

Time is Not of the Essence

Re-Evaluating the Traditional Response Interval

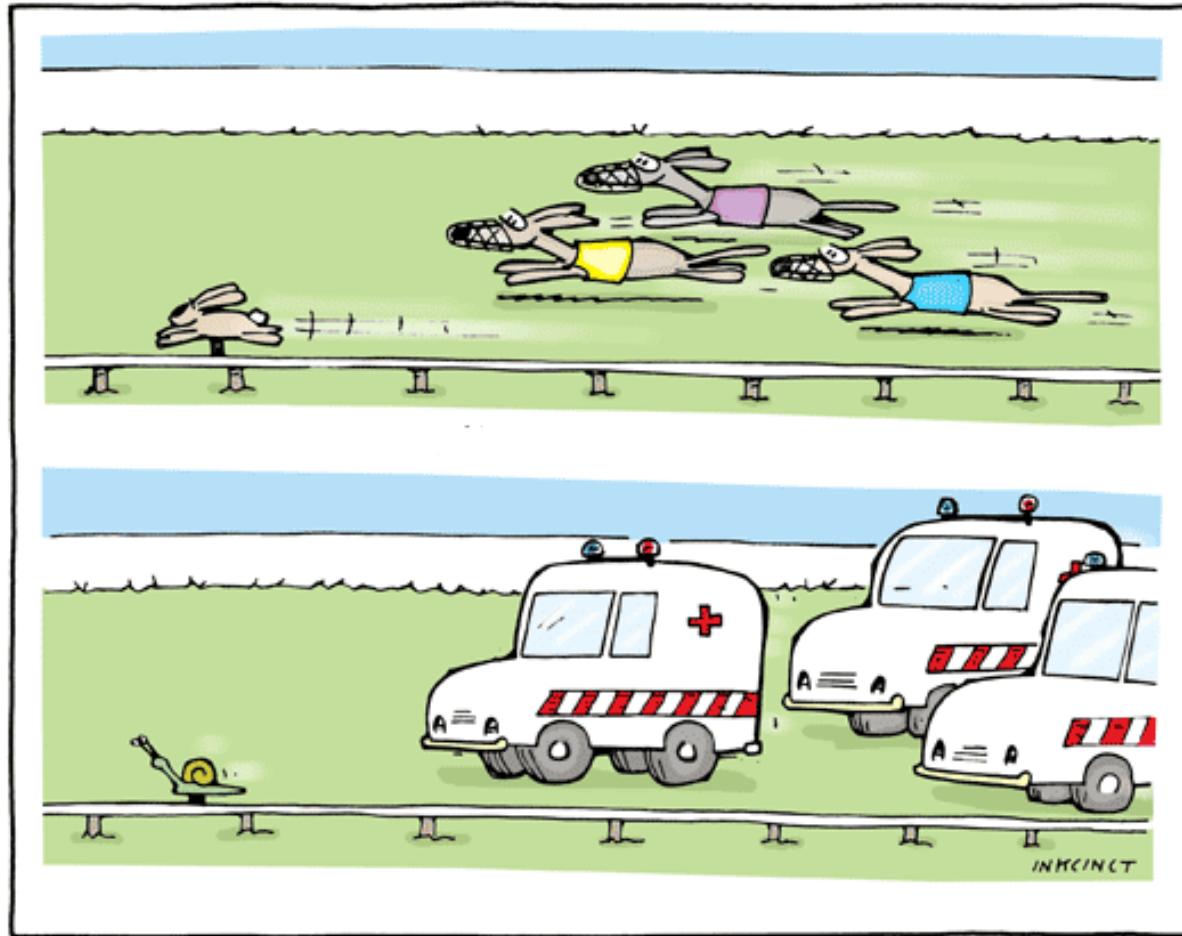


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Greenville Health System



UNIVERSITY OF
SOUTH CAROLINA
School of Medicine
Greenville

What's all this stuff about “Response Time?”



Does it make a difference?

The Charlotte Observer

SUNDAY, FEBRUARY 25, 1996

Heart attack. You call 911.
Help is on the way, they say.
But it may come too late.



THE RACE TIME

The report came in less than 20 minutes after the ambulance arrived at the scene of the crash. The race was on.

484
368
37

RACE AGAINST DEATH

AN OBSERVER SPECIAL REPORT

Truck driver collapses, waits 25 minutes for EMS and dies



Observer's Notebook
Dante's 1995's 100-year-old
birthday, John, died waiting for
an ambulance in Gaston County.
It's hard, Lord, it's hard...
the way he lived.

By CHRIS WILSON
Staff Writer
It was a Tuesday morning in December. The weather was cold, and the traffic was heavy. A truck driver, John, collapsed while driving on a highway. He was alone in the truck, and he was waiting for help. The ambulance arrived 25 minutes later, but it was too late. John had died.

It's a sad story, but it's not unique. Every year, thousands of people die from heart attacks while driving. The problem is that there's no one to help them when they need it. The ambulance has to come from somewhere, and it takes time to get there. In the meantime, the person is alone and dying.

The Charlotte Observer

MONDAY, FEBRUARY 26, 1996

Overworked personnel
and overloaded system
can spell disaster.



Paramedics take a patient to the scene of the crash on the way to the hospital.

By CHRIS WILSON
Staff Writer
The system is broken. The personnel are overworked, and the system is overloaded. The result is disaster.

SIRENS IN THE NIGHT

It's the way the system works, and it's the way the agendas get rid of the redundancies.

Charlotte Fire Chief Luther Fisher

When 911 rings, who goes?



Emergency response may be changing if Charlotte Fire Chief Luther Fisher gets his way. He wants to streamline the city's system by merging the city's fire department and the county's emergency medical service into the city's fire department, saving city and county taxpayers money.

Talks have begun
on merging fire,
MEDIC tasks to
speed response,
save money

By DAN CHAPMAN
Staff Writer

Two years ago, the city and county started talking about merging the fire department and the emergency medical service. The idea was to save money and improve response time. But now, the talks are still going on, and no decision has been made.

Charlotte Fire Chief Luther Fisher wants to streamline the city's system by merging the city's fire department and the county's emergency medical service into the city's fire department, saving city and county taxpayers money.

Because it's the only way they can justify increasing their (combined) strength, says Richard Lewis, operations manager for the county EMS. They've done a lot of work in the past, but they're still not satisfied with the results.

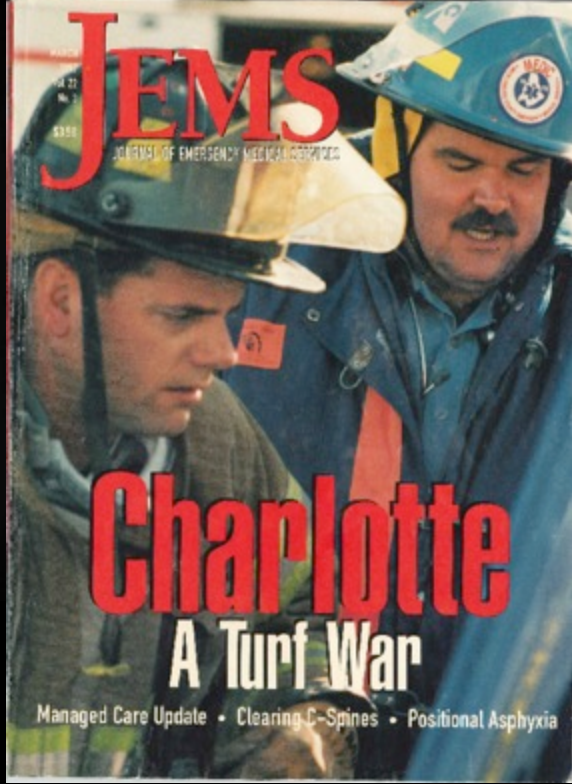


Fisher
Fisher says it will save city and county taxpayers money. He says the service will be quicker and more professional. He says it's

county EMS dispatcher who determines whether the fire department should be sent to assist. Typically, a police officer will be sent on the scene, followed by the fire department's first responder. The dispatcher will then call out an ambulance to provide more advanced medical help, if necessary, and to transport the victim to the hospital.

The fire department reports to respond to 47,000 calls this year. EMS, for medical emergencies, its average response time is four minutes, most weekends. By contrast, MEDIC, the Charlotte County Emergency Medical Service, takes an average of 10 minutes to respond.

EMS covers all 142 square miles of Mecklenburg County.



JEMS
JOURNAL OF EMERGENCY MEDICAL SERVICES

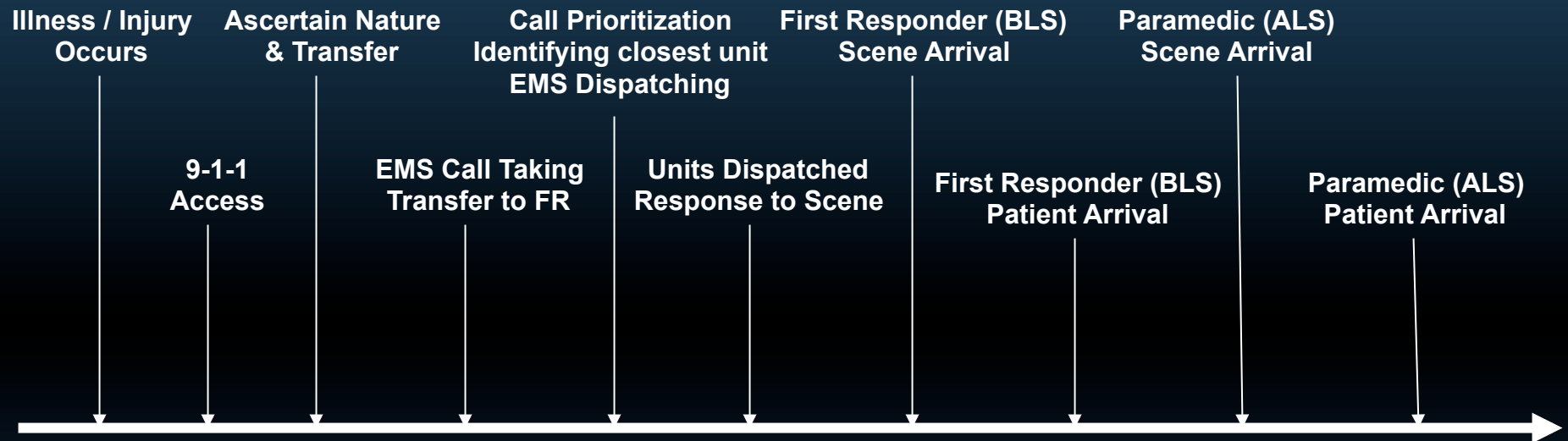
Charlotte A Turf War

Managed Care Update • Clearing C-Spines • Positional Asphyxia

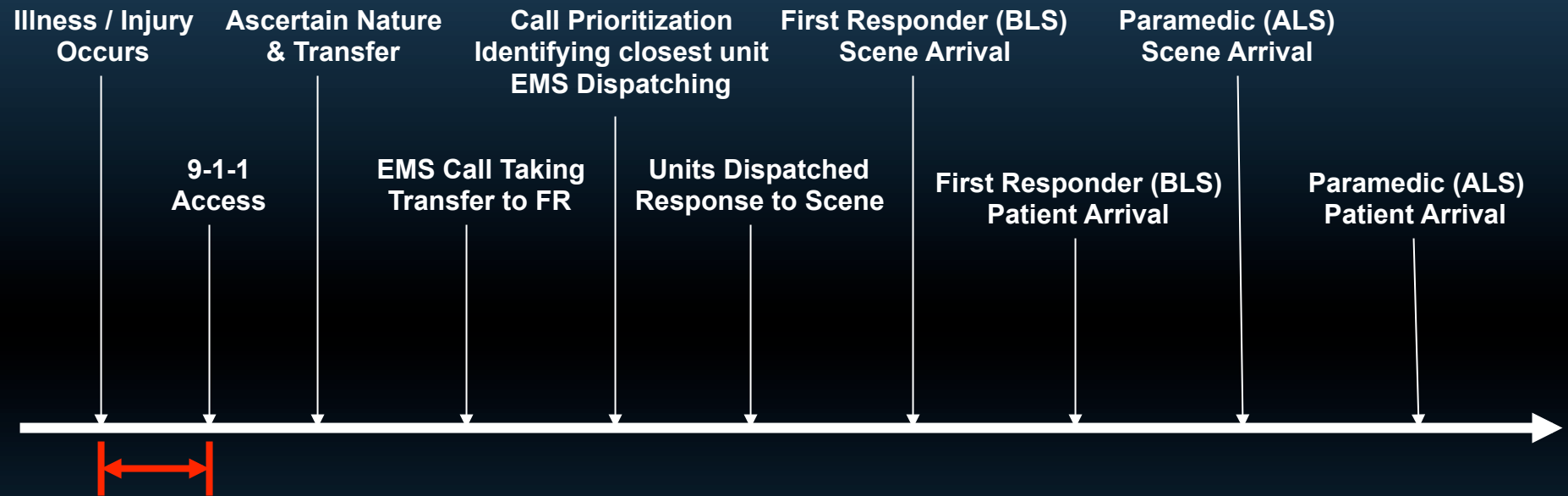




EMS Response Intervals

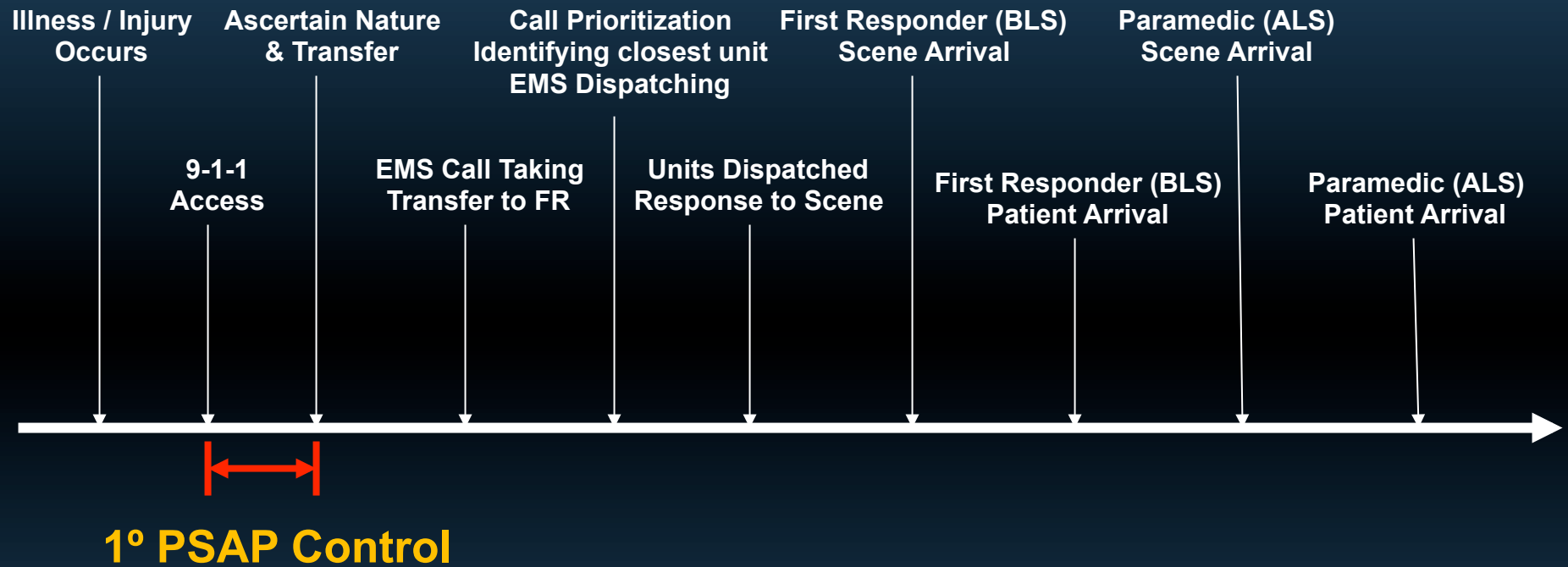


EMS Response Intervals

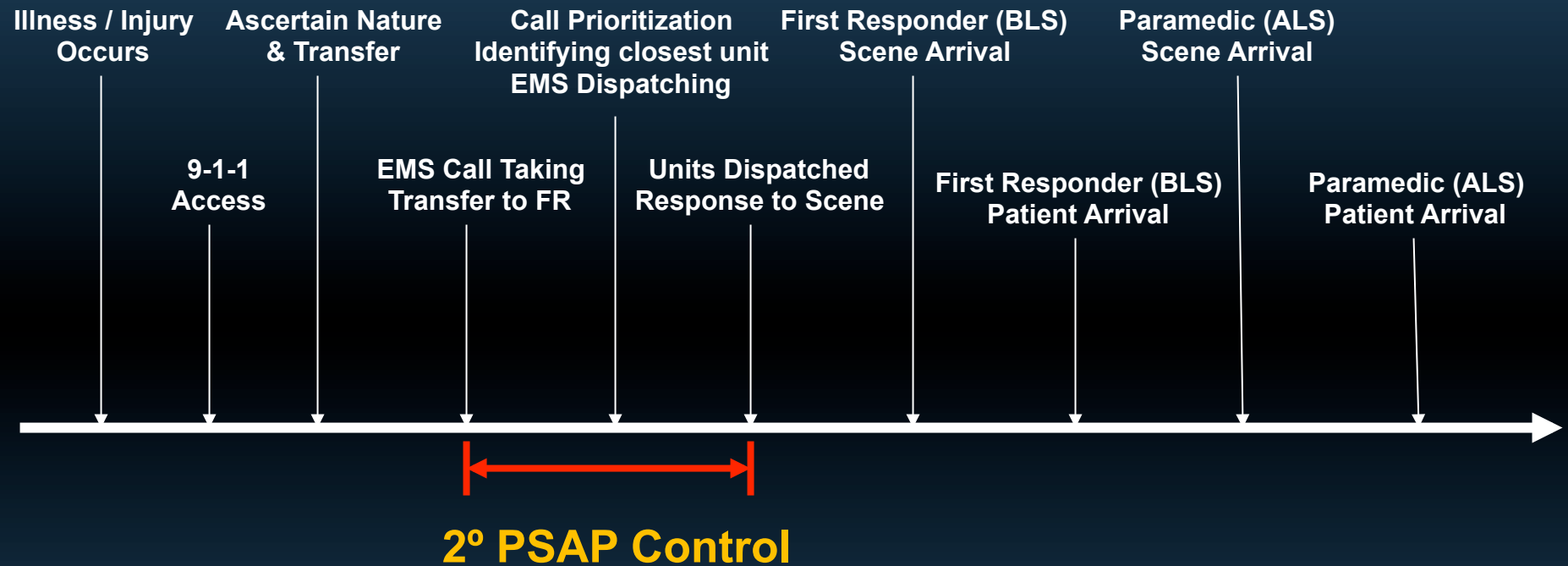


No Control

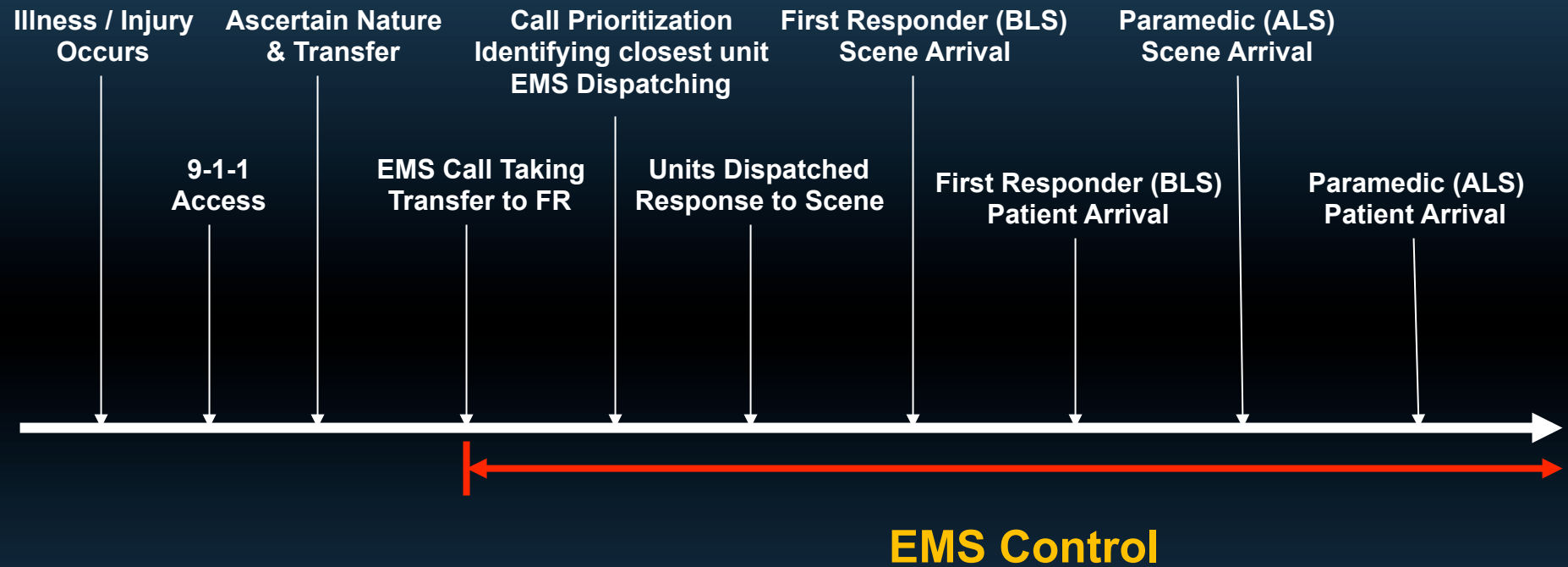
EMS Response Intervals



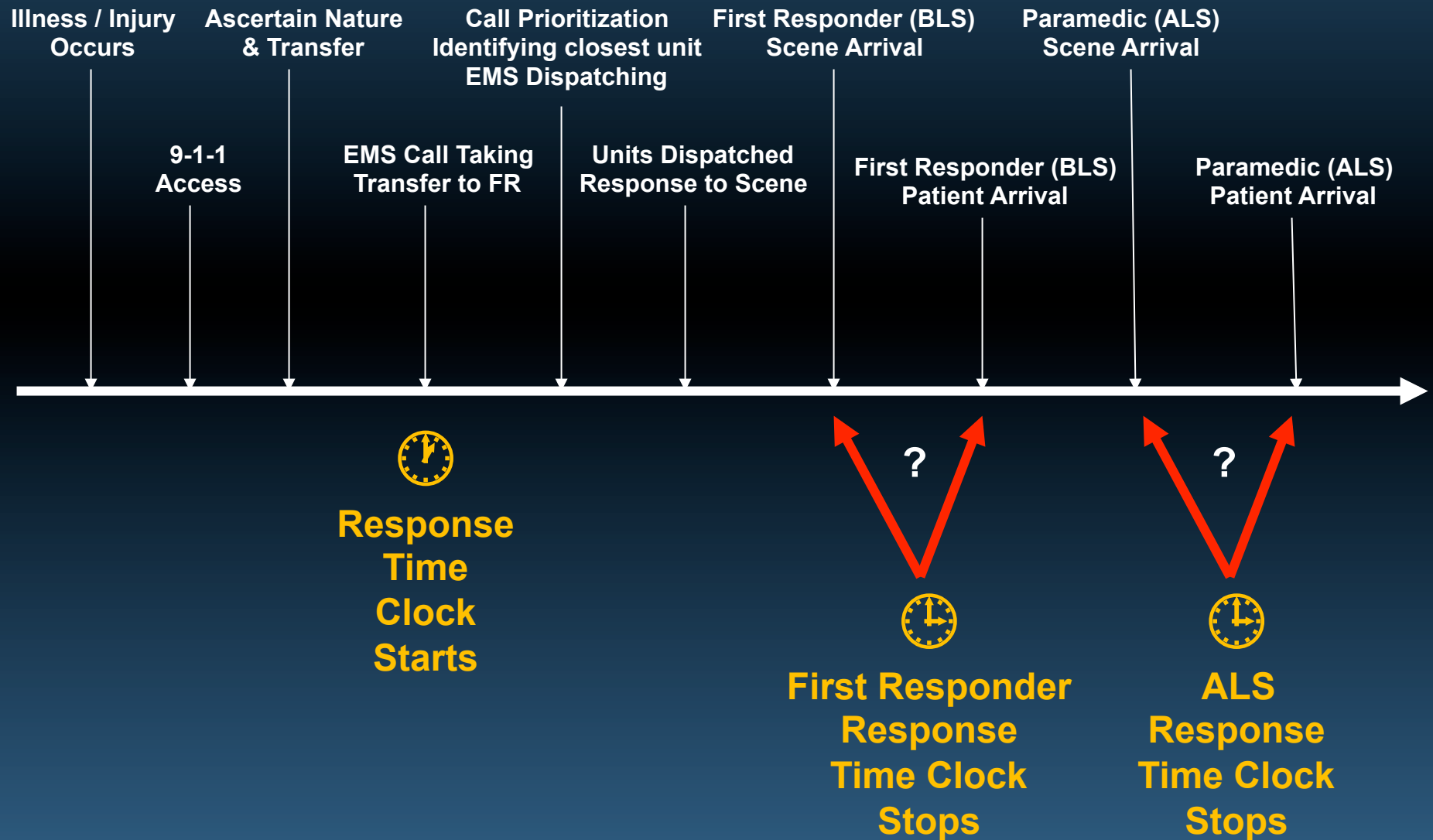
EMS Response Intervals



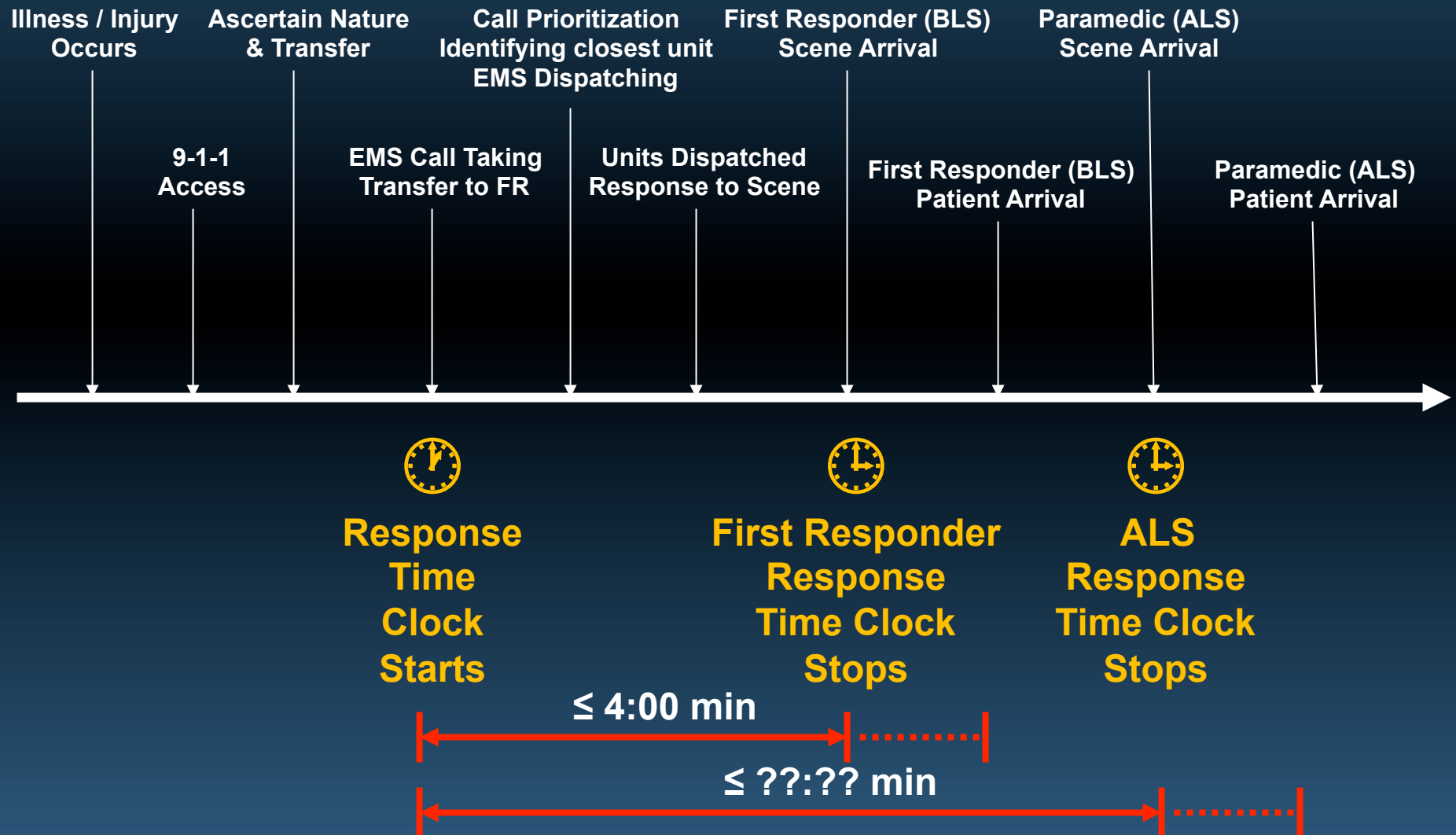
EMS Response Intervals



EMS Response Intervals



EMS Response Intervals



Cardiac Resuscitation in the Community Importance of Rapid Provision and Implications for Program Planning

Eisenberg MS, et al. JAMA 1979;241:1905-1907

Conclusion:

- **Victims of non-traumatic cardiac arrest have a better outcome if BLS (CPR) is initiated within 4 min of arrest and ALS (defibrillation) is provided within 8 min**

Problem:

- **Times extrapolated to all patients - medical and trauma**

Eight Minutes or Less: Does the Ambulance Response Time Guideline Impact Trauma Patient Outcome?

Pons PT, et al. J Emerg Med 2002;23:43-48

Objective:

Evaluate the effects of exceeding 8 min RT guideline on survival from traumatic injuries

3490 Trauma patients

Group I: RT $\leq$ 8 min (n=2450)

Group II: RT $>$ 8 min (n=1040)

Stratified by age, mechanism of injury, and ISS

	1-15
	16-25
	>25

**Eight Minutes or Less:
Does the Ambulance Response Time Guideline
Impact Trauma Patient Outcome?**

Pons PT, et al. J Emerg Med 2002;23:43-48

Results:

No difference in survival between ≤ 8 or > 8 min groups

**No difference when stratified by age, MOI, ISS... except in
 > 8 min group:**

**Survival increased in ISS > 25 group
(44% vs 26%, $p=0.02$)**

No outcome difference for ISS groups 1-15 and 16-25

**Eight Minutes or Less:
Does the Ambulance Response Time Guideline
Impact Trauma Patient Outcome?**

Pons PT, et al. J Emerg Med 2002;23:43-48

Results:

RT stratified in 2-min increments and controlled for ISS group, age, endotracheal intubation, or type of trauma:

No differences in survival for any RT interval

Logistic regression relating survival to independent variables (RT, age, gender, ISS, trauma type, ETI):

No effect on survival based upon RT

**Eight Minutes or Less:
Does the Ambulance Response Time Guideline
Impact Trauma Patient Outcome?**

Pons PT, et al. J Emerg Med 2002;23:43-48

Conclusion:

- RT has no effect on survival in trauma
- Exceeding the 8 min RT criterion does not affect survival from traumatic injury

Response Time Effectiveness: Comparison of Response Time and Survival in an Urban Emergency Medical Services System

Blackwell TH, et al. Acad Emerg Med 2002;9:288-295

Purpose:

Determine the effect of RT specifications on survival to hospital discharge (90% fractile = 10:59 and 12:59)

Calculate the probability of mortality as a function of arbitrarily assigned RTs to determine if improved survival would result from reducing times

5424 patients (Priority-1 and 2 transports)

Response Time Effectiveness: Comparison of Response Time and Survival in an Urban Emergency Medical Services System

Blackwell TH, et al. Acad Emerg Med 2002;9:288-295

Results:

Mean RT

Survivors: 6.96 min

Non-survivors: 7.06 min

Difference: 0.10 min (6 sec)

Response Time Effectiveness: Comparison of Response Time and Survival in an Urban Emergency Medical Services System

Blackwell TH, et al. Acad Emerg Med 2002;9:288-295

Results:

Median RT

All patients: 6.5 min (0.2 min to 43.9 min)
90% of responses were within 10.6 min

Survivors: 6.4 min

Non-survivors: 6.8 min

Difference: 0.4 min (24 sec; $p=0.10$)

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71 non-survivors

Mortality prevalence of 1.31% (95% CI: 1.02%,1.65%)

Response Time Effectiveness: Comparison of Response Time and Survival in an Urban Emergency Medical Services System

Blackwell TH, et al. Acad Emerg Med 2002;9:288-295

Results:

Probability of mortality as a function of RT...

Plotted proportion of those who did not survive at each integer response time (0-12 min) with the number of non-survivors that would have been expected if observed death proportion (1.31%) was uniform across all times

No inequality between observed and expected death rates for all RTs ($p=0.14$)

Response Time Effectiveness: Comparison of Response Time and Survival in an Urban Emergency Medical Services System

Blackwell TH, et al. Acad Emerg Med 2002;9:288-295

Results:

But...

Number of actual deaths consistently fell below the expected number for RTs less than 5 min, but exceeded the number at response times ranging from 5 to 12 min

So...

Post hoc test for effect on survival of RT dichotomized at < 5 min and ≥ 5 min

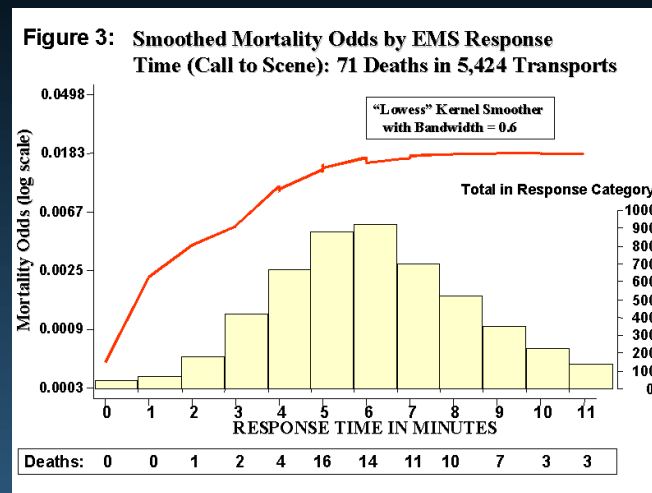
Response Time Effectiveness: Comparison of Response Time and Survival in an Urban Emergency Medical Services System

Blackwell TH, et al. Acad Emerg Med 2002;9:288-295

Results:

	Mortality Risk		
	< 5 min	≥ 5 min	
Total patients	1381	4043	
Deaths	7 (0.51%)	64 (1.58%)	(p=0.002)

Mortality risk curve was generally flat over RT intervals exceeding 5 min



Response Time Effectiveness: Comparison of Response Time and Survival in an Urban Emergency Medical Services System

Blackwell TH, et al. Acad Emerg Med 2002;9:288-295

Conclusion:

Mortality risk appeared sensitive to RTs < 5 min

There were no statistically significant differences for RTs between 5 and 10 min

There was evidence to suggest that very low RTs (< 5 min) are associated with a low risk of mortality and may theoretically save as many as 6-10 lives per year

Paramedic Response Time: Does it Affect Patient Survival

Pons PT, et al. Acad Emerg Med 2005;12:594-600

Purpose:

Evaluate the effect of paramedic RT on unselected patient survival to discharge, controlling for confounders:

Age, gender, ST, TT, 3 categories of illness severity

<u>Risk of Mortality</u>	<u>% Survival to Hospital Discharge</u>	
All (9559)	92%	
Low (6696)	99%	
Intermediate (2619)	83%	p=0.0001
High (244)	3%	

Paramedic Response Time: Does it Affect Patient Survival

Pons PT, et al. Acad Emerg Med 2005;12:594-600

Results:

**RT modeled as continuous variable controlling ST, TT,
age, gender, ISS:**

No effect on survival

RT categorized as ≤ 4 and > 4 min:

**Survival benefit identified ≤ 4 min
(Intermediate and high risk groups)**

RT categorized as ≤ 8 and > 8 min:

No survival benefit identified at 8 min cutoff

Paramedic Response Time: Does it Affect Patient Survival

Pons PT, et al. Acad Emerg Med 2005;12:594-600

Conclusion:

- **Survival benefit was identified for RT < 4 min (immediate or high risk of mortality)**
- **Paramedic RT > 4 min did not influence mortality, even after controlling for illness severity**

Lack of Association Between Prehospital Response Times and Patient Outcomes

Blackwell TH, et al. Prehosp Emerg Care 2009;13:444-450

Purpose:

Examine EMS RTs, clinical care provided, and patient outcome for high acuity 9-1-1 calls to determine if the current response time specifications and clinical care provision set for the community are appropriate

746 medical and trauma patients (priority transports)

RT > 10:59 (cases: n=373)

RT ≤ 10:59 (controls: n=373)

Lack of Association Between Prehospital Response Times and Patient Outcomes

Blackwell TH, et al. Prehosp Emerg Care 2009;13:444-450

Results:

Survival to hospital discharge:

Cases: 80% (95% CI: 76% to 84%)

Controls: 82% (95% CI: 77% to 85%)

Yield: 95% CI for 2% difference in proportions of -6% to +4%

ALS procedures performed:

Cases: 47% (95% CI: 43% to 53%)

Controls: 45% (95% CI: 40% to 51%)

Yielded: 95% CI for 2% difference in proportions of -10% to +5%

Lack of Association Between Prehospital Response Times and Patient Outcomes

Blackwell TH, et al. Prehosp Emerg Care 2009;13:444-450

Conclusion:

- **The 95% confidence interval analysis suggests:
Priority patients who wait longer than 10:59 min
could experience between a 6% increase to a 4%
decrease in mortality**

**No evidence of increased mortality nor increased
requirement for critical procedures for priority
patients where RT exceeded 10:59 min**

Emergency Medical Services Response Time and Mortality in an Urban Setting

Blanchard IE, et al. Prehosp Emerg Care 2012;16:142-151

Purpose:

To determine whether an ALS RT of ≥ 8 min (compared with < 8 min) was associated with increased mortality in an urban system

**Adults with potentially life-threatening conditions
(delta and echo MPDS calls)**

Emergency Medical Services Response Time and Mortality in an Urban Setting

Blanchard IE, et al. Prehosp Emerg Care 2012;16:142-151

Results:

7760 calls

1865 (24%) ≥ 8 min

5895 (76%) < 8 min

Risk of mortality: ≥ 8 min: 7.1%

< 8 min: 6.4%

Adjusted OR of mortality ≥ 8 min: 1.19% (CI: 0.97,1.47)

Emergency Medical Services Response Time and Mortality in an Urban Setting

Blanchard IE, et al. Prehosp Emerg Care 2012;16:142-151

Conclusion:

No statistically significant difference in all-cause mortality for patients receiving a response of ≥ 8 min versus < 8 min

Evidence Conclusion.....

Many studies (mostly non-trauma patients) include RTs as part of dataset, but most focus on scene time and total prehospital time - only few looked at actual RT, but...

It is the RT that has become a measure of effective ambulance service

Evidence Conclusion.....

Many studies (mostly non-trauma patients) include RTs as part of dataset, but most focus on scene time and total prehospital time - only few looked at actual RT, but...

It is the RT that has become a measure of effective ambulance service

RT standard developed based on one intervention and where data exists documenting the need for specific RT



Evidence Conclusion.....

4 studies demonstrated no improvement in outcome based on short RT

RT < 4 or 5 min may improve survival

Evidence Conclusion.....

4 studies demonstrated no improvement in outcome based on short RT

RT < 4 or 5 min may improve survival

Maybe we need RTs for interventions within a time frame rather than the delivery of the equipment !



Decreasing Response Time

Decreasing Response Time

Warning Lights and Sirens



Decreasing Response Time

Warning Lights and Sirens

1. Is ambulance transport time with lights and siren faster than without?
Hunt RC, et al. Ann Emerg Med 1995;25:507-511
2. The effectiveness of lights and siren use during ambulance transport by paramedics
O'Brien DJ, et al. Prehosp Emerg Care 1999;3:127-130
3. Time saved with use of emergency warning lights and sirens during response to requests for emergency medical aid in an urban environment
Ho J, Casey B. Ann Emerg Med 1998;32:585-588
4. Time saved with the use of emergency warning lights and siren while responding to requests for emergency medical aid in a rural environment
Ho J, Lindquist M. Prehosp Emerg Care 2001;5:159-162
5. Do warning lights and sirens reduce ambulance response times?
Brown LH, et al. Prehosp Emerg Care 2000;4:70-74

Decreasing Response Time

More resources



Decreasing Response Time

American Ambulance Association...
Significant financial cost associated with lowering response times.

Cost of 1 ambulance + labor 24 hrs / day / year:

\$500,000 - \$600,000



Decreasing Response Time

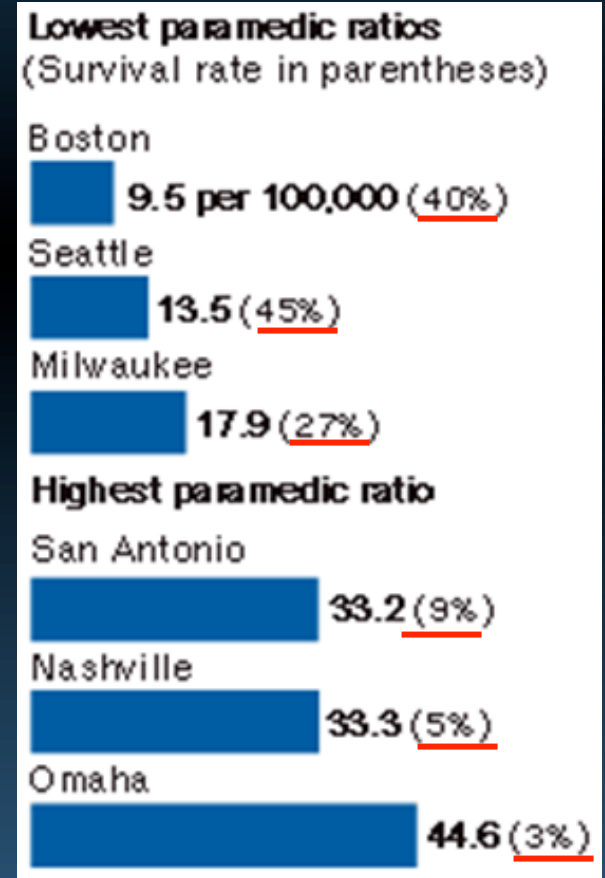


Six Minutes to Live or Die

Robert Davis

May, 2005

Survey of emergency medical services
in the nation's 50 largest cities



Decreasing Response Time

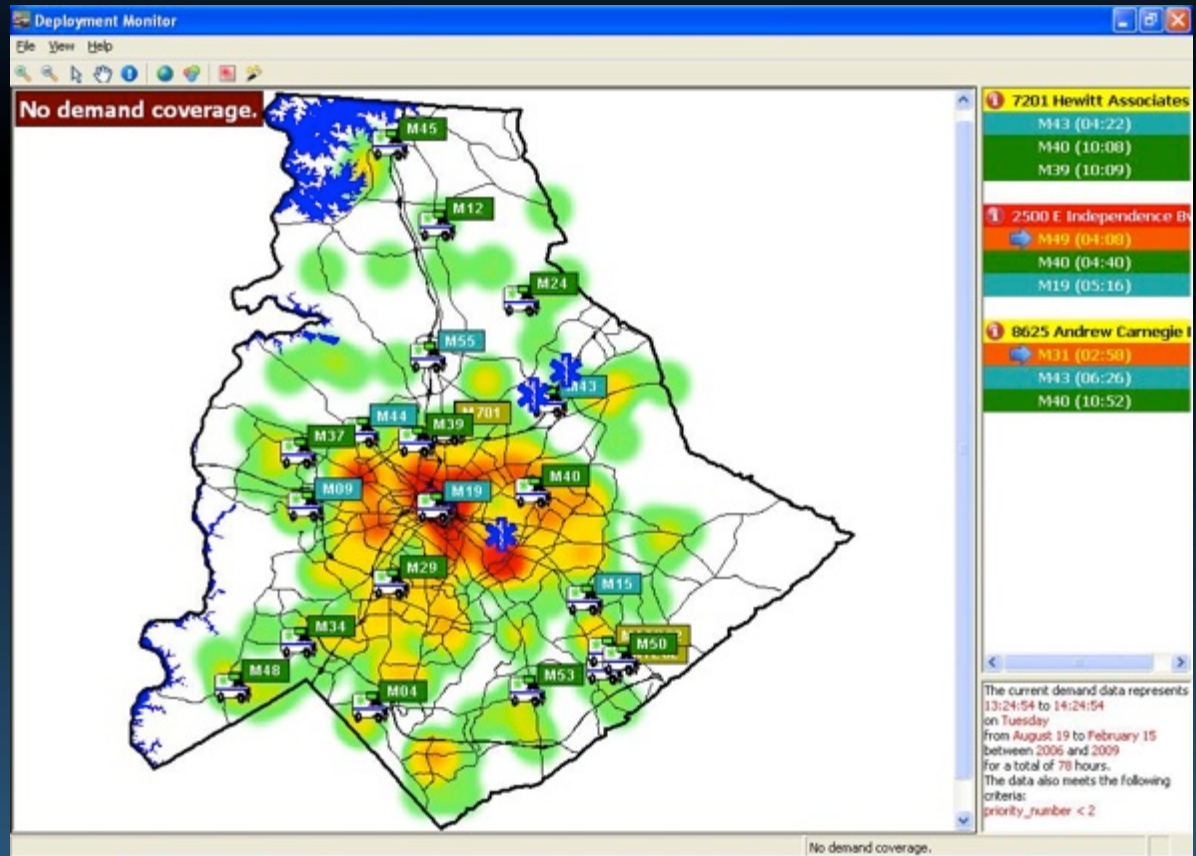
System Status Management High Performance System

Demand Analysis

1330-1430

Tuesdays

2006-2009



Increasing Response Time

Increasing Response Time

Luxury Defined
Entitlement to EMS



Increasing Response Time

Luxury Defined Entitlement to EMS



Increasing Response Time

Luxury Defined
Entitlement to EMS



Increasing Response Time

Jurisdiction Infrastructure
Impediment to response



Response Time Standards

Governance of Response Times

Federal or State laws: None

Many municipal, e.g. 3rd service, fire-based services have no response performance standards

Contractual agreements (EMS & political) stipulating response times: Some

Many non-municipal, e.g. public utility, hospital-based, private services have adopted some response standard

Response Time Standards

Governance of Response Times

National Fire Protection Association's (NFPA) 1710

- Standard for the organization and deployment of fire suppression operations, emergency medical operations, and special operations to the public by career fire departments
- Provides key EMS benchmarks for municipal and career fire departments

Response Time Standards

NFPA 1710 standard:

- Establishes

Turnout time:	1 minute
First responder arrival:	4 minutes
Objective met:	90%

- Fire-based ALS service

Arrival	8 minutes
Objective met:	90%
Personnel:	2 Paramedics 2 EMTs

Response Time Standards

NFPA 1710 standard:

- Establishes
 - Turnout time: 1 minute
 - First responder arrival: 4 minutes
 - Objective met: 90%
- Fire-based ALS service
 - Arrival 8 minutes
 - Objective met: 90%
 - Personnel: 2 Paramedics
2 EMTs

Response Time Standards

NAEMSP Position Paper

Considerations in Establishing Emergency Medical Services Response Time Goals

Bailey ED, et al. Prehosp Emerg Care 2003;7:397-399



Response Time - Dependent Clinical Conditions

Possible

1. Pulmonary

- a. COPD exacerbation**
- b. Asthma exacerbation**
- c. Toxic inhalation**

2. Cardiovascular

- a. Acute MI**
- b. Malignant dysrhythmias**
- c. Decompensated heart failure**

Response Time - Dependent Clinical Conditions

Possible

3. Neurological

- a. Thrombotic stroke**
- b. Status seizure**

4. Other

- a. Choking**
- b. Diabetic**
- c. Overdose**
- d. Childbirth**
- e. Significant Trauma ?**

Response Time - Dependent Clinical Conditions

No Question

- 1. VT / VF arrest (defibrillation)**
- 2. Severe anaphylactic reaction (epinephrine)**
- 3. Uncontrolled hemorrhagic shock (transport)**

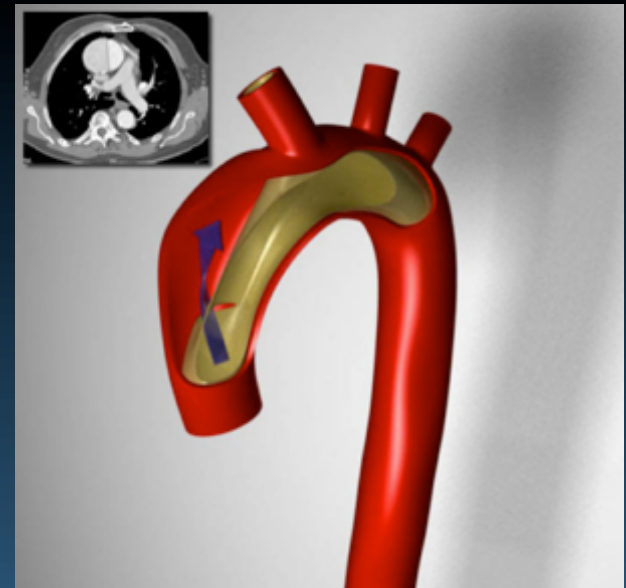
Response Time - Dependent Clinical Conditions

No Question

1. VT / VF arrest (defibrillation)
2. Severe anaphylactic reaction (epinephrine)
3. Uncontrolled hemorrhagic shock (transport)
4. Aortic disease (transport)

Dissection

Leaking aneurysm



What's all this stuff about
“Response Time?”



Does it make a difference?

**What's all this stuff about
“Response Time?”**



For most, it probably doesn't matter...