



# Module Two: EMS Systems

Wisconsin EMS Medical Director's Course

# Objectives

- List the components of EMS systems
- Outline organizational and design options for EMS systems
- Outline system staffing and response configurations
- Identify the major communications and dispatch issues in EMS systems
- Describe regionalization of care and destination issues

# Objectives (Cont.)

- Contrast and compare the differences between rural and urban EMS systems
- Outline the ways in which EMS systems may be integrated with community health care and public safety resources
- Describe the interface of EMS systems with managed care organizations
- Describe the issues related to the utilization of air medical services and EMS systems
- Outline funding options available for EMS systems



# EMS System Components

# EMS Systems Overview

The EMS System is not simply one person, one ambulance, one agency, one organization or one hospital. Multiple components must be present and must interact well for the system to function effectively.



# Critical Components

- Regulation & Policy
  - State and Local Agency oversight through creation of laws and statutes regarding prehospital care
- Resource Management
  - Appropriate utilization of equipment and services that result in the most efficient delivery of care
- Human Resources & Training
  - Supply and competency of personnel and quality education are fundamental to success

# Critical Components (Cont.)

- Transportation
  - Array of transportation means must be identified and pre-determined for any given condition
- Facilities
  - Resources of each hospital and clinic must be assessed to determine the most appropriate destination for each patient
- Communications
  - Entire spectrum of communication options must be explored to ensure reliable communications

# Critical Components (Cont.)

- Public Information & Education
  - Public must be informed of the systems capabilities and how to access appropriately
- Medical Direction
  - Pre-hospital care must be approved and overseen by a qualified physician
- Trauma Systems
  - EMS system must be integrated into a broader system of trauma care to ensure the best possible outcome for the seriously injured



# Critical Components (Cont.)

- Evaluation
  - Periodic review of the systems performance must be undertaken to ascertain both excellence and areas needing improvement
- Finance
  - Every component of the system has a cost associated with it and must be balanced by potential revenues and/or subsidies
- Audit & Quality Assurance
  - More commonly referred to as Quality Improvement
  - Primary force for change in any system

# Critical Components (Cont.)

- Mutual Aid
  - Ability to call on other systems to assist in times of need must be pre-arranged and agreed upon
- Disaster Planning
  - Possibility of demand exceeding resources must be contended with
  - Creative management must be undertaken to prepare for the worst case scenario

# Organizational Design Options

- Depends on location and resources available
- Often multiple agencies providing services
- May be multiple designs in one system
- Medical director should understand and be involved in the evaluation of EMS system design options

# Design Options

- System is described in terms of the type of organization providing the emergency care and transport for the area
- Often multiple organizations are involved in the EMS response
- Be familiar with the types in your system and the role that each organization plays



# Delivery of EMS

- Private, for-profit companies
- Community-based, not-for-profit organization
- Municipally based service
- Fire Department





# Delivery of EMS (Cont.)

- “Third service department”
  - Separate, government based EMS organizations form a cooperative arrangement to share services
- Law Enforcement may provide medical first aid
- Volunteer organizations
- Hospital based service



# EMS System Staffing and Response Configurations

# EMS System Staffing Goal

- Goal is to have medically trained personnel available to the patient as quickly as possible
- Based on increased recognition of the importance of providing a rapid response to potentially life-threatening emergencies, including early defibrillation

# Who might be an Emergency Medical Responder?

- Individuals that can get to the patient within a few minutes and provide early stabilizing care
- Staff trained in the use of automated external defibrillator (AED)
- Often based in local fire department and involve a response with fire apparatus
- Law enforcement staff with appropriate training
- May be volunteers prepared to leave work if needed to respond to a call

# Transporting Services

- Ambulances for further care and transport of the patient
- Level of care:
  - EMT-Basic
  - Intermediate Technician
  - Intermediate
  - Paramedic



# EMS Deployment Strategies

- Single tier
  - one agency provides response and transport at one level of care
- Multiple tiered response
  - Multiple agencies and/or various levels of care available for response and transport

# Multiple Tiered Response Examples

- BLS First Response – ALS Transport
- ALS First Response – ALS Transport
- Police or Fire service first Response (BLS or ALS – Private ambulance transport (BLS or ALS)
- ALS intercept vehicle to support BLS transport service

# Vehicle Deployment Methods

- Fixed deployment
  - Vehicles housed in a fixed location within the agency's response area and respond from that location (typical of fire service based EMS)
- Variable "System Status Management" deployment
  - Vehicles will be placed in different locations throughout response area

# System Status Management Deployment

- Locations are identified based on careful review of the response call volumes over time in an attempt to “predict” statistically where the next call will occur
- A given vehicle may move from location to location depending on call volume and time of day



# Response Times

- Response time standards: Standard of guidelines established by the EMS system for acceptable times in which to respond to medical care requests
- Controversy over what is acceptable response time
- No universally accepted national standard



# Historic Response Standards

- Urban setting
  - o 4 minutes or less for first response
  - o 8 minutes or less for ALS responders for prospectively identified life-threatening situations
  - o 12-15 minutes for non-life-threatening calls
- Numbers based on cardiac arrest studies
- Response time longer in suburban and rural areas

# Response Time Factors

- Personnel and resources available
- Geography
- Weather
- Traffic
- Access issues
  - o High rise building
  - o Population density
  - o Special events and mass gatherings

# Fractile Response Time

- Percentage of time that the response times meet the guidelines
- Most view fractile response time within 90% as acceptable
  - For example, first responders arrive within 4 minutes of call 90% of the time
- Considered a more realistic reflection of the system's overall performance than average or "median" response times

# Response Intervals

1. Event occurrence to event recognition interval
2. Access Interval:
  - Time from event recognition to access of EMS (9-1-1)
3. Dispatch Interval:
  - Time from access to dispatch of resources
4. Activation Interval:
  - Time from dispatch to resources en route
5. Response Interval:
  - Time from en route to arrival at scene



# Response Intervals (Cont.)

## 6. Patient access Interval

- Time from arrival at scene to arrival at patient

## 7. On-Scene interval

- Time at scene to time of departure to hospital

## 8. Transport Interval

- Time depart scene to arrival at hospital

# Response Intervals (Cont.)

## System Response Time

### Event

Recognition Interval

Access Interval

Dispatch Interval

Out of Chute Interval

Response Interval

Patient Access Interval

On-scene Interval

Transport Interval

### Arrival at Hospital



# Communications and Dispatch

# 9-1-1 Access

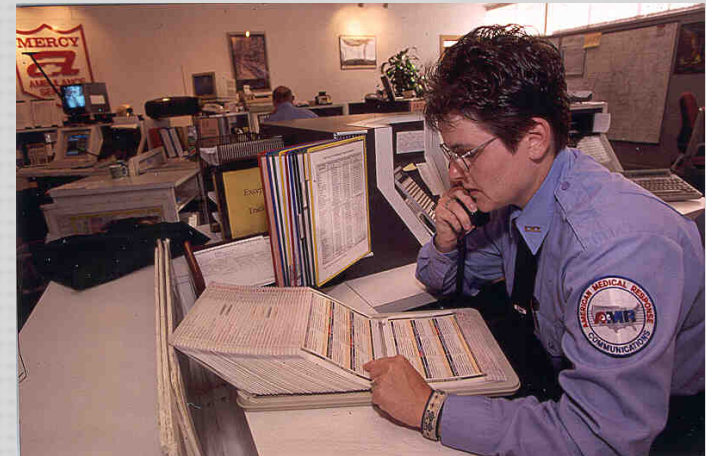
- Community access is critical
- Public must know how/when to access EMS
- Must allow for common access to police, fire, and EMS
- 9-1-1 covers 50% of area and 85% of population in the US
  - 100% of area and 100% of Wisconsin population





# 9-1-1 Types

- Basic 9-1-1
  - Caller is connected to a call-taker at a PSAP (Public Safety Answering Point)
  - Call-taker then must determine location and nature of the emergency
- Enhanced 9-1-1
  - Call-taker's computer console displays the phone number (Automatic Number Identification – ANI) and location (Automatic Location Identification – ALI) of the phone from which the call is being made



# 9-1-1 Options

- Wireless 9-1-1 access
  - o 9-1-1 access is increasingly available via cell phone
  - o Technology developing to add ANI/ALI capability to wireless 9-1-1

# 9-1-1 Options (Cont.)

- Intelligent transportation systems
  - o Systems are being investigated that provide automated crash notification information to local PSAPs
- N-1-1 systems
  - o Some local programs are providing alternative phone numbers for access to non-emergency services

# 9-1-1 Oversight

- 911 call is typically received in a law enforcement or fire dispatch center that may be responsible for dispatching EMS or may transfer the call to a dedicated EMS dispatcher
- Legislative or legal authority for EMS dispatch is limited
- Wisconsin statute regarding EMS dispatcher training or certification does not exist





# EMD

- EMD (Emergency Medical Dispatch)
- Dispatcher is first EMS provider contact
- They are trained to:
  - Use communications techniques to appropriately interview the caller
  - Determine the nature of the emergency
  - Dispatch the necessary resources
  - Provide instructions to the caller for the care of the victim until EMS arrives

# EMD Goal

- Priority Dispatching
  - o Goal is to provide the medically necessary response in an appropriate manner
  - o Decisions are based on EMD protocols that have been reviewed and approved by the medical director

# EMD Pre-Arrival Instructions

- Protocols established and approved by the medical director with regular and routine re-evaluation
- Allows the dispatcher to provide instructions to the caller to begin care for the patient until EMS arrives (e.g. control of bleeding, child birth, choking, CPR)



# Components of EMS Communication Systems



# EMS Communications Functions

- Operational – contact with vehicles
  - o Dispatch center to vehicle
  - o Vehicle to vehicle
  - o Dispatch center to other agencies
- Medical – allows interaction between field personnel and medical oversight resource
  - o On-line medical care

# EMS Radio Systems

- Simplex
  - Allows for only one-way communication at any given time
- Duplex
  - Uses complementary “paired” radio frequencies between the two radios communicating: one unit transmits on one frequency and receives on the other frequency
  - Allows for communication in both directions at the same time similar to a telephone

# Telemetry

- Allows for the transmission of patient information (e.g. pulse and ECG tracing)
- Allows medical control to provide EMS with medical direction based on information
- Employed more often today in the transmission of 12-Lead ECGs

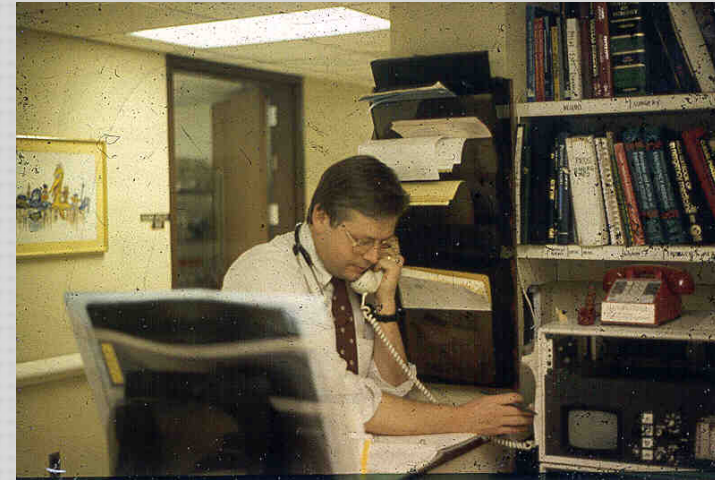
# Telephone

- Land-line (regular telephone) for field to hospital communications
  - Facilitate communication of confidential information
- Wireless
  - Cellular transmission of 12-lead ECGs
  - Not a secure line and not reliable in disaster situations



# Telemedicine

- Transmits data, voice and video images from the scene or ambulance to the hospital
- Allows more direct contact between EMS personnel and physicians providing medical direction
- Not widely used but technology evolving rapidly



# Communication Oversight

- EMS system medical director must ensure that EMS personnel in the field have access to on-line medical direction at all times
- System must provide for the education, QI oversight, and routine review of on-line personnel and activities

# Central Communications Center

- All on-line medical direction is provided by a designated center, regardless of the hospital to which the patient is being transported
- Patient information is then relayed to the receiving hospital
  - o Allows for standardized medical direction by a small group of physicians, nurses or in some cases paramedics
  - o Facilitates regionalization of medical direction

# Direct Hospital Contact

- Field personnel talk directly with the hospital to which the patient is being transported
  - o Provides the receiving hospital directly with information about their patients
  - o Necessitates that a larger number of people provide the on-line medical direction which may be difficult to standardize





# Regionalization of Care

# EMS Role in Regionalization

- All facilities that care for EMS patients are important components of the EMS system
- Many facilities are community hospitals with resources to care for many of the illnesses and injuries that patients experience

# Specialized Care

- Receiving facility may provide special resources
  - Potentially impacts how EMS personnel treat patients and locations to which the patients are transported
- System must have in place a process for accessing the appropriate resources for the needs of the patient

# Specialized Care (Cont.)

- Appropriate monitoring of transferred patients
- Impact of EMS resources on the primary service area
- Financial impact on local and regional hospitals
- Applicable federal and state regulations
- Bypass/diversion issues



# Specialty Considerations

- EMS medical director should look to specialists in the area as resources and consultants
- Contracts and/or transfer agreements with all specialty centers should be established
- Mechanism by which patients are transferred should be established consistent with local, state, and/or federal regulations

# Pediatrics

- Children respond differently than adults to acute illnesses and injury and require special knowledge and resources to care for them
- Medical directors should ensure that personnel receive the necessary education and vehicle stock is appropriate for the care of the pediatric patient
- Medical director should establish relationships with local pediatric specialists

# Trauma

- Many states have recognized the need to develop organized trauma systems in the region or state
- Establish criteria and protocols which address triage (bypass) decisions to identify patients who should be taken directly to a trauma center
- If not available, the patient should be stabilized at the nearest appropriate facility and expeditiously transferred to a trauma center

# Cardiac Care

- Focus has been on the early identification/treatment of patients experiencing an acute coronary syndrome
- Potential patient benefit of prehospital modalities and interventions should be investigated and implemented when appropriate based on available local prehospital and hospital resources
- Referral centers for emergent interventional therapy like thrombolysis, angioplasty, and by-pass surgery should be identified



# Cardiac Care (Cont.)

- Rapid identification and treatment of cardiac arrest patients should include evaluation of:
  - o Public Access Defibrillation (PAD) – making AED units available in as many locations as feasible or prudent
  - o PAD programs should be integrated with the EMS system through appropriate education, medical oversight and quality improvement activities

# Other Specialty Centers

- Stroke care
- Hazardous materials exposure
- Burn units
- Hyperbaric oxygen chambers
- Special neonatal and obstetrics
- Psychiatric units
- Re-implantation centers
- Rehabilitation centers



# Challenges in EMS System Design

# Community Health Care

- It is likely that EMS will begin to serve a broader based community health role in some areas with EMS personnel being available to participate in:
  - o Community health care education & health screening programs
  - o Social Services & Public Health medical care



# Managed Care Organizations

- There are many points of interaction between EMS agencies and managed care organizations (MCO)
- Managed cared groups and transporting agencies interact to provide medical transport for the subscribers, creating a potential revenue source for the transporting agency
- MCOs may require subscribers to contact the MCO for permission to call an ambulance,
  - o may conflict with the usual 9-1-1 access

## Managed Care (Cont.)

- MCOs may suggest treatment or transport options that also vary from routine EMS protocols
- EMS medical director must work closely with the EMS services and managed care organizations to ensure an appropriate interface

# Other EMS Agencies

- Air Medical Programs
  - May offer additional patient care resources (physicians, specially trained nurses or paramedics to provide patient care)
  - Triage criteria to identify those patients for whom air medical transport is warranted
  - Process by which these resources are activated
- Mutual Aid
  - Vital to have agreed upon relationship with surrounding EMS agencies to provide additional support when needed

# Advanced Life Support Intercepts

- Must have agreements in place to facilitate getting patient to ALS care as quickly as possible when appropriate
- Process by which intercepts are activated
- Agreed upon relationship with agency regarding billing, liability, and crew responsibilities must be in place





# Funding EMS Systems

# Billing

- Historically, reimbursement to EMS agencies is dependent on physically transporting a patient from the scene to the hospital
- Growing interest in paying agencies for care provided on-scene without transport or for transport to facilities other than the emergency department

# Subsidies

- Municipal EMS agencies are often partially funded by public agency monies, frequently taxes
- Many community based and volunteer organizations still receive funding from donations and contributions

# Medical Oversight

- Funding for medical oversight is an important issue that must be addressed if the medical oversight program is to be effective and accountable
- Medical director should receive appropriate support and reimbursement
- Medicare has a billing code for on-line medical direction but it is unclear how well it is accepted



# Medical Oversight - Sources

- Hospitals or physician practice groups provide financial and administrative support
- Some hospitals may also provide staff support for the administrative activities of medical oversight
- Many EMS systems have medical control authority contracts with physician and pay them through an independent or employee relationship with the agency or system