EMS System Models

Jerry Overton
Chair
Board of Accreditation
International Academies of Emergency Dispatch

Conflict of Interest Disclosure

NONE

A conflict of interest exists when an individual is in a position to profit directly or indirectly through application of authority, influence, or knowledge in relation to the affairs of ABC. A conflict of interest also exists if a relative benefits or when the organization is adversely affected in any way.

The Looming Question . . .
“Ideal” EMS System Model – The IOM

The “Ideal” EMS System is . . .???

A. Yours
B. What It Always Has Been
C. Don’t Know
D. Don’t Care

The EVIDENCE

“Evidence on the value of delivery models . . . is either nonexistent or inconclusive.”
From the **Past** . . .

Roots of EMS System Design

- Accidental death and disability – 1966

Roots of EMS System Design

- Accidental death and disability – 1966
- Emergency Medical Services System Act – 1973
Roots of EMS System Design

- Accidental death and disability – 1966
- Emergency Medical Services System Act – 1973
- “Chain of Survival” – 1991

Roots of EMS System Design

- Accidental death and disability – 1966
- Emergency Medical Services System Act – 1973
- “Chain of Survival” – 1991
- EMS Agenda for the Future - 1996

To the Present . . .
Types of System Models

- Fire Based
- Private
- Public
- PUM
- Volunteer
- Hospital Based

Fire Based

- First Response
- Transport
- Paramedic
- Subsidized
- User Fee

Third Service

- Fire First Response
- Government Department
- ALS
- Variable Financing
Private

- Fire First Response
- Private Provider
- Contract
- User Fee
- “Public-Private Partnership”

Public Utility Model

- Public Authority
- Performance Based Contract
- Sole Provider
- Variable Financing

Hospital Based

- Direct Provider
- Contract
- Supplemental
- Variable Financing Model
Volunteer
• Rural OR Urban
• Volunteer Staffing
• Often Paid ALS Provider
• Donations
• Subsidization
• Fee for Service

International System Models
Paramedic (West)
Vs.
Physician (East)

Anglo American
• Paramedic/EMT
Anglo – American
The Systems

• United States
• Canada
• England
• Australia
• Denmark
• Ireland

Franco German

• Physician

Franco - German

• Eastern Europe
Physician - Pro

• Increased Knowledge and Skills
• Autonomous
• Diagnosis
• Treat and Release

Physician - Con

• Need
• More Likely to “Stay and Play”
• Cost
• Number of Calls Few

The Question of Advanced Skills

How Many Attempts Are Required to Accomplish Endotracheal Intubation?

Mathematically Predictors of Failed Endotracheal Intubation

Number of Turkey (MD) Intubation Yes

Number of Turkey (MD) Intubation No

Number of Turkey (MD) Intubation Yes

Number of Turkey (MD) Intubation No

Number of Turkey (MD) Intubation Yes

Number of Turkey (MD) Intubation No

Number of Turkey (MD) Intubation Yes

Number of Turkey (MD) Intubation No

Number of Turkey (MD) Intubation Yes

Number of Turkey (MD) Intubation No

Number of Turkey (MD) Intubation Yes

Number of Turkey (MD) Intubation No

Number of Turkey (MD) Intubation Yes

Number of Turkey (MD) Intubation No

Number of Turkey (MD) Intubation Yes

Number of Turkey (MD) Intubation No

Number of Turkey (MD) Intubation Yes

Number of Turkey (MD) Intubation No

Number of Turkey (MD) Intubation Yes

Number of Turkey (MD) Intubation No

Number of Turkey (MD) Intubation Yes

Number of Turkey (MD) Intubation No

Number of Turkey (MD) Intubation Yes

Number of Turkey (MD) Intubation No

Number of Turkey (MD) Intubation Yes

Number of Turkey (MD) Intubation No

Number of Turkey (MD) Intubation Yes

Number of Turkey (MD) Intubation No

Number of Turkey (MD) Intubation Yes

Number of Turkey (MD) Intubation No

Number of Turkey (MD) Intubation Yes

Number of Turkey (MD) Intubation No

Number of Turkey (MD) Intubation Yes

Number of Turkey (MD) Intubation No

Number of Turkey (MD) Intubation Yes

Number of Turkey (MD) Intubation No

Number of Turkey (MD) Intubation Yes

Number of Turkey (MD) Intubation No

Number of Turkey (MD) Intubation Yes

Number of Turkey (MD) Intubation No

Number of Turkey (MD) Intubation Yes

Number of Turkey (MD) Intubation No

Number of Turkey (MD) Intubation Yes

Number of Turkey (MD) Intubation No

Number of Turkey (MD) Intubation Yes

Number of Turkey (MD) Intubation No

Number of Turkey (MD) Intubation Yes

Number of Turkey (MD) Intubation No

Number of Turkey (MD) Intubation Yes

Number of Turkey (MD) Intubation No

Number of Turkey (MD) Intubation Yes

Number of Turkey (MD) Intubation No

Number of Turkey (MD) Intubation Yes

Number of Turkey (MD) Intubation No

Number of Turkey (MD) Intubation Yes

Number of Turkey (MD) Intubation No

Number of Turkey (MD) Intubation Yes

Number of Turkey (MD) Intubation No

Number of Turkey (MD) Intubation Yes

Number of Turkey (MD) Intubation No

Number of Turkey (MD) Intubation Yes

Number of Turkey (MD) Intubation No

Number of Turkey (MD) Intubation Yes

Number of Turkey (MD) Intubation No

Number of Turkey (MD) Intubation Yes

Number of Turkey (MD) Intubation No

Number of Turkey (MD) Intubation Yes

Number of Turkey (MD) Intubation No

Number of Turkey (MD) Intubation Yes

Number of Turkey (MD) Intubation No

Number of Turkey (MD) Intubation Yes

Number of Turkey (MD) Intubation No

Number of Turkey (MD) Intubation Yes

Number of Turkey (MD) Intubation No

Number of Turkey (MD) Intubation Yes

Number of Turkey (MD) Intubation No

Number of Turkey (MD) Intubation Yes

Number of Turkey (MD) Intubation No

Number of Turkey (MD) Intubation Yes

Number of Turkey (MD) Intubation No

Number of Turkey (MD) Intubation Yes

Number of Turkey (MD) Intubation No

Number of Turkey (MD) Intubation Yes

Number of Turkey (MD) Intubation No

Number of Turkey (MD) Intubation Yes

Number of Turkey (MD) Intubation No

Number of Turkey (MD) Intubation Yes

Number of Turkey (MD) Intubation No

Number of Turkey (MD) Intubation Yes

Number of Turkey (MD) Intubation No

Number of Turkey (MD) Intubation Yes

Number of Turkey (MD) Intubation No

Number of Turkey (MD) Intubation Yes

Number of Turkey (MD) Intubation No

Number of Turkey (MD) Intubation Yes

Number of Turkey (MD) Intubation No

Number of Turkey (MD) Intubation Yes

Number of Turkey (MD) Intubation No

Number of Turkey (MD) Intubation Yes

Number of Turkey (MD) Intubation No

Number of Turkey (MD) Intubation Yes

Number of Turkey (MD) Intubation No

Number of Turkey (MD) Intubation Yes

Number of Turkey (MD) Intubation No

Number of Turkey (MD) Intubation Yes

Number of Turkey (MD) Intubation No

Number of Turkey (MD) Intubation Yes

Number of Turkey (MD) Intubation No

Number of Turkey (MD) Intubation Yes

Number of Turkey (MD) Intubation No

Number of Turkey (MD) Intubation Yes

Number of Turkey (MD) Intubation No

Number of Turkey (MD) Intubation Yes

Number of Turkey (MD) Intubation No

Number of Turkey (MD) Intubation Yes

Number of Turkey (MD) Intubation No

Number of Turkey (MD) Intubation Yes

Number of Turkey (MD) Intubation No

Number of Turkey (MD) Intubation Yes

Number of Turkey (MD) Intubation No

Number of Turkey (MD) Intubation Yes

Number of Turkey (MD) Intubation No

Number of Turkey (MD) Intubation Yes

Number of Turkey (MD) Intubation No

Number of Turkey (MD) Intubation Yes

Number of Turkey (MD) Intubation No

Number of Turkey (MD) Intubation Yes

Number of Turkey (MD) Intubation No

Number of Turkey (MD) Intubation Yes

Number of Turkey (MD) Intubation No

Number of Turkey (MD) Intubation Yes

Number of Turkey (MD) Intubation No

Number of Turkey (MD) Intubation Yes

Number of Turkey (MD) Intubation No

Number of Turkey (MD) Intubation Yes

Number of Turkey (MD) Intubation No

Number of Turkey (MD) Intubation Yes

Number of Turkey (MD) Intubation No

Number of Turkey (MD) Intubation Yes

Number of Turkey (MD) Intubation No

Number of Turkey (MD) Intubation Yes

Number of Turkey (MD) Intubation No

Number of Turkey (MD) Intubation Yes

Number of Turkey (MD) Intubation No
European Emergency Data (EED) Project
Clinical Benchmarking

Jerry Overton, Thomas Krafft, Luis Garcia-Castrillo Riesgo
On behalf of the Steering Committee of the EED project
Ludwig-Maximilians-Universität München, Arbeitsgruppe GEOMED, D

European Emergency Data (EED) Project
Results Chest pain Clinical Evaluation

<table>
<thead>
<tr>
<th></th>
<th>MEES1</th>
<th>Δ MEES</th>
<th>% Better</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coventry</td>
<td>23,6</td>
<td>1,20**</td>
<td>56,5</td>
</tr>
<tr>
<td>Richmond</td>
<td>23,7</td>
<td>0.93</td>
<td>57,9</td>
</tr>
<tr>
<td>Bonn</td>
<td>24,1</td>
<td>1,86**</td>
<td>78,8</td>
</tr>
<tr>
<td>Cantabria</td>
<td>24,4</td>
<td>1,13</td>
<td>55,8</td>
</tr>
<tr>
<td>Mean</td>
<td>23,89</td>
<td>1,36</td>
<td>66.7%</td>
</tr>
</tbody>
</table>

** statistical significance P<0.05

European Emergency Data (EED) Project
Results Dyspnea Clinical Evaluation

<table>
<thead>
<tr>
<th></th>
<th>MEES1</th>
<th>Δ MEES</th>
<th>% Better</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coventry</td>
<td>22,2</td>
<td>1,25</td>
<td>60,0</td>
</tr>
<tr>
<td>Richmond</td>
<td>22,6</td>
<td>1,16</td>
<td>62,7</td>
</tr>
<tr>
<td>Bonn</td>
<td>23,1</td>
<td>1,79**</td>
<td>75,0</td>
</tr>
<tr>
<td>Cantabria</td>
<td>22,6</td>
<td>1,44</td>
<td>68,1</td>
</tr>
<tr>
<td>Mean</td>
<td>22,7</td>
<td>1,4</td>
<td>68,1</td>
</tr>
</tbody>
</table>

** statistical significance P<0.05
A Recent Paper...

The Evidence

There is considerable variation across Europe in the structure and process of EMS systems. Some countries have adopted almost exclusively paramedic-emergency medical technician (EMT)-based systems while other incorporate prehospital physicians to a greater or lesser extent. Studies indirectly comparing resuscitation outcomes between physician-staffed and other systems are difficult to interpret because of the extremely high variability between systems, independent of physician-staffing. Given the inconsistent evidence, the inclusion or exclusion of physicians among prehospital personnel responding to cardiac arrests will depend largely on existing local policy.

Asian

- Fire
- Japan
- Singapore
Asian

- Hospital Based
- China
- Malaysia
- Vietnam
- Brunei

U. S. . . . As Seen from Abroad

The U. S. . . .
U. S. . . . As Seen from Abroad

But . . .

U. S. . . . As Seen from Abroad

• “Economically Driven” – South Africa
• “Complacent” – Germany
• “Without Strategic Direction” – England
• “Fragmented” – France
Understanding the EMS System Model
The Components

Two Premises

Premise 1
Two Commonalities to Every EMS Systems Model

Every EMS system model, regardless of its design, receives requests to render individualized services to patients, dependent upon the presenting problem or presumptive diagnosis.

The Second Commonality to Every EMS System Model

Every EMS system, regardless of its design, is required to transform revenues into services for its patient's individual needs.

Premise 2
EMS is a Practice of Medicine

EMS - 2015

The Medical Director unwilling or unable to understand the realities of system design, and its dynamics, cannot be taken seriously by policymakers who must deal with these concerns.

Defining the EMS System Model

The EMS system consists of those organizations, individuals, and resources from whom some action is required to ensure timely and medically-appropriate response.
System Design Model Determines

- Geographic scope of the system's primary service area;
- How functional responsibilities are divided among participating organizations;
- Production strategies employed;

System Design Model Determines

- How (and if) performance standards are established, monitored, and enforced;
- The sources, amounts, and routes of dollar flow into and within the system; and
- The system's potential for economic efficiency.

Economic Efficiency

The ability to produce more service of higher quality from available dollars.
The Importance of the EMS System Design Model

Of all the forces influencing an EMS system's ability to convert available dollars into clinical performance and response time reliability, system design is by far the most powerful.

Key Elements

“Performance Based”

Key Elements of Performance

- Clinical Sophistication
- Response Time Reliability
- Economic Efficiency
- Continuously Measured
- Results Achieved Simultaneously
Key Elements of Performance

• Clinical Sophistication

Clinical Sophistication

• Dispatch

Dispatch

• Initial Point of Accountability
• Source and Pathway
  • Response Times
  • Enroute Times
  • Presumptive Patient Condition
Dispatch
DLS Care Provider
• The FIRST First Responder
• Zero Minute Response Time

Performance Objectives
• Control the Caller
• Control the EMS Response
• Control the Data and System Information
• Resource Redeployment

Clinical Sophistication
• Dispatch
• EMS Response and Transport
EMS Response and Transport

- Transport
  - Life-threatening calls (presumptively classified)
  - “Routine” transport calls (presumptively classified)
  - Interfacility transfers
  - Critical Care Transfers
  - Helicopter transport

Clinical Sophistication

- Dispatch
- EMS Response and Transport
  - Medical Oversight

Medical Oversight

- On-line medical control
- Receiving facility interface
  - Diversions
  - Patient exchange procedures
  - Participation in quality assurance
  - Medical Oversight
Medical Oversight

• Recommends Standard of Care
• Establishes and Updates Protocols
• Oversees and Controls Care
• System Authority
• Autonomous

Clinical Sophistication

• Dispatch
• EMS Response and Transport
• Medical Oversight
• First Response
First Response

- First Response
- Extrication
- Hazmat
- At Scene medical care and assistance enroute

Clinical Sophistication

- Dispatch
- EMS Response and Transport
- Medical Oversight
- First Response
- Citizen Involvement

Citizen Involvement

- Prevention Programs (e.g., seat belt awareness, drowning prevention, early recognition).
Citizen Involvement

- Bystander Action/System Access
  - Citizen CPR and First Aid
  - Telephone access

Performance Objectives

**Clinical Accountability**
- Data Driven
- Dispatch is the Control Center
- Early Resuscitation
- Appropriate Intervention
- Stabilization or Rapid Transport
- Continual Medical Oversight

Key Elements of Performance

- Clinical Sophistication
- *Response Time Reliability*
Response Time

Clinically Significant
- Out of Hospital Cardiac Arrest

Factors Influencing Survival After Out-of-Hospital Cardiac Arrest

Weaver et al. JACC 1986; 7:752-757
Response Time

Clinically Significant

- Acute MI
- Trauma

Journal of Prehospital and Disaster Medicine 1994; 9:160-164

The Issue of Response Times!!!

The Issue of Response Times
Response Time Reliability

- Average Methodology
- Fractile Methodology

Response Time Reliability

Average vs. Fractile - Effective pursuit of the lowest possible average response time produces a different plan of deployment than does the effective pursuit of a desirable fractile response time.

Response Time Reliability

Fractile Method - All applicable response times are “stacked” in ascending order, then the total number of calls within a predetermined minute are calculated as a percentage of the total number of calls. 90th percentile is commonly used.
Response Time

- Reliability

1/8/2015

Response Time Establishment

- Localized
- Economically Reasonable
- Stakeholder Involvement
  - Patients
  - Physicians
  - Governmental Officials
Performance Objectives

Response Time Reliability
- Data Driven
- Fractile Compliance
- Measured for all priorities
- Equality of service in entire service area.
- Independently monitored and validated.

Key Elements of Performance

- Clinical Sophistication
- Response Time Reliability
- Economic Efficiency

The Past Twenty Years
The Focus

“Quality” Patient Care
“Quick” Response Time
Patient and Citizens
“Expectations” Met
To the **Future**

The Emergencies - 2015

• Cardiac Arrest – 1% to 2%
• Other Emergencies – 12% to 20%

**But**

*Life Threatening* . . . ???
“EMS” to “Out of Hospital Care” – The Shift

- Emergencies – 15% to 25%
- Out of Hospital Care – 75% to 85%
- Increasing as percentage to total responses

The Results

The Results
“Taking Healthcare to the Patient”

However, only 10% of patients ringing 999 have a lifethreatening emergency. Many patients have an urgent primary (or social) care need. This includes large numbers of older people who have fallen in their homes (around 10% of incidents attended), some with no injury; patients with social care needs and mental health problems.

THE Why . . .

Growing Demand

- 45 (???) Million Uninsured
- Limited Access
- Lack of Primary Care
The Aging Population

Aged 65 years or older
• 38% of EMS Responses
• Four times Average Utilization
• Highest Clinical Need
• Fastest Growing Subset-15% in 2020

Growing Demand

• The Homeless
  • More time in ED (7.5 to 4.4 hrs.)
  • Less likely to be admitted (19% vs. 8%)
  • More likely to use EMS (51% vs. 29%)

Growing Demand - Obesity
National Health Status

• 15% of age 6 to 19 obese
• 10% of Preschool Overweight
• 66% of Adults Overweight
• Rates doubled 1976 to 1994

Growing Demand – Obesity

• “Epidemic”
• Approximately 300,000 premature deaths annually
• Lack of Community Based Programs

Why Obesity???

• Illnesses can be more prevalent
  • 61% of Type 2 diabetes direct cause
  • 25% of hypertension
  • 30% Gall Bladder Disease
  • 25-40% of Asthma
  • 95% of Sleep Apnea
**Disease burden (DALYs lost) for the 10 leading causes**

**1999 Disease or Injury**
1. Lower respiratory infections
2. HIV/AIDS
3. Pernatal conditions
4. Diarrhoeal conditions
5. Unipolar major depression
6. Ischaemic Heart Disease
7. Cerebrovascular Disease
8. Malaria
9. Road Traffic injuries
10. COPD

**2020 (Baseline Scenario) Disease or Injury**
1. Ischaemic Heart Disease
2. Unipolar major depression
3. Road Traffic Injuries
4. Cerebrovascular Diseases
5. COPD
6. Lower respiratory tract infections
7. Tuberculosis
8. War
9. Diarrhoeal Disease
10. HIV

**THE Impact**

**Challenges and the Impacts**

- Resource Depletion
- Response Times
- ROSC
Pressures and the Impacts

EMS – Philadelphia, PA USA

Pressures and the Impacts

Hospital A & E Departments

• Hospital Diversions
• EMS Wait Times
• Patient Wait Times

Reality - The Challenge Ahead
EMS, Care, and Growing Demand

The Challenges
• Increasing Unscheduled Care
• Lack of Primary Care Centers
• Lack of Access
• Lack of Preventive Health Care
• Increasing Social Needs

EMS - The Gatekeeper of Emergency Care

- EMS are only part of the care system.
- The management of social care, with emergency, urgent and routine care, is a major challenge.
- Integrated responses using a common prioritisation system must be sensitive and specific.
- Delivering care as near as possible to home is a key objective, to demand-manage emergency admissions.

“Ideal” EMS System Model – The IOM
The Concept of Integration

**WHERE WE WANT TO BE**

For its patients and the community as a whole, EMS provides care and service that is integrated with other health care providers and community health resources. Thus, EMS patients are assured that their care is considered part of a complete health care program, connected to sources for continuous and/or follow-up care, and linked to other potentially beneficial health resources.

Integration with Health Care

- Continuum of Care
- Health Care System
- Provision of Clinical Care
- Integrating with the Community

THE TROUBLED STATE OF EMS

EMS suffers from the intersection of health care, public health, and public safety and therefore has overlapping roles and responsibilities (Figure 5-1). Often, local EMS systems are not well integrated with any of these groups and therefore they receive inadequate support from each of them. As a result, EMS has a role in many places but no clear home.
The EMS System Model is Out of Hospital Care Model

Achieving the Vision

• Congress: Establish a lead agency in DHHS for emergency and trauma care.

The Challenge . . .
“If you’ve seen one EMS System, you’ve seen one EMS system.”

EMS System Models . . . . and What it Means

The Result

- **No** Equality of Access
- **No** Equality of Care
- **No** Standardized Care Protocols
- **No** Reciprocity of Trained Providers
- **No** Emphasis on PATIENT Outcomes
The Result

• **NO** National Lead Agency
• **NO** National Research Agenda
• **NO** National Advocacy
• **NO** National Funding

“So you want to be a rock’n’roll star
Then listen now to what I say
Just get an electric guitar
And take some time and learn how to
play
And when your hair’s combed right
and your pants fit tight
It’s gonna be all right”

*The Mandate.*
The rapidly shifting balance between acute and chronic health problems is placing new and different demands on the health care workforce.

The skills of health professionals must be expanded to meet these new complexities.

The “EMS” System Model

The Synopsis

The Past
- Call Center
- Response Times
- Resuscitation Strategies

The Future
- Call Center
- Care Delivery
- Care Integration
- Systemic Change

“Plain question and plain answer make the shortest road out of most perplexities”

Mark Twain
Questions . . .

Jerry.overton@emergencydispatch.org