standby or launch plan based on distance
- The farther away the earlier you launch
- Rapid 12-lead EKG is critical

Strive for simultaneous Cath Lab activation (STEMI)

Or

Known trauma center destination

Improved patient outcomes (that's who this is about)

Consider Auto-launch

- medical transport rando launching
- Listening t anners for the “bad o ”
- Forcing air trans rt of unnecessary patien

911 center has established criteria, dispatcher follows established process

Dispatch of local EMS

Immediate dispatch of pre-determined HEMS resources (no wait for first responders)

Automatic coordination of regionalized PDLZ

2011 Guidelines for Field Triage of Injured Patients

Dispatch based on Mechanism

- **Falls**
  - Adults: >20 feet (one story is equal to 10 feet)
  - Children: >10 feet or two or three times the height of the child
- **High-risk auto crash**
  - Intrusion, including roof: >12 inches occupant site; >18 inches any site
  - Ejection (partial or complete) from automobile
  - Death in same passenger compartment
  - Vehicle telemetry data consistent with a high risk of injury
- **Auto vs. pedestrian/bicyclist thrown, run over, or with significant (>20 mph) impact**
- **Motorcycle crash >20 mph**

Transport based on Findings

Glasgow Coma Scale	≤13
Systolic Blood Pressure (mmHg)	<90 mmHg
Respiratory Rate	<10 or >29 breaths per minute, or need for ventilatory support (<20 in infant aged <1 year)

NO

Assess anatomy of injury

- All penetrating injuries to head, neck, torso, and extremities proximal to elbow or knee
- Chest wall instability or deformity (e.g. flail chest)
- Two or more proximal long-bone fractures
- Crushed, degloved, mangled, or pulseless extremity
- Amputation proximal to wrist or ankle
- Pelvic fractures
- Open or depressed skull fracture
- Paralysis

Does Mechanism of Injury Predict Trauma Center Need?

Table 3. Sensitivity, Specificity, Positive Likelihood Ratio of Each Triage Criterion for Determining Trauma Center Need**

Mechanism of Injury	Triage Criteria	Number that met the Criteria	Sensitivity*	Specificity*	+LR*
Motor Vehicle Crash	Death of another occupant	25	3% (0.7%–5.9%)	99.5% (99.3%–99.7%)	6.8 (2.7–16.7)
	Extrication >20 min	105	11% (6.6%–15.8%)	98% (97.3%–98.3%)	5.1 (3.2–8.1)
	Intrusion >12″	202	19% (13.0%–25.4%)	95% (94.7%–96.1%)	4.2 (2.9–5.9)
	Ejection	38	3% (0.4%–5.1%)	99% (98.9% – 99.4%)	3.2 (1.3–8.2)
	Deformity >20″	457	27% (20.4%–34.2%)	89% (87.9%–89.9%)	2.5 (1.9–3.2)
	Speed >40 mph	969	47% (39.6%–54.9%)	76% (75.0%–77.7%)	2.0 (1.7–2.4)
	Rollover	523	13% (8.2%–18.0%)	87% (86.2%–88.3%)	1.0 (0.7–1.5)
Fall	Fall >20 ft	36	4% (1.4%–7.2%)	99% (98.9%–99.5%)	5.3 (2.4–11.4)
Pedestrian/bicyclist struck by a car	thrown or run over	251	65% (48.6%–80.8%)	46% (41.8%–51.2%)	1.2 (0.9–1.6)
	Struck at speed >5 mph	314	93% (84.4%–100%)	24% (20.0%–28.7%)	1.2 (1.1–1.4)
Motorcycle crash	Speed >20 mph	297	87% (77.2%–96.7%)	29% (23.9%–33.3%)	1.2 (1.1–1.4)
	Rider separated from motorcycle	350	83% (72.4%–93.0%)	19% (14.8%–22.7%)	1.0 (0.9–1.2)

The mechanism-of-injury criteria used in the 1999 version of the Field Triage Decision Scheme resulted in significant overtriage. Death of another occupant, fall distance, and extrication time were found to be good predictors of trauma center need when a patient does not meet the anatomic or physiologic criteria. Intrusion, ejection, and vehicle deformity were found to be moderate predictors. The remaining mechanism-of-injury criteria were found to be poor predictors: motor vehicle crash speed, rollover, pedestrian or bicyclist thrown or run over, pedestrian or bicyclist striking vehicle speed, motorcycle crash speed, and separation of a rider from a motorcycle.

Good MOI predictors

Death of another occupant

Fall distance

Extrication time

PREHOSPITAL EMERGENCY CARE 2011;15:518–525

NAEMSP: Medical Patients Guidelines

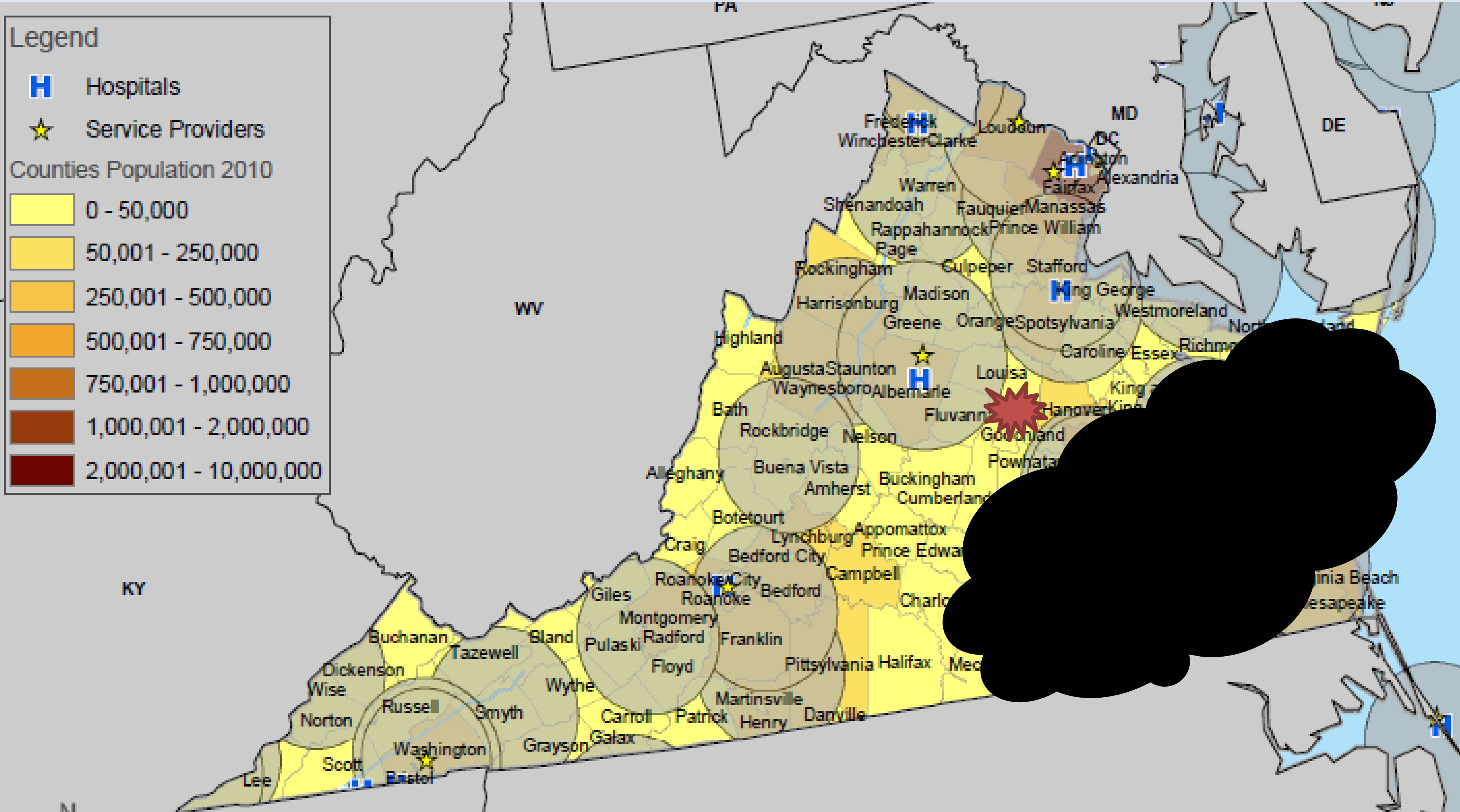
Medical	• Respiratory arrest • ROSC following cardiac arrest • Overdose/poisoning requiring specialized center • GI hemorrhage with hemodynamic compromise
Neurological	• Status epilepticus • Stroke: tPA canidate
Cardiac & Cardiothoracic	• STEMI • Aneurism & dissection

Helicopter Shopping

Helicopter shopping occurs when multiple different HEMS agencies are requested for a single mission when the mission has been turned down for weather safety reasons.

Establish a policy that prohibits helicopter shopping

Virginia HEMS Programs



[redacted]

ADAM 2013 National GIS database

3. Utilize an Intercept Model

Avoid waiting on scene

- Increased E2B time increases mortality
- “golden time period” in trauma
- Our goal is a <5 min wait at any LZ

Move towards definitive care

- Weather changes
- Helicopter malfunction
- Patient deterioration

Have a back up plan

- Direct to PCI
- To local ED for fibrinolytics

Keep the patient moving

Why Intercept?

Realistic response timeline

- "weather go" to airborne →10 minutes
- Right time 2 miles/minute→
  25 miles=13 min
- Hover and land →3 minutes
- Shut down if necessary →2-5 minutes

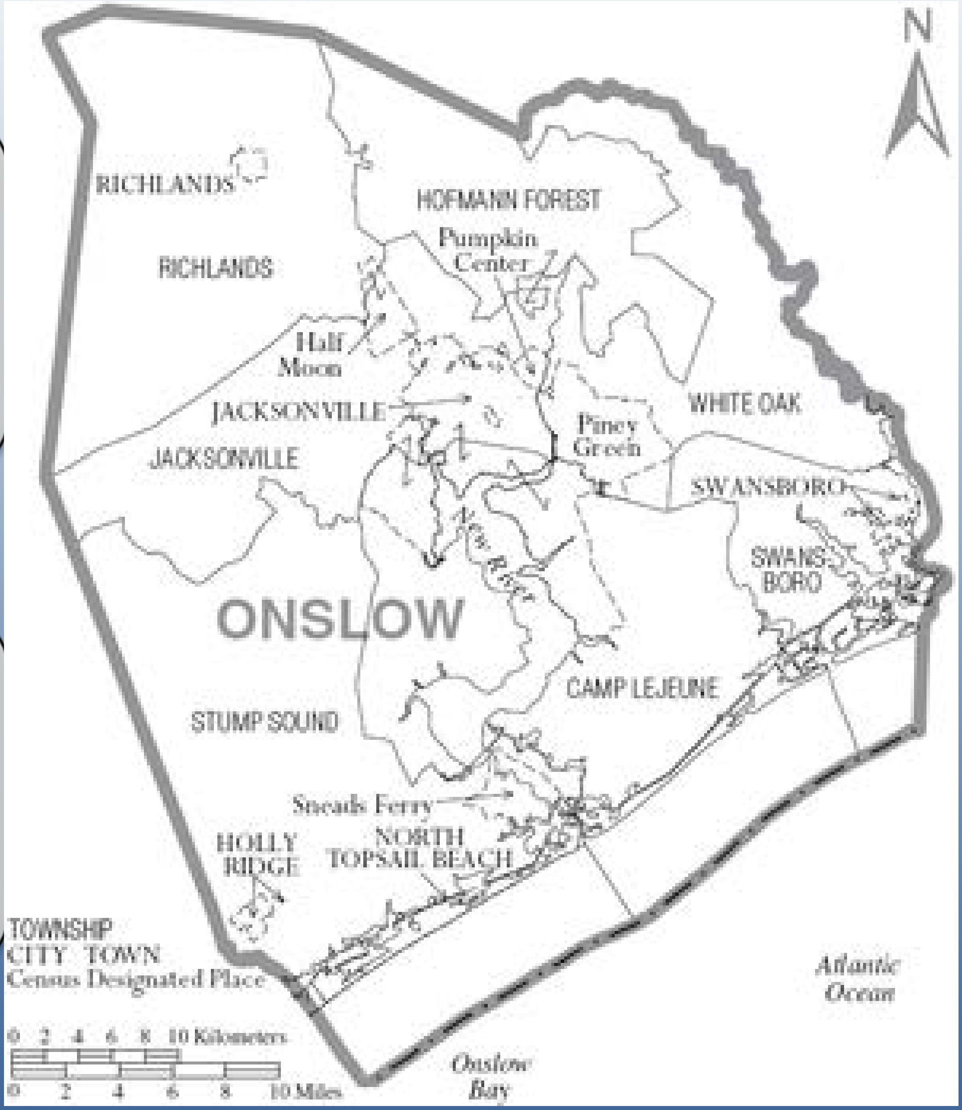
Landing Zone Selection

Use a standard set of LZ locations

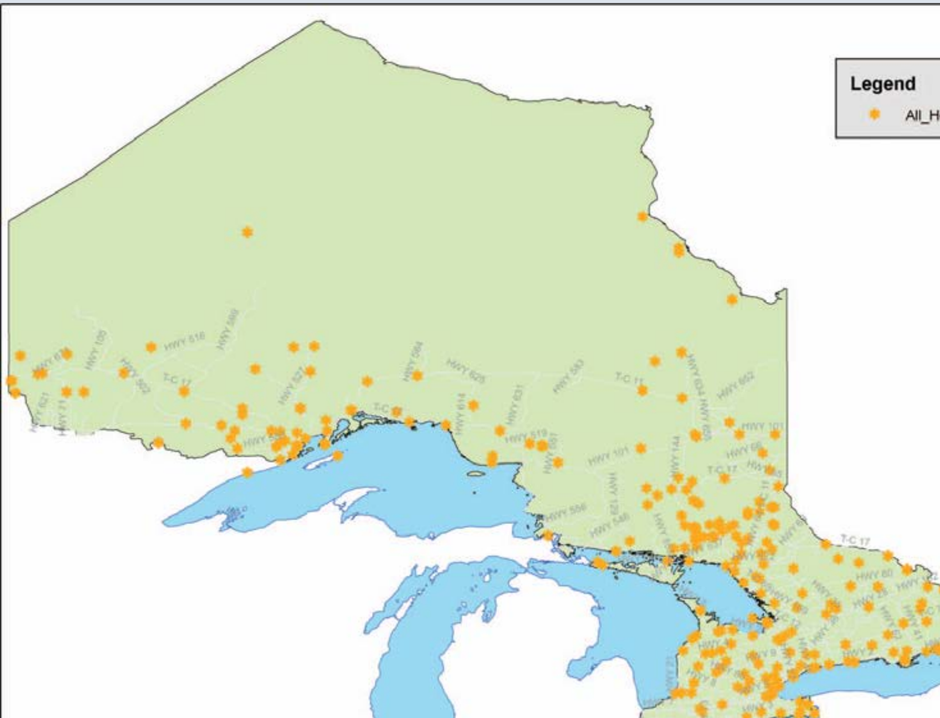
- Known by both services
- Familiar locations increases safety

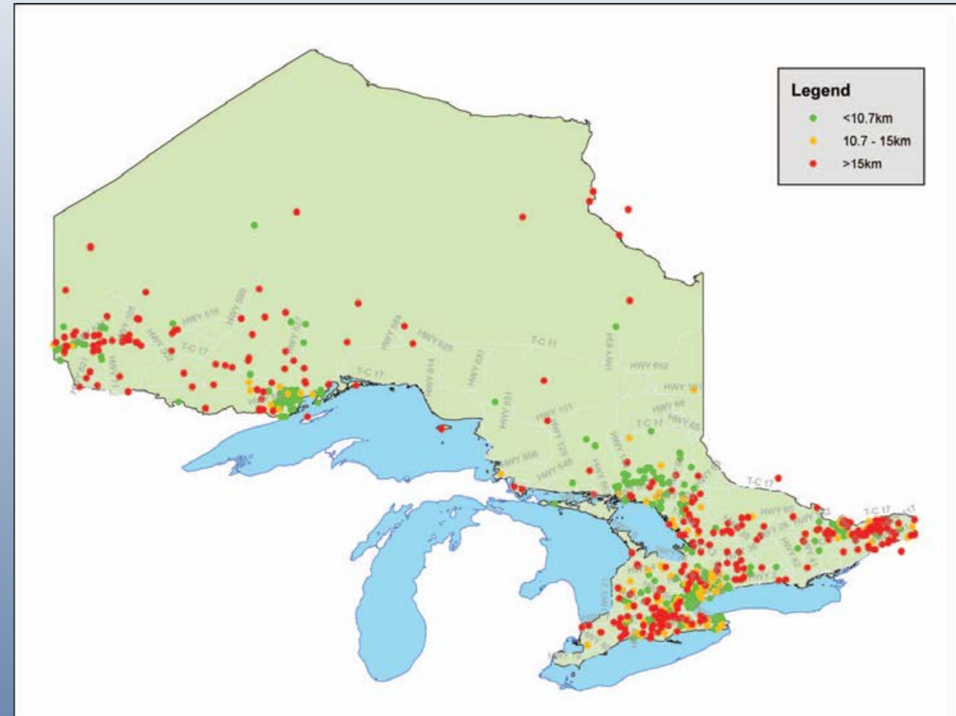
Establish regions or sections of your system

- LZ pre-determined before ever on scene
- Improves overall safety
- Creates a "plan"



Use of Geographic Information Systems to Determine New Helipad Locations and Improve Timely Response While Mitigating Risk of Helicopter Emergency Medical Services Operations





the closest helipad. **Conclusion.** GISs can be used to determine potential locations for new helipad construction using historical call request data. This evidence-based approach can improve HEMS access while mitigating operational risk. **Key words:** helicopter EMS; helipad; safety; emergency

PREHOSPITAL EMERGENCY CARE 2010;14:461–468

What Makes a Good PD-LZ?

Community hospital helipad

Fire station parking lot

Firm sports fields

Airport

Easy hand-off

Regularly available

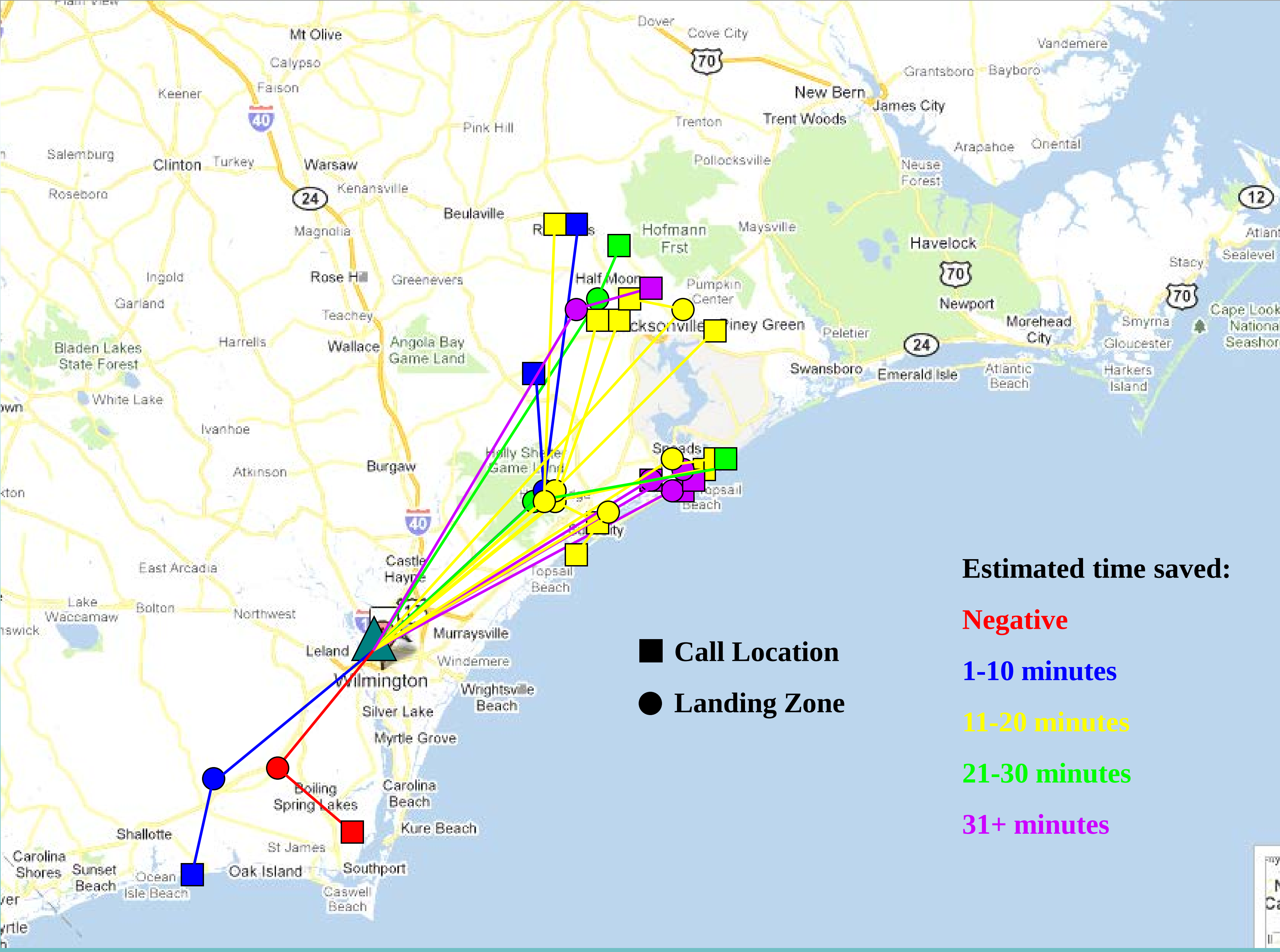
Stretchers move easily

No hazards

What About

Often have large ruts

Expect helicopter to stay running
Law Enforcement may worry about traffic flow


Estimated time saved:
Negative
1-10 minutes
11-20 minutes
21-30 minutes
31+ minutes
Call Location
Landing Zone
Mt Olive
Calypso
Faison
Keener
Dover
Cove City
Vandemere
Grantsboro
Bayboro
New Bern
James City
Trent Woods
Trenton
Pink Hill
Salemburg
Clinton
Turkey
Warsaw
Kenansville
Roseboro
Beulaville
Pollocksville
Arapahoe
Oriental
Neuse Forest
Magnolia
Hofmann Frst
Maysville
Havelock
Stacy
Sealevel
Ingold
Rose Hill
Greenevers
Half Moon
Pumpkin Center
Newport
Garland
Teachey
Piney Green
Peletier
Morehead City
Smyrna
Gloucester
Cape Lookout National Seashore
Bladen Lakes State Forest
Harrells
Wallace
Angola Bay Game Land
Swansboro
Emerald Isle
Atlantic Beach
Harkers Island
White Lake
Ivanhoe
Burgaw
Atkinson
Topsail Beach
East Arcadia
Castle Hayne
Lake Waccamaw
Bolton
Northwest
Murraysville
Leland
Windemere
Wilmington
Wrightsville Beach
Silver Lake
Myrtle Grove
Boiling Spring Lakes
Carolina Beach
Kure Beach
Shallotte
Carolina Shores
Sunset Beach
Ocean Isle Beach
Oak Island
St James
Southport
Caswell Beach

4. Streamline Hand-Off

STEMI requirements

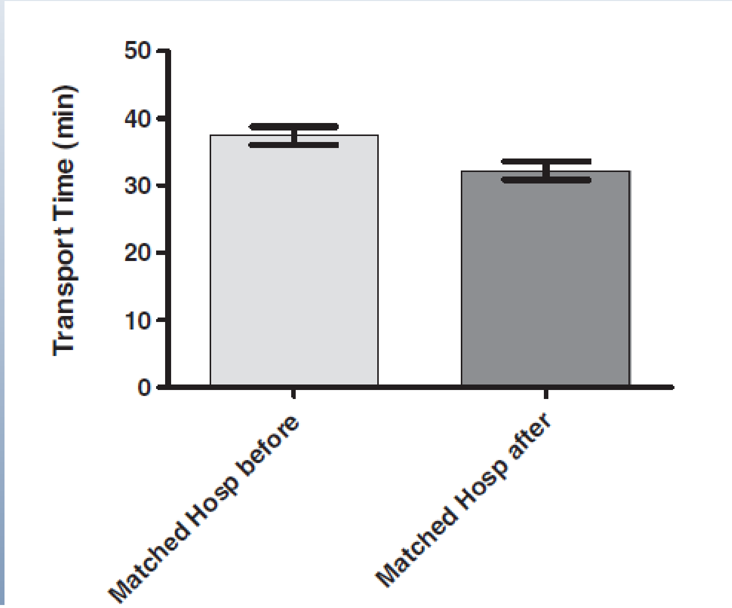
- 12-lead EKG
- Key interventions
- Limited infusions

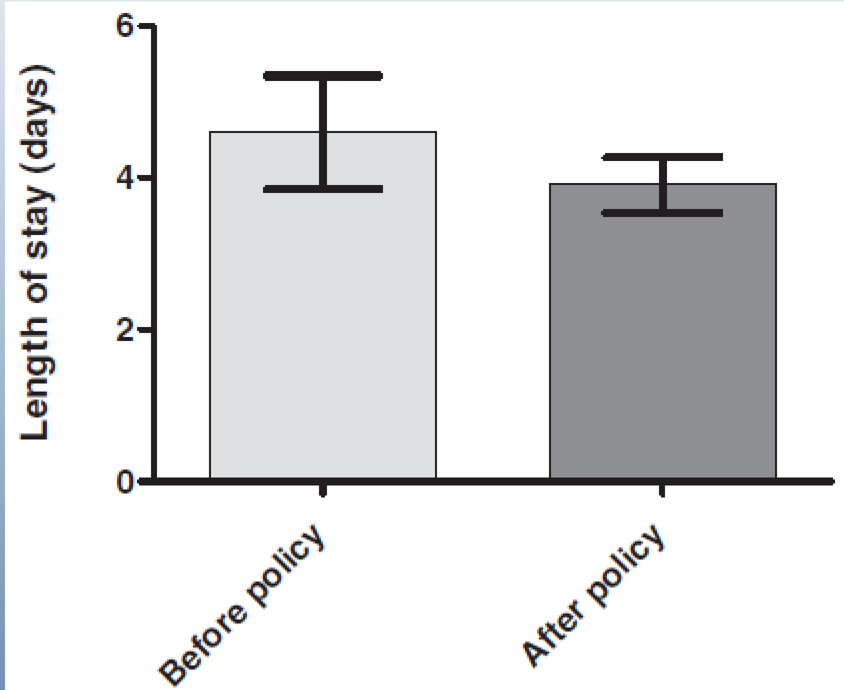
Trauma

- Infusions
- Extra equipment
- Airway management

Our Goal is a skid to skid time of < 10 minutes

Transporting without Infusions: Effect on Door-to-Needle Time for Acute Coronary Syndrome Patients





Our critical care ambulance service (air and ground) covers a large area of central Massachusetts and a large number of facilities of varied distances from the primary study institution. When we analyzed transport times only from a selected group of matched hospitals, we still found that up to 7 minutes was saved transporting a patient without infusing medications. This reduction, although modest, is important because it would help to reduce the overall door-to-balloon times.

PREHOSPITAL EMERGENCY CARE 2010;14:159–163

Location of Airway Management in Air Medical Transport

TABLE 1. Distribution of Locations Where Airway Management Was Performed

Location	Number Successful/Total for This Location	Percentage of Overall Total ($n = 936$)	Percentage of Success
Scene	595/627	67	94.9
En-route	60/67	7.2	89.6*
In-flight	57/64	6.1	89
Ambulance	3/3	0.3	100
Referring hospital	232/235	25.1	98.7
Receiving hospital	7/7	0.7	100.0

*$p = 0.002$, chi-square.

TABLE 3. Characteristics of Patients Requiring En-route Airway Management

Patient Type	Number	Percentage
Trauma	39	57.4
Burn	1	1.5
Medical	28	41.1
TOTAL	68*	100

*One case classified as both trauma and burn.

TABLE 4. Reasons for In-Flight Airway Management

Reason	Number	Percentage
Patient deterioration in-flight	30	46.9
Unknown	16	25
Planned en-route secondary to patient acuity	14	21.9
Extubated/reintubated in-flight	4	6.2
Scene unsafe/better environment	0	0
TOTAL	64	100

cess. Air medical teams are challenged by many variables such as limited space, limited equipment, noise, vibration, and poor lighting, all of which may play a role in making in-flight intubations more difficult.

Thomas et al.[11] discusses the idea that flight crews have a good ability to select which patients are appropriate for in-flight airway management. This may, therefore, explain the reasonable success rate despite the challenges in this setting. Utilizing rapid difficult airway evaluation techniques prior to transport may identify those patients for whom pretransport definitive airway management would be safest.[16] This as-

PREHOSPITAL EMERGENCY CARE 2008;12:438–442

Packaging the Patient

- Blankets under seatbelts
- If immobilized place sheets beneath backboard straps
- Its ok to remove monitoring equipment as air crew lands

5. After the Helicopter Leaves

Call receiving Hospital w/ Patient report

PRN provide Interpretation of 12-lead

Communicate scene information

Complete the chain

6. Consistent Follow up

Establish appropriate over-activation rates

- STEMI: 90% accuracy is common
- Trauma: 70% appropriate use based on criteria

Ensure the process is working

- Feedback with the HEMS program
- Feedback with the hospital

Don’t be afraid to change

- Destination hospitals
- Update/change LZ
- Mode of transport

camts

Flight programs should be doing this and bringing it back to you

TABLE 2. Commission on Accreditation of Medical Transport Systems Recommendations for Indications That May Cause a Flight to be Reviewed for Medical Appropriateness[19]

- Patients discharged directly from the emergency department (ED) after transfer.
- Patients transported without an intravenous (IV) line or oxygen.
- Patients upon whom cardiopulmonary resuscitation (CPR) is in progress at the referring location.
- Patients not transferred from a critical care unit.
- Patients who are "scheduled transports."
- Patients who are air transported more than once for the same illness or injury within 24 hours.
- Patients transported from the scene of injury with a trauma score of 15 or greater or who fail to meet area-specific triage criteria for a critically injured trauma patient.
- Patients treated at the scene or a referring hospital but not transported.
- Patients not transferred bedside to bedside by the flight team.
- Patients transported from facility to facility, and the receiving facility is not a higher level of care than the referring facility.
- Patients transported from the scene of injury to any hospital that was not the closest appropriate and available trauma center (based on regional trauma plans, if present).
- Patients flown initially by fixed-wing aircraft and transported from the airport to the receiving facility by helicopter.
- Patients ground-transported with red lights and sirens.
- Patients served by an inappropriate aircraft (time/distance/speed considerations).
- Patients served by an inappropriate team, e.g., advanced life support (ALS) team was used but patient requires critical care skills.
- Patients served by an inappropriate ambulance that met the aircraft to assume care of the patient and continue transport without the level of care, equipment, and supplies appropriate to the patient's specific needs.
- Patients who die during transport.

HELICOPTER SCENE RESPONSE:

REGIONAL VARIATION IN COMPLIANCE WITH AIR MEDICAL TRIAGE GUIDELINES

TABLE 3. Helicopter Triage Criteria Met by Study Patients

Variable	Number of Patients
Physiologic criteria*	
Systolic blood pressure <90 mmHg	14
Respiratory rate <10 or >30 breaths/min	9
At least one physiologic criterion met	18
Physiologic criteria were the only triage criteria met	1
Anatomic criteria*	
Evidence of spinal cord injury	3
Severe head injury (Glasgow Coma Scale score ≤12)	28
Severe abdominal, chest, or pelvic injury	45
Burns	2
Penetrating injury	2
Extremity amputation	2
At least one anatomic criterion met	53
Anatomic criteria were the only triage criteria met	25
Special criteria*	
Vehicle ejection or same-compartment death	11
Pedestrian thrown >15 feet or run over by vehicle	11
Age <10 years (n = 3) or >55 years (n = 17)	20
Multiple special criteria met	5
At least one special criterion met	38
Special criteria were the only triage criteria met	18
Patients meeting no triage criteria	27

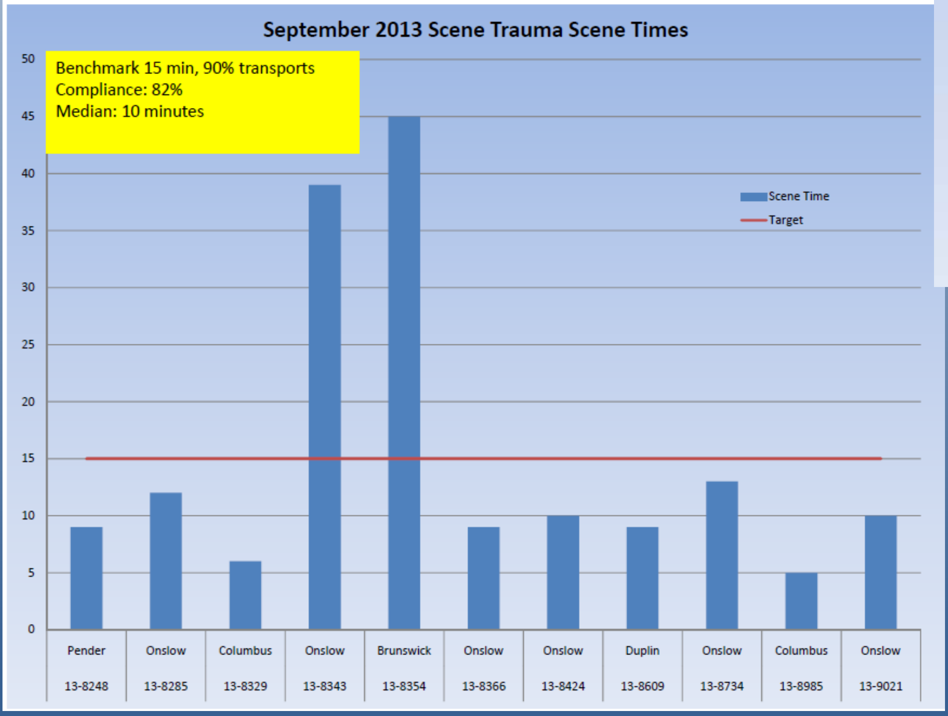
TABLE 5. Hospital Course and Disposition

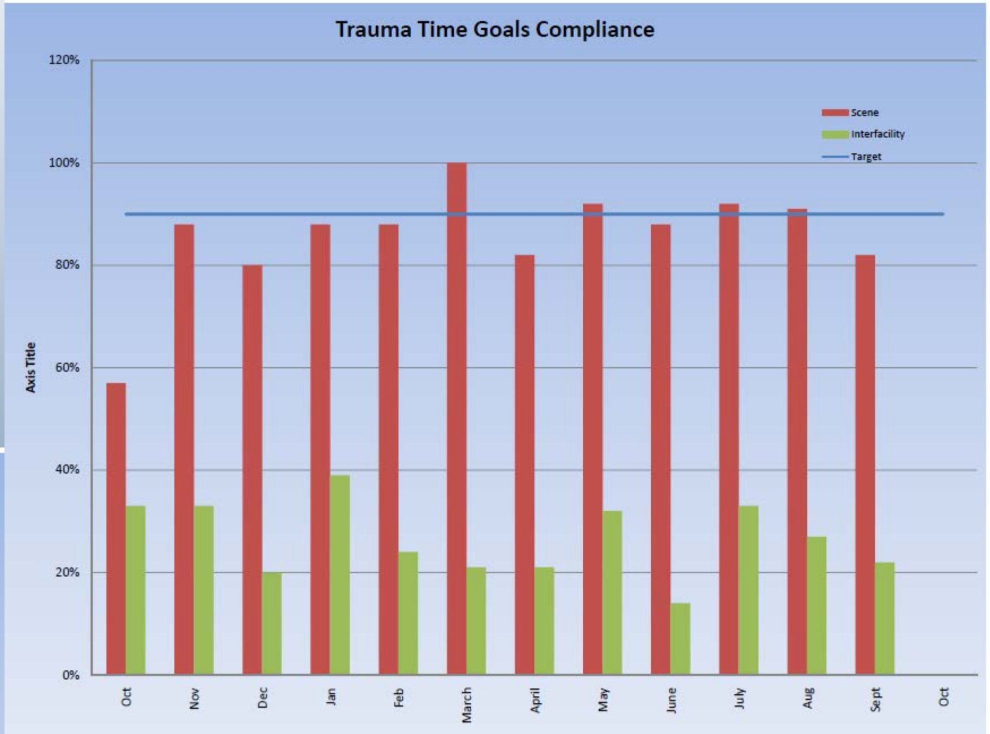
Variable	Number of Patients
HEMS interventions	
Endotracheal intubation	25
Fentanyl or morphine analgesia	75
Hospital workup	
At least one computed tomography test	84
Operative intervention	40
Intensive care unit admission	33
Disposition	
Died	13
Home	66
Rehabilitation	21

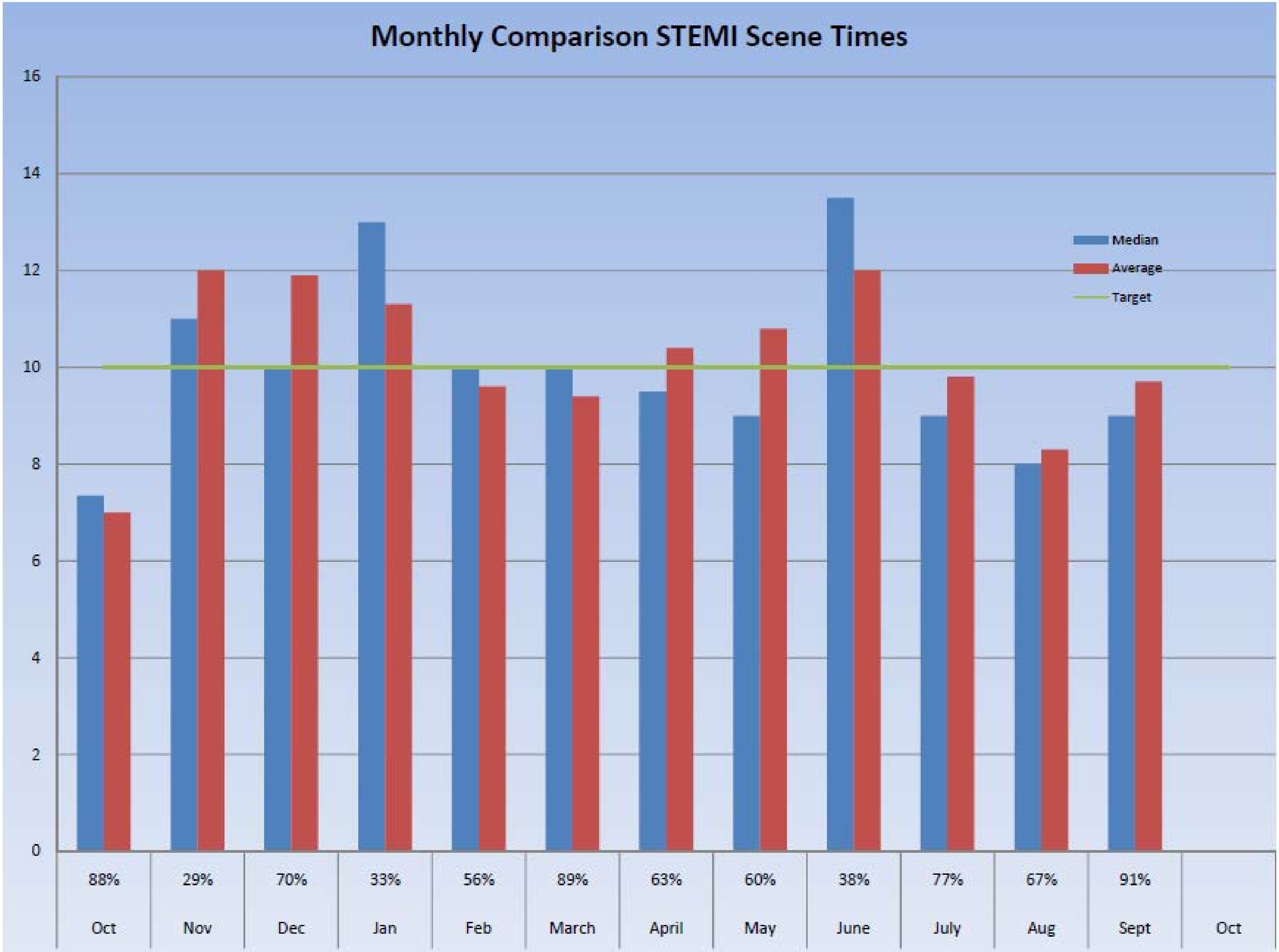
Conclusion: There are regional variations in the decisions to use air medical transport that require local level evaluation to determine appropriate utilization

PREHOSPITAL EMERGENCY CARE 2008;12:443–450

Request HEMS Program QA Data



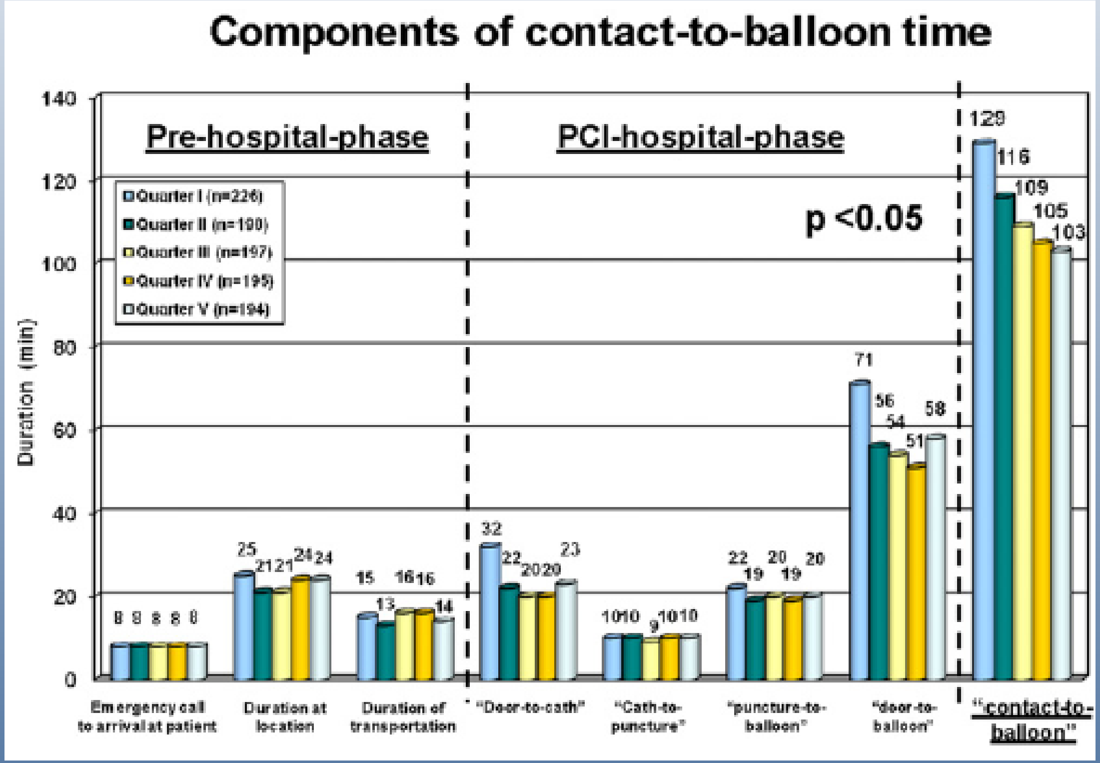




Monthly Comparison STEMI Scene Times
16
14
12
10
8
6
4
2
0
Median
Average
Target
88%
29%
70%
33%
56%
89%
63%
60%
38%
77%
67%
91%
Oct
Nov
Dec
Jan
Feb
March
April
May
June
July
Aug
Sept
Oct

Reduction in Treatment Times Through Formalized Data Feedback

Results From a Prospective Multicenter Study of ST-Segment Elevation Myocardial Infarction



Conclusions

The current trial shows that implementation of a systematic data assessment and formalized data feedback is possible across different regional STEMI networks, independent of their specific setting. We were able to demonstrate a significant reduction in C2B and D2B times after implementing this feedback process. There was a significant improvement in clinical outcomes, including 1-year mortality. We conclude that a formalized feedback process is an effective intervention to improve treatment times for STEMI and should complement the strategies of the American College of Cardiology D2B initiative.

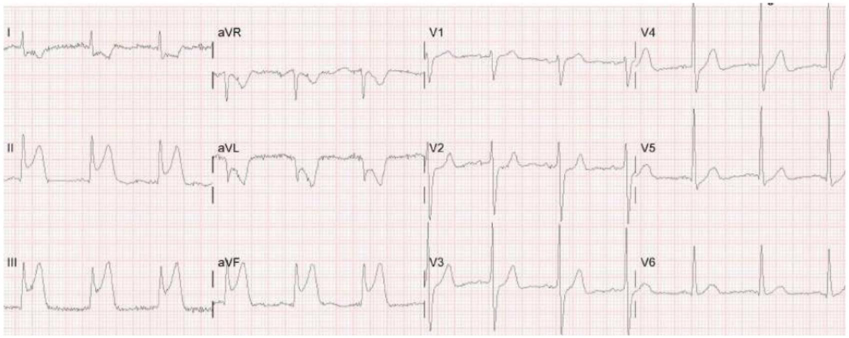
JACC: CARDIOVASCULAR INTERVENTIONS
VOL. 5, NO. 8, 2012

Code STEMI Feedback
Direct Presenters by EMS

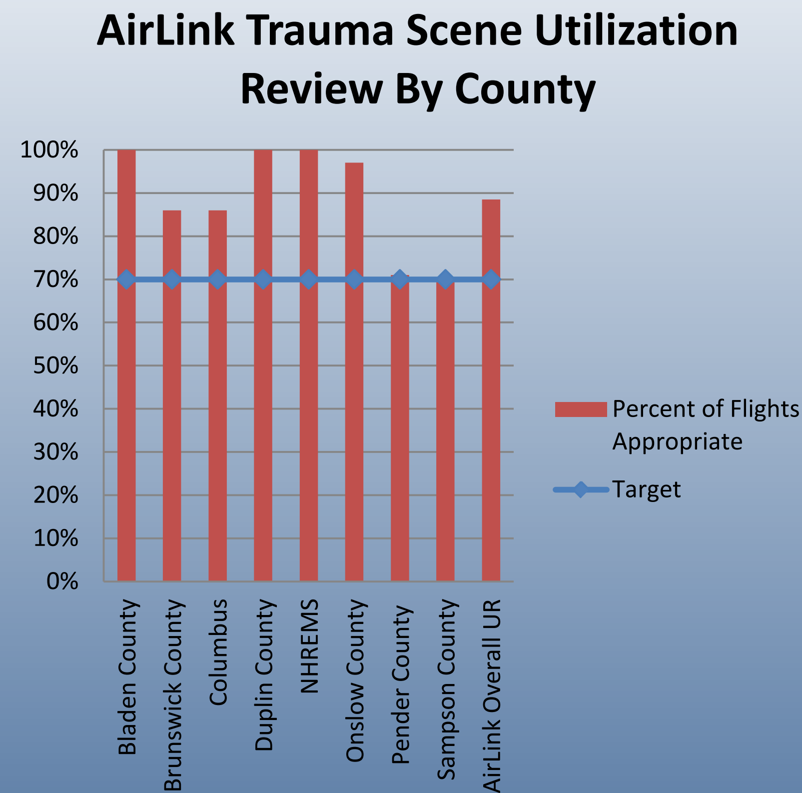
Date of Service: March 11
Time of Code STEMI Activation: 1612
EMS Agency: OEMS
Paramedics: Shepard, Magee
Airlink Staff: Wright, Tran, Sherwell
ED Physician: ?
ED Staff: Spaulding
Cardiologist: Weaver
Cath Lab Staff: Burke, Pickard, White

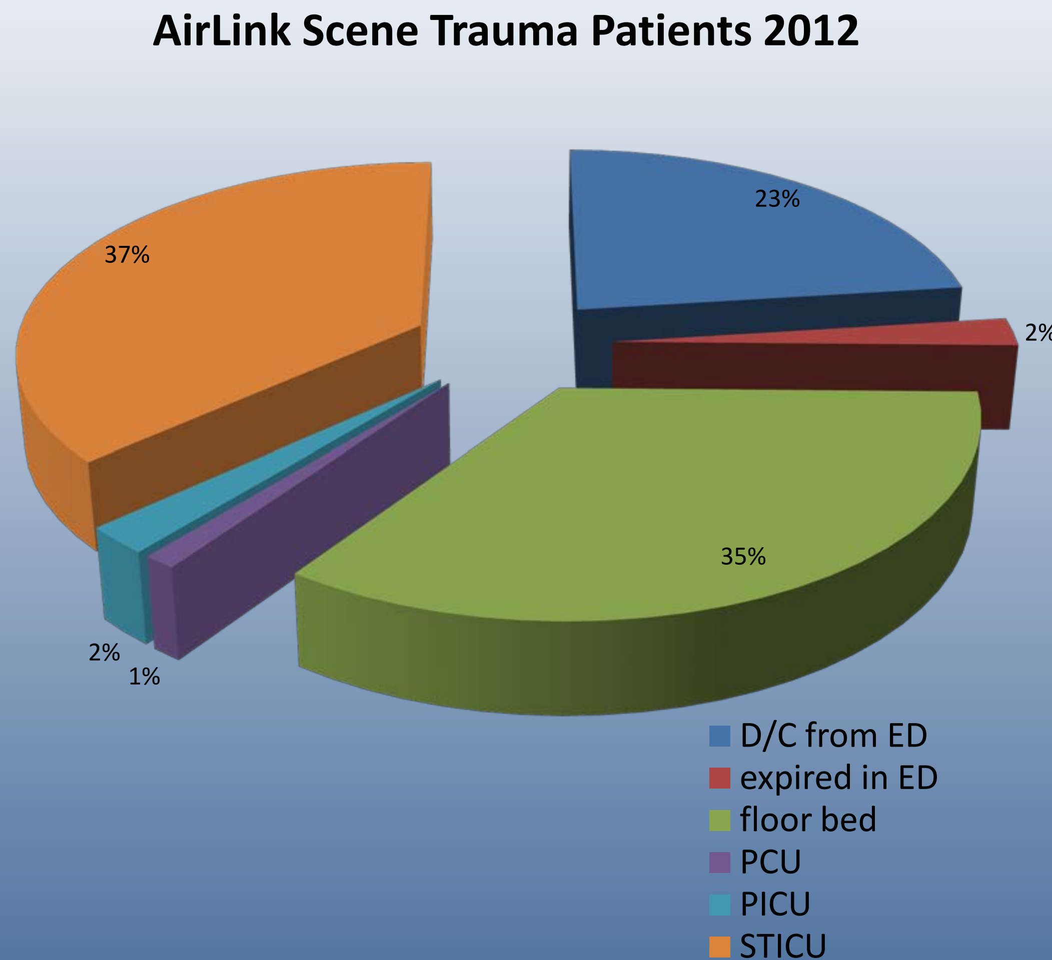
30-30-30 Goal		Recommended Targets (mins)	Actual Data
	EMS On-scene	< 10	?
55 Mins EMS	EMS Total Time		23
	Airlink Scene Time	10	9
	Airlink Total Time with Pt		29
	Door to CS Activation		-36
5 Mins ED	CS Page to Cath Team Arrival	30	PTA
	Total Time in ED	5	<1
	Depart ED to Setup Complete	12	6
30 Mins CL	Departure ED to Procedure Start		8
	Depart ED to PCI	30	13
	Door to Balloon	60	13
	First Medical Contact to Balloon	90	65

EMS EKG



Retrospective Reviews





Goals: Over-activation <25-30%
under activation <5%

Objective 4: Advancing Patient Care

Early Patient Report

Team may prepare for

Advanced skills

- Needle chest decompression
- Pericardialcentesis
- Central lines
- IO access
- Blood
- Point of care testing
- Antibiotics
- Rapid Sequence Intubation

Only provide pertinent safety information via radio when helicopter is in flight. The approach is a critical phase of flight and the team is in "sterile cockpit."

Position Statement

EMS Spinal Precautions and the Use of the Long Backboard

National Association of EMS Physicians and American College of Surgeons Committee on Trauma

- Patients for whom immobilization on a backboard is not necessary include those with all of the following:
  - Normal level of consciousness (Glasgow Coma Score [GCS] 15)
  - No spine tenderness or anatomic abnormality
  - No neurologic findings or complaints
  - No distracting injury
  - No intoxication
- Patients with penetrating trauma to the head, neck or torso and no evidence of spinal injury should not be immobilized on a backboard.

- The long backboard can induce pain, patient agitation, and respiratory compromise. Further, the backboard can decrease tissue perfusion at pressure points, leading to the development of pressure ulcers.
- Utilization of backboards for spinal immobilization during transport should be judicious, so that the potential benefits outweigh the risks.

PREHOSPITAL EMERGENCY CARE 2013;17:392–393

Position Statement

EMS Spinal Precautions and the Use of the Long Backboard

National Association of EMS Physicians and American College of Surgeons Committee on Trauma

- Spinal precautions can be maintained by application of a rigid cervical collar and securing the patient firmly to the EMS stretcher, and may be most appropriate for:
  - Patients who are found to be ambulatory at the scene
  - Patients who must be transported for a protracted time, particularly prior to interfacility transfer
  - Patients for whom a backboard is not otherwise indicated

PREHOSPITAL EMERGENCY CARE 2013;17:392–393

Study of Placing a Second Intravenous Line in Trauma

Table 2. Estimated Difference in Adjusted and Unadjusted Means (Confidence Intervals and p-Values for Testing No Difference) between Subjects with One and Two Intravenous Lines

Variable	Unadjusted	Adjusted for Age, Gender, and Whether below Median on Scene (When Appropriate)	Adjusted for Age, Gender, Whether below Median on Scene (When Appropriate), and Volume of Fluids
Pulse oximetry, %	−0.05 (−0.64, 0.54) 0.87	−0.10 (−0.69, 0.49) 0.74	0.20 (−0.45, 0.84) 0.55
Volume of fluids, mL	348.4 (235.6, 461.1) < 0.0001	357.2 (224.1, 470.4) < 0.0001	–
Change in GCS score			
All subjects	0.29 (−0.17, 0.74) 0.22	0.28 (−0.19, 0.74) 0.24	0.34 (−0.18, 0.86) 0.21
GCS score <15 on scene	0.72 (−0.60, 2.04) 0.29	0.73 (−0.64, 2.11) 0.30	0.91 (−0.68, 2.51) 0.26
Change in heart rate, bpm			
All subjects	−0.21 (−2.89, 2.46) 0.88	0.40 (−2.13, 2.92) 0.76	0.87 (−1.94, 3.67) 0.54
HR > 100 bpm on scene	2.65 (−3.55, 8.86) 0.64	2.88 (−3.27, 9.02) 0.36	3.92 (−3.01, 10.86) 0.27
Change in systolic BP, mmHg			
All subjects	3.42 (−2.10, 8.94) 0.22	4.34 (−1.09, 9.77) 0.12	2.93 (−2.83, 8.69) 0.32
Systolic BP <132 mmHg on scene	4.26 (−3.24, 11.75) 0.27	5.41 (−2.08, 12.89) 0.16	2.55 (−5.86, 10.97) 0.55
Systolic BP <100 mmHg on scene	4.30 (−13.71, 22.31) 0.64	2.50 (−18.59, 23.58) 0.82	22.00 (−4.17, 48.16) 0.10
Change in diastolic BP, mmHg			
All subjects	5.32 (1.02, 9.62) 0.015	5.27 (1.10, 9.45) 0.013	5.41 (0.76, 10.07) 0.023
Diastolic BP <80 mmHg on scene	8.18 (2.16, 14.19) 0.0077	8.58 (2.79, 14.37) 0.0037	9.89 (3.38, 16.40) 0.0029
Diastolic BP <60 mmHg on scene	13.47 (−7.43, 34.37) 0.21	6.86 (−20.41, 34.13) 0.62	31.63 (2.20, 61.05) 0.035

Conclusion

Redundant prehospital IV lines provided no difference in physiologic outcomes for trauma patients. When controlling for confounding variables, no significant outcome difference of heart rate or volume infused was noted, even in the hypotensive patients. The traditional approach for establishment of a secondary IV line in prehospital trauma patients should not be followed in a dogmatic fashion.

A 2nd IV doesn't improve outcomes in trauma patients

PREHOSPITAL EMERGENCY CARE 2011;15:208–213

Prehospital Intravenous Fluid Administration is Associated with Higher Mortality in Trauma Patients: A National Trauma Data Bank Analysis

776,734pt study

49.3% received prehospital fluids

Increased mortality 4.5%→4.8%

Concluded that fluids cause significant harm

Annals of Surgery 2011; 253(2): 371-377

Blood

Decreases mortality

Early blood administration = less blood overall

Plasma being studied at 10 sites

If they don't have it ask why not?

Location of Airway Management in Air Medical Transport

Table 1. Distribution of Locations Where Airway Management Was Performed

Location	Number Successful/Total for This Location	Percentage of Overall Total ($n = 936$)	Percentage of Success
Scene	595/627	67	94.9
En-route	60/67	7.2	89.6*
In-flight	57/64	6.1	89
Ambulance	3/3	0.3	100
Referring hospital	232/235	25.1	98.7
Receiving hospital	7/7	0.7	100.0

*$p = 0.002$, chi-square.

Table 2. Intubation Success Based on Location

Location	OR	95% CI	p-Value
En route	1	—	—
Scene	2.3	0.95–5.7	0.065
Hospital	8.7	2.2–35	0.002

Adjusted for age, gender, and case type.
CI = confidence interval; OR = odds ratio.

Table 4. Reasons for In-Flight Airway Management

Reason	Number	Percentage
Patient deterioration in-flight	30	46.9
Unknown	16	25
Planned en-route secondary to patient acuity	14	21.9
Extubated/reintubated in-flight	4	6.2
Scene unsafe/better environment	0	0
Total	64	100

PREHOSPITAL EMERGENCY CARE 2008;12:438–442

Oxygen

2010 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care

In the absence of compelling evidence for established benefit in uncomplicated cases, ACC/AHA Guidelines have noted that there appeared to be little justification for continuing routine oxygen use beyond 6 hours. [2] There is insufficient evidence to recommend the routine usage of oxygen therapy in patients suffering from an uncomplicated AMI or an ACS without signs of hypoxemia or heart failure. Supplementary oxygen has been shown to limit ischemic myocardial injury in animals,[168–171] but evidence of benefit from supplementary oxygen from human trials is limited.[168] A case study found improvement in ST changes with the use of oxygen in humans.[172] Others suggested harm with *high*-flow oxygen administration.[173,174]

8.6. Oxygen

Few data exist to support or refute the value of the routine use of oxygen in the acute phase of STEMI, and more research is needed. A pooled Cochrane analysis of 3 trials showed a 3-fold higher risk of death for patients with confirmed acute MI treated with oxygen than for patients with acute MI managed on room air. Oxygen therapy is appropriate for patients who are hypoxemic (oxygen saturation <90%) and may have a salutary placebo effect in others. Supplementary oxygen may, however, increase coronary vascular resistance.[447] Oxygen should be administered with caution to patients with chronic obstructive pulmonary disease and carbon dioxide retention.

Circulation. 2013;127:e362-e425

Analgesia

2010 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care

Analgesia

Providers should administer analgesics, such as intravenous morphine, for chest discomfort unresponsive to nitrates. Morphine is the preferred analgesic for patients with STEMI (Class I, LOE C). However, analysis of retrospective registry data raised a question about the potentially adverse effects of morphine in patients with UA/NSTEMI.[44] As a result, the ACC AHA UA/NSTEMI writing group reduced morphine use to a Class IIa recommendation for that patient population.[3]

Options

Fentanyl
Dilaudid
Morphine

Use boluses whenever feasible

Morphine	• Pain • Anxiety • Pulmonary edema	• 4 to 8 mg IV initially, with lower doses in elderly • 2 to 8 mg IV every 5 to 15 min if needed	• Lethargic or moribund patient • Hypotension • Bradycardia • Known hypersensitivity

Circulation. 2013;127:e362-e425

Additional Cardiac Medicines

Heparins

Heparin is an indirect inhibitor of thrombin that has been widely used in ACS as adjunctive therapy for fibrinolysis and in combination with aspirin and other platelet inhibitors for the treatment of non-ST-segment elevation ACS. UFH has several disadvantages, including (1) the need for IV administration; (2) the requirement for frequent monitoring of the activated partial thromboplastin time (aPTT); (3) an unpredictable anticoagulant response in individual patients; and (4) heparin can also stimulate platelet activation, causing thrombocytopenia. Because of the limitations of heparin, newer preparations of LMWH have been developed.

Levophed
Neosynepherine
Heparin
Esmolol
labatelol

Helicopter Emergency Medical Services Crew Administration of Antibiotics for Open Fractures

HEMS Crew Open Fracture Treatment and Time Intervals

HEMS crews administered Abx (ceftriaxone, 1 g) in 60 cases (43.5%). Thus, the number of patients in the HEMS Abx group was 60, and the number of Hosp Abx patients was 78 (56.5% of the total of 138).

When Abx were administered by HEMS crews, the time interval from the incident to Abx was 30 minutes shorter than the corresponding interval for the Hosp Abx patients. The median

Study showed a 40.3% relative risk reduction for infection following open FX

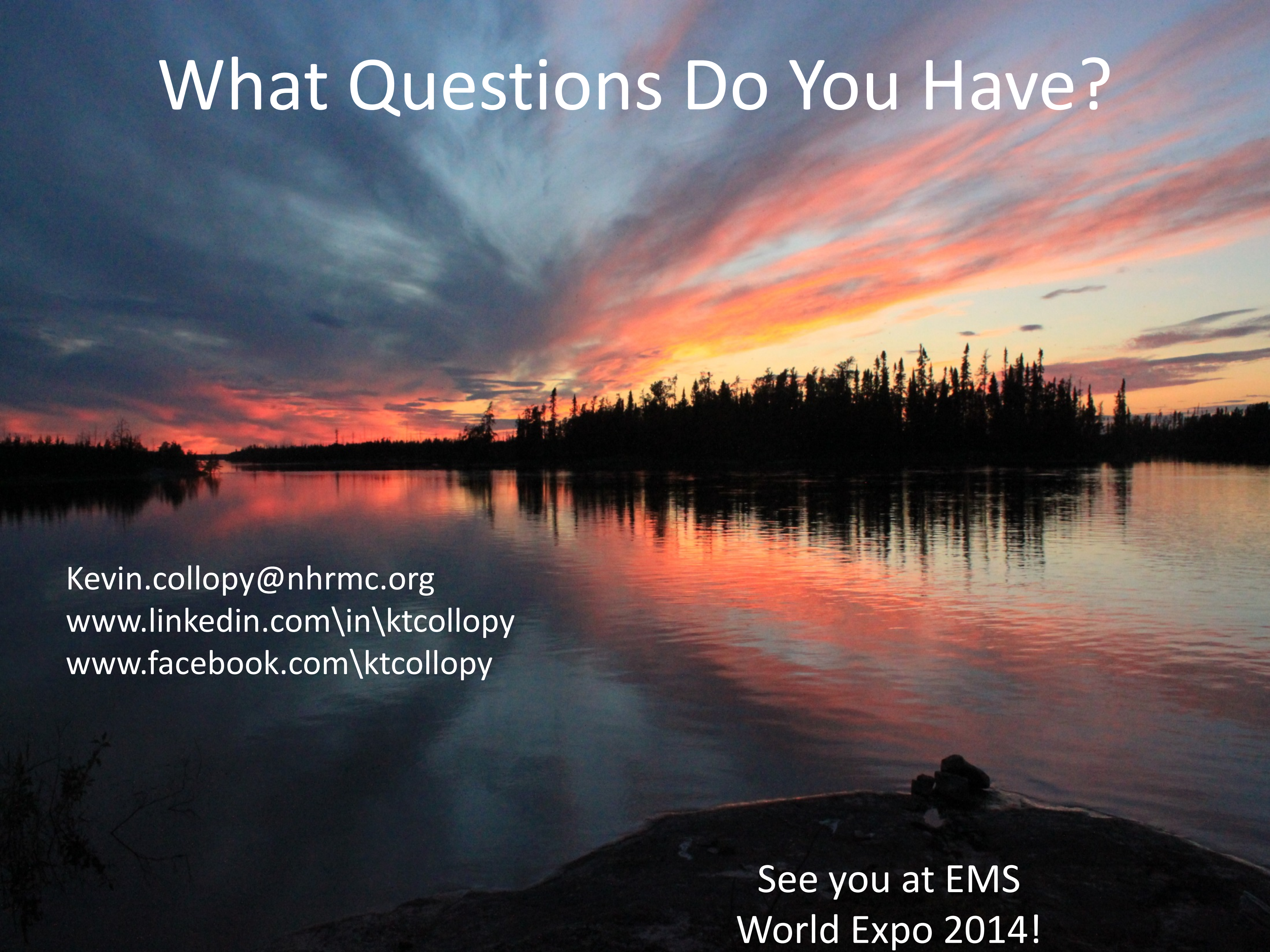
Point of Care Testing

- Arterial Blood Gas
- Chemistries
- Lactate
- Troponin
- Glucose

Summary

- HEMS Programs can help improve patient outcomes
- Improving outcomes requires pre-planning and coordination
- Standardize as many aspects as possible
- Rapid transport is not helpful without early Cath Lab activation and accurate 12-lead interpretation

What Questions Do You Have?



Kevin.collopy@nhrmc.org
www.linkedin.com\in\ktcollopy
www.facebook.com\ktcollopy

See you at EMS
World Expo 2014!