A DECISION MATRIX FOR IMPLEMENTING AN EMS EXPANDED SCOPE OF PRACTICE PROCESS

Advanced Leadership Issues in Emergency Medical Services

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Abstract

Fire departments involved with emergency medical service (EMS) delivery are being challenged to diversify this role through the addition of expanded scope of practice processes.

The purpose of this research was to determine if the Sierra Vista fire department (SVFD) should expand their current EMS service delivery process or focus instead on improving clinical outcomes for our customers.

This study employed a historical, evaluative, and action research methodology to answer the following questions:

1. What clinical outcome(s) does the EMS research literature identify as an indication that an EMS system is functioning effectively?
2. How effective is the SVFD's EMS process in achieving the clinical outcome(s) identified in question one?
3. Does the literature offer any theories or models the Sierra Vista fire department can use as a framework for deciding whether is should expand current levels of EMS service?

The procedures used for this study included an extensive review of the EMS research literature as well as informal interviews with stakeholders intimate with the SVFD's EMS system.

The results of this study revealed that two factors – a rapid advanced life support (ALS) response of eight minutes or less and out of hospital cardiac arrest survival – are the clinical indicators of a well-functioning EMS delivery system. Since the SVFD does not measure either factor, the effectiveness of the local EMS system is unknown.

Therefore, a decision matrix was created to guide the SVFD into an expanded scope role without compromising current service levels.

It was recommended the SVFD: 1) immediately begin measurement of clinical indicators to establish system effectiveness; 2) begin an expanded scope process using off-duty personnel; 3) prospectively evaluate the process on a regular basis.

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Introduction

The Sierra Vista Fire Department (SVFD) has identified expanding their emergency medical service (EMS) service delivery into non-emergent expanded scope of practice processes as an organizational objective for 1998. Expanded scope of practice services might include influenza immunizations, blood cholesterol screenings, and intravenous (IV) restarts in the home.

However, our department is cognizant that the addition of expanded scope of practice procedures would not occur in a vacuum; some impact on the quality of our current EMS service delivery will occur.

The purpose of this research paper is to determine if the SVFD should expand their current EMS service or focus instead on current EMS delivery processes with a goal of improving current clinical outcomes for its customers.

This study employed a historical, evaluative, and action research methodology designed to answer the following questions:

1. What clinical outcome(s) does the EMS research literature identify as an indication an EMS system is functioning effectively?
2. How effective is SVFD's EMS process in achieving the clinical outcome(s) identified in question one?
3. Does the literature offer any theories or models based on patient outcome data the SVFD can use as a framework for deciding whether it should expand its current levels of EMS service?

Background and Significance

The SVFD has been involved in EMS delivery since the late 1970's, when the local funeral parlor opted out of the ambulance business.

Starting as a basic life support transport service, an advanced life support (ALS) component was added in 1986. Currently, the SVFD is the sole provider of EMS delivery within our community of 38,000, including all inter-facility transports. Cost recovery has been practiced since the department began EMS transports, with last year's revenues contributing approximately $500,000 to the community's general fund. The fact that EMS calls constituted the bulk of all calls for service in 1997 (2,586/3012 or 86%) is not unusual in a fire-based EMS system. Cross-trained/dual role personnel are mandated by department policy, with all personnel trained to at least an emergency medical technician-basic (EMT-B) level. It is optional for personnel to upgrade their level of certification to emergency medical technician - paramedic (EMT-P).

The SVFD receives medical direction from Sierra Vista Community Hospital. The function of this medical direction is to provide the SVFD with retrospective, concurrent, and prospective medical control. The SVFD has an EMS coordinator accountable for overall EMS service delivery.

As my elective course for the Executive Fire Officer program (EFOP), I opted to attend Advanced Leadership Issues in EMS (ALIEMS). During the course, San Diego deputy chief G.A. Cannon presented his community's EMS System design, which discussed external changes occurring throughout the country relative to fire-based EMS delivery (Cannon, 1996).

One key issue presented was the expanded scope of practice role of the paramedic (ALIEMS student manual; pg.11-4). Deputy chief Cannon explained that the goal of the expanded scope of practice process was preventing – rather than reacting to – medical emergencies. He further stated that the large private sector ambulance industry was already experimenting with this concept.

This concept of fire-based EMS systems providing non-emergency medical care became a recurrent theme throughout the two-week course. Therefore, during the final applied examination for the course,

I developed a conceptual model detailing how the SVFD might proceed to establish an expanded scope of practice process within our community (appendix A).

One of the issues identified in that exercise (4A-3) was "what impact will providing these services have on existing service levels?"

Marketed as a retirement community, a dual-role EMS system – one offering both the traditional emergency response and non-traditional prevention processes – would have positive social and economic value. By offering preventive medical services, system resources would be maximized. The community would enjoy a new level of medical convenience, since senior citizens could receive their annual influenza vaccine at their local firehouse.

Finally, private sector EMS agencies – such as Arizona based RuralMetro corporation - were already experimenting with the expanded scope process concept. To stay competitive, the SVFD would need to provide similar services.

Following my return from the National Fire Academy, informal dialogue was initiated within our management team regarding expanding EMS service levels. Legitimate concerns surfaced regarding this concept. If implemented, how would the new service impact current EMS service? Would using on-duty personnel cause response times to suffer? Would the overtime budget absorb extra costs if off-duty personnel were used instead? Could we afford to do this? Could we afford not to?

Closer scrutiny revealed that, from a purely clinical perspective, the SVFD did not know how effective the current EMS delivery process was. In fact, disagreement arose within the management team regarding how clinical efficacy was to be measured.

Response time performance was offered as one possible measurement. Overall patient outcome following hospital admission was also suggested as a measurement of EMS service effectiveness. A

third suggestion was information gathered from customer service questionnaires. Our management team quickly dismissed this suggestion. Although subjective customer perceptions of overall service quality are important, clinical outcome data would not be obtained.

How to measure the clinical effectiveness of the current EMS delivery process, then, would be a necessary prerequisite in learning how the current EMS system was functioning. Once a determination was made on how to measure current clinical performance, actual measurement would have to occur to determine if performance was meeting stated goals and objectives. At that point, it might be possible to determine what impact expanding our scope of services would have on the current system. For example, we might determine that our current system was functioning at a level allowing us to expand current EMS services into prevention activities. On the other hand, the data might alert us to the fact that our current system was not meeting stated goals and objectives, forcing us to focus instead on improving existing service delivery levels.

Literature Review

A review of the current EMS research literature specific to clinical effectiveness was undertaken. A historical overview of EMS provides perspective and is pertinent to this paper. I suspected that research data relating to clinical patient outcomes – whether that outcome is positive or negative – would be limited comparative to other fields of medicine due to EMS's relatively short history. Yet, I was confident a number of studies existed proving that EMS in North America had positive outcomes on a number of clinical conditions.

Modern EMS systems in North America were developed as a result of the 1966 white paper, *Accidental Death and Disability: The Neglected Disease of Modern Society (*EMS Agenda for the Future, 1996) and therefore have been in existence for only 30 years. Although this paper addressed

the specific epidemiology of trauma, the initial development of EMS systems was for the provision of care to victims of cardiac arrest (Cobb et.al, 1980). Cobb also states the measurement of system effectiveness at that time was based on cardiac arrest survival. However, because EMS responses to cardiac arrest account for only 1% to 2% all EMS responses (Spaite et. al, 1995), EMS systems subsequently evolved into what Mustalish and Post have characterized as "a multi-faceted health care safety net for anyone perceiving a medical emergency" (Mustalish and Post, 1994, pg.7).

As this evolution occurred, response time performance became the accepted determinant of system effectiveness, replacing cardiac arrest survival data (Swor, et.al, 1993).

Today, many communities cite response time criteria as the critical determinant of system effectiveness. The city of Santa Clara, California has a list of qualities necessary for the Santa Clara Fire Department to provide a quality service, including "a total response time of seven (7) minutes or less 90% of the time" (City of Santa Clara Paramedic Report, 1994; pg.3-4). Similarly, the city of San Diego lists an emergency response criteria of "12 minutes 0 seconds on not less than ninety percent (90%) of all life threatening emergency response requests" (Request for Proposal; Emergency Medical and Medical Transportation Services; 1996; pg.IV-5:a).

Our own fire department has guaranteed the community a response time performance of ten minutes (10) on 95% of all EMS responses (certificate of necessity document; Arizona Department of Health Services, 1997).

At this point, the literature seems clear on one fact. Current emphasis on how to measure EMS system effectiveness has changed. Instead of measuring results (patient outcomes) as Cobb mentions, EMS systems now emphasize measurement of the process (response time) necessary to obtain the result. However, what evidence is there linking response time performance with improved patient

outcomes? Which illnesses or injuries encountered by EMS providers does response time performance make a difference?

As it turns out, the literature does document several studies demonstrating a relationship between response times and a specific clinical outcome. In Effectiveness of Fire-Based EMS (1995), the International Association of Firefighters (IAFF) links rapid response time criteria with the specific clinical entity of cardiac arrest, stating that "of all the EMS calls, the most time critical is that of cardiac arrest" and that "the EMS system must be able to respond….within 4 minutes to initiate CPR and 8 minutes to provide advanced life support" (IAFF, 1995, pp.4-6). In what is considered a hallmark study within EMS research, Eisenberg et al conclude that the components of early EMS system activation, cardio-pulmonary resuscitation (CPR), defibrillation, and advanced cardiac life support (ACLS) are interdependent, with *time* being the important linkage within this "chain of survival" (Eisenberg, 1993, pg. 1657). Campbell et al similarly concur that the specific clinical condition of cardiac arrest and the patient outcomes associated with it are most frequently associated with rapid EMS response times (Campbell, 1994).

Is out-of-hospital cardiac arrest the only medical condition where a rapid EMS response has proven to improve patient outcome? The research literature revealed at least two studies linking positive clinical outcomes with rapid response times in trauma, as well. Delivery of the trauma patient to an appropriate facility as quickly as possible results in lower rates of morbidity and mortality (Smith, et.al., 1985). Gervin found that EMS response times also had a profound impact on morbidity and mortality in the chest trauma victim (Gervin, et.al. 1982).

At this point, the literature revealed disagreement among EMS researchers and their findings respective to this topic. Dr. Daniel Spaite of the Arizona Emergency Medicine Research Center at the

University of Arizona in Tucson asserts that "all studies regarding trauma outcomes use flawed methodologies and thus cannot be cited as confirmatory" (Spaite 1995, pg. 11). He further suggests a need to develop effective research methodology for the trauma patient (Spaite, 1995, p.147).

Investigating further as to why Spaite regarded studies related to trauma outcome data as flawed, I discovered other researchers shared the same opinion. The work of Dr. Michael Callaham, Deputy Director of the Division of Emergency Medicine at the University of California, San Francisco highlights this issue and is pertinent to this paper.

Callaham undertook an exhaustive literature search of over 4,633,000 citations indexed by the National Library of Medicine in the MEDLINE Database between January 1st, 1985 and September 1st, 1997, in all languages (Callaham, 1997). His results indicate 5,842 published studies on pre-hospital EMS during that time frame. However, only fifty-four (54 or .9%) of these studies were random controlled trials, or confirmatory in nature. Random controlled trials ensure the investigator(s) "are not allowed to follow their natural tendency to make the results come out positive" (Callaham, 1997, pp. 785-786).

Of the fifty-four (54) random controlled studies, only seven (7 or 13%) demonstrated a positive effect of the new therapy and only one (2%) showed actual improved survival outcomes.

In comparison, there are more random controlled studies on such subjects as urticaria (hives) and constipation then there are for all of EMS (Callaham, 1997).

I was quite surprised by this finding. Although I suspected that EMS's infancy as a branch of medicine contributed to the lack of research data on clinical outcomes, I assumed that a growing body of scientific evidence existed documenting positive clinical outcomes on more than one clinical condition. Callaham's study contradicts this assumption, causing Callaham himself to suggest that, aside from

cardiac arrest, no portion of EMS could meet the requirements of the "Food and Drug Administration for approval as a safe and effective therapy" (Callaham, pp.786, 787).

Spaite concurs with Callaham's perspective, asserting that EMS does make a positive difference in cardiac arrest, but once again it is the only clinical entity in which this is proven in a confirmatory study (Spaite et.al, 1997). Because of this, Spaite expresses a deep concern for the future of EMS (Spaite, 1995, 150):

> It is likely that the relative availability of societal resources for each potential need (in EMS) will decrease in the future. Thus, allocation will be based on the ability to objectively and convincingly prove the cost-effectiveness of a given service. Currently, EMS is enormously overfunded in relation to our current ability to scientifically justify its effectiveness.

Summarizing this last section, out-of-hospital cardiac arrest is the only medical condition EMS has proven to impact positively. Research also indicates that the quicker the EMS response, the better the outcome.

With funding for EMS decreasing, fire-based EMS systems will have to justify their products based on results. Therefore, the question becomes "how cost-effective is an EMS response to cardiac arrest?"

Two studies suggest that EMS responses to out-of-hospital cardiac arrest are cost-effective relative to other medical interventions. Valenzuela analyzed 190 out-of-hospital cardiac arrests in an urban setting (Valenzuela, et. al, 1990). The cost-per-year of life saved for care of sudden cardiac arrest by paramedics, including training, personnel, equipment, and response time maintenance was calculated at $8000 dollars. This was substantially less than the cost-per-year of life saved by several other

procedures in the same urban setting, including heart transplantation ($27,000), liver transplant ($44,000), and chemotherapy for leukemia ($62,500).

A second study by Ornato reported that the cost-per-year of life saved for patients suffering out of hospital cardiac arrest was approximately $2,200. This compared favorably with other accepted medical interventions that were more expensive yet yielded less impressive outcomes (Ornato et al; 1988).

The fact that only in cardiac arrest has EMS proven to improve patient survival and does so in a cost-effective manner leads Spaite to conclude that cardiac arrest outcome data be used as the EMS "system monitor" (Spaite 1997, pg. 4). Furthermore, he proposes a model for measuring any change in the system based on this concept (Spaite, 1997). His model is predicated upon knowing the current cardiac arrest survival rate in a community. After additional services are implemented, changes to the out of hospital cardiac arrest survival rate can be measured, thereby allowing system administrators to evaluate the impact the new service has on existing service levels. Spaite's model is presented in its entirety in appendix D.

Spaite stresses that any expanded scope of practice processes must be prospectively evaluated against the system monitor of cardiac arrest survival.

Otherwise, expanded scope will simply "become the 'standard of care,' making it impossible to 'go back' and identify its effects" (Spaite, 1997, pg.5).

Summary

Modern EMS systems have been in existence for thirty years. The major impetus for EMS system design and funding was a document informing Americans that an epidemic of trauma was the major killer of Americans between the ages of 1 and 37. Yet, EMS system design and implementation

subsequently addressed care and treatment for victims of cardiac arrest. Due to the extremely low percentage of EMS responses to cardiac arrest, however, EMS systems evolved into a health-care safety net for almost every medical illness or injury, regardless of acuity.

This has caused confusion on how to measure EMS system effectiveness relative to patient outcomes. Cardiac arrest outcome data was initially proposed as the measurement of an effective system, but has been mostly replaced by response time performance.

However, aside from the singular clinical condition of cardiac arrest, no scientifically valid evidence exists linking rapid response times with positive patient outcomes relative to survival. Although numerous studies exist purporting a relationship between response times and positive outcomes in trauma, none can be considered confirmatory.

The literature indicts EMS research for not using random controlled trials, yet proclaiming confirmatory results. Without a random controlled trial, the investigator has a strong tendency to be biased towards a favorable result.

The only substantive research in EMS using random controlled trials establishing a clear relationship between rapid response times and positive patient outcomes is for the medical condition of out-of-hospital cardiac arrest. Furthermore, in two urban EMS systems, it has been documented that the cost-per-year of life saved for victims suffering an out-of-hospital cardiac arrest and subsequently resuscitated by EMS personnel is cost effective relative to other medical interventions.

Only one model could be found in the literature offering a potential framework for EMS systems attempting to expand their scope of practice. This model proposes a using out-of-hospital cardiac arrest survival data as the system monitor when adding new services. Therefore, EMS systems

contemplating expanded scope of practice processes must first attempt to determine current cardiac arrest survival data prior to the addition of non-emergent services.

Procedures

A review of the medical literature pertaining to emergency medical services was the first step of this research. A historical research methodology was used to gain perspective of the evolution of EMS in our country over the past thirty years. This was accomplished through a literature search of the Learning Resource Center (LRC) at the National Emergency Training Center. Specifically, a review of the literature specific to EMS research and outcome data was completed. Simultaneously, a request for literature references pertaining to EMS research was made of Elizabeth Criss, RN, MEd, a senior research associate at the University of Arizona and a member of the Board of Advisors of the Prehospital Care Research Forum. This list of literature references was then filtered for pertinent citations with article retrieval achieved using the CD-ROM database accessible through the medical library at Sierra Vista Community Hospital.

The literature was reviewed with material relevant to this project summarized in the literature review section of this paper. This review was designed to provide the answer to my first and third research questions, while providing the necessary background information necessary to answer the second.

The second step of the process was an informal interview of six stakeholders intimate with the EMS delivery process in Sierra Vista (appendix B – questionnaire). Three people were selected from Sierra Vista Community Hospital and three from the SVFD. From the hospital, the system medical director, the pre-hospital coordinator, and the emergency department manager were identified as stakeholders intimate with the EMS delivery process. From the SVFD, the deputy chief of operations, the EMS

coordinator, and an EMS educational specialist were interviewed for their expertise with the EMS system.

The purpose of the interviews was to determine the answer to my second research question. This evaluative portion of this research was necessary to determine the present state of EMS effectiveness within the community as defined by the answer to my first research question. Each interview lasted approximately 15 minutes. Key data elements from the interviews are summarized in appendix C.

Finally, an action research methodology was employed to create a decision matrix guiding the SVFD's expansion into non-traditional health care roles. The decision matrix was created through an analysis of the answers to the first and third research questions.

Limitations and Assumptions

This project attempted to utilize only that data found in the literature resulting from studies using sound research methodology as described by Callaham (Callaham, 1997). This created a limitation, as there are few research studies meeting this criteria. This can be explained by the fact that sound EMS research is generated by relatively few researchers in just a couple of medical schools (EMS Agenda for the Future, 1996).

Definition of Terms

The following terms have been defined for the purpose of clarity for this research project:

Expanded scope of practice – *increased dimensions of the services, activities, or care of a preventive nature provided by an EMS system.*

Clinical outcome – *any change in the patient's physical condition that can be measured quantitatively.*

Response Time – *the total elapsed time between obtaining a verifiable address in the communications center and the arrival of trained personnel at the patient's side.*

Advanced Life Support – *use of basic life support plus advanced airway management, defibrillation, and intravenous medications.*

Cardiac arrest survival – *any victim of out of hospital cardiac arrest treated by the EMS system who is subsequently discharged from the hospital to lead a normal life. Data collected is defined as the cardiac arrest survival rate (CASR) within that system.*

Public access defibrillation – *use of automatic external defibrillators by the lay person.*

Results

I will present my results by addressing each of the three research questions in their respective order.

1. What clinical outcome(s) does the EMS research literature identify as an indication that an EMS system is functioning effectively?

Survival from cardiac arrest is the only clinical outcome EMS has proven to positively impact. A strong correlation has been established between survival from out of hospital cardiac arrest and rapid ALS response times occurring within 8 minutes or less (Eisenberg, 1993).

And, in two studies, EMS response to cardiac arrest is cost effective comparative to clinical outcomes of selected in-hospital procedures.

I conclude that cardiac arrest survival is the only clinical outcome indicative of an effectively functioning EMS system. A rapid ALS response must occur for this outcome to be achieved. Collectively, both are critical components to an effectively functioning EMS system.

Interestingly, almost all EMS systems measure response time performance. Almost none measure cardiac arrest outcome data (Eisenberg, et. al, 1980). The challenge is to begin that process, especially if additional services are contemplated.

If cardiac arrest survival data and a rapid ALS response are the clinical outcomes definitive of an effective EMS system, then:

2. How effective is the SVFD's EMS process in achieving the clinical outcome(s) identified in question one?

We don't know. Only educated guesses could be provided regarding cardiac arrest survival data and response time performance.

As identified in the procedures section, the answer to this question was provided by interviewing six stakeholders integral to the local EMS system (questionnaire-appendix B) with their answers summarized in appendix C.

Scrutinizing appendix C further, the estimated cardiac arrest survival rate was generally poor. Only the emergency department manager offered a positive, although subjective, response ("no stats - I think it's fairly good").

The literature review indicated a strong correlation between cardiac arrest survival and a rapid ALS response. The response times (question 4, appendix B) offered by each of the six stakeholders, although quite favorable, are estimates; the fact is that response time performance is unknown.

Summarizing, it is theorized that within our community cardiac arrest survival outcomes are poor while the percentage of ALS responses occurring within 8 minutes or less is high. This theory is unsubstantiated by fact. Anecdotal evidence only was offered by the six system stakeholders. Since

both cardiac arrest survival outcome and a rapid ALS response are the clinical measures of EMS system effectiveness, the answer to the second research question is “we don’t know.”

Not knowing how effective the current EMS system is makes the decision to expand current service levels a difficult one. It is hoped that my third research question will provide guidance to our department.

3. Does the literature offer any theories or models based on patient outcome data the SVFD can use as a framework for deciding whether it should expand its current levels of EMS service?

Yes. Appendix D describes the only decision model found in the literature offering guidance when implementing an expanded scope process.

Spaite et al developed this model using survival from out of hospital cardiac arrest data as the cornerstone for their decision process.

Spaite offers three advantages to his approach. First, the ability to prospectively evaluate the impact of adding an expanded scope of practice on the system monitor – cardiac arrest survival rates – will allow systems managers to calculate the value of each new process added.

A second advantage is it forces EMS systems unsure whether or not they are positively affecting cardiac arrest outcomes to begin measuring cardiac arrest survival.

Spaite asserts that this aspect could have the largest impact on EMS. This is because EMS systems historically assuming they were saving lives may realize they are not (Spaite , 1997).

A final advantage is that, in at least some EMS systems, administrators will realize that their ability to positively impact cardiac arrest outcomes will never occur, regardless of resource allocation or system

changes. These systems will then be able to concentrate human and non-human resources on prevention processes that will reduce mortality and morbidity.

The literature has demonstrated a correlation between survival from out of hospital cardiac arrest survival and a rapid ALS response time of less than 8 minutes. It seems appropriate, therefore, to use cardiac arrest survival data *and* a rapid ALS response as factors to consider when considering expanding services. The model presented by Spaite does not do this.

Therefore, a decision matrix (appendix E) was developed as a result of the findings of this study. It incorporates the ALS response component with Spaite's suggested model. I will discuss in-depth each of the four quadrants presented in this model during the next section.

Summarizing, a model discovered in the literature uses cardiac arrest survival data as the cornerstone for implementing expanded scope processes.

Since a rapid ALS response is necessary for out-of-hospital cardiac arrest survival to occur, a decision matrix incorporating that model with ALS response times was created. It is imperative, however, that prospective evaluation of new services and their impact on existing service levels occur.

Discussion

EMS evolved in response to a need articulated in the publication Accidental Death and Disability: The Neglected Disease of Modern Society (EMS Agenda for the Future, pg. 61). However, meaningful data demonstrating system effectiveness of out of hospital treatment is still forthcoming. In fact, it wasn't until 1991 that a standardized data set for comparing cardiac arrest was established (Criss, pg.S-24). As a result, EMS systems embrace a deep seated belief that the treatments they provide saves lives. This study has demonstrated this is true in only one clinical condition: cardiac arrest.

It must be noted that cardiac arrest may not be the only clinical condition positively impacted by EMS systems. It is, however, the only one that has been proven. It is our tradition within EMS that historical precedent – not science, has driven the evolution of patient care. Two reasons have contributed to this.

First, virtually no prospective evaluation of EMS processes occurs within EMS systems. Second, there is very little confirmatory research substantiating EMS effectiveness in reducing morbidity and mortality.

The belief that EMS effectiveness is based more on opinion than fact is evidenced by the responses (appendix C) to the questionnaire (appendix B) designed to answer the second research question. These responses exemplify beliefs deeply embedded within the EMS culture of our community totally unsubstantiated by fact.

Specifically, question one asks "what clinical outcomes would you use to measure EMS system effectiveness?" In appendix C, we observe that four of the six system stakeholders defined hospital discharge as a criteria for system effectiveness. This was congruent with the literature findings (Cobb, 1980). What was incongruent with the literature was that none of the four specified which clinical conditions (stroke, cardiac arrest, trauma) had been favorably impacted in order for hospital discharge to occur. The assumption seems to be that there are any number of medical emergencies favorably impacted by EMS system intervention.

This is inconsistent with the literature findings, which clearly state that only in out of hospital cardiac arrest has EMS proven to have a favorable impact on survivability.

Many EMS systems believe that effective response times are the key to EMS system effectiveness for all emergency calls. One of our system stakeholders mentioned response times as a partial measure

of system effectiveness ("response times and success rate of skills"). The question that must be answered is "which clinical conditions demonstrated improved outcomes because of a rapid ALS response and a high success rate of skills?" Our respondent made no attempt to link either with favorable outcomes for a specific illness or injury.

An interesting finding regarding response times within the Sierra Vista EMS system is that, although one respondent deemed it a benchmark for EMS system effectiveness, the answer to the second research question clearly indicates that response times are not currently measured. This absence of prospective evaluation is a localized symptom of a global problem confronting EMS as a profession.

Finally, one stakeholder mentioned "trauma aspects" as an important measure of EMS system effectiveness. Yet, the research is undecided on the effectiveness of EMS on this subject (Spaite, 1995, Callaham, 1997).

Summarizing, little prospective evaluation of EMS processes occurs nationwide. Few studies exist confirming EMS has a positive impact on patient survival. Within the Sierra Vista EMS system, no studies exist demonstrating a positive EMS impact on patient outcome. Response time data is not measured. No prospective evaluation of EMS processes is occurring. The EMS culture is infected with opinions masquerading as fact.

Against this background, EMS systems across the country – including our own – are contemplating, and in some cases implementing, expanded scope of practice activities.

Spaite, et al. provided a model useful in guiding EMS systems in their quest to expand their scope of services. It is useful for two reasons. First, it stresses service expansion must not compromise survival rates from cardiac arrest. Second, additional services must be prospectively evaluated as to their effectiveness in achieving not only their desired outcomes, but also overall systemic impact. (Spaite,

1997). Presented in appendix D, this model may serve as a template for systems contemplating expanding EMS service delivery. However, it does not reflect one of the key findings of this study relating to EMS system effectiveness: rapid ALS response to-out-of hospital cardiac arrest.

As mentioned earlier, I decided to incorporate the rapid response component into Spaite's proposed model for expanding EMS service levels (appendix D). The resulting decision matrix (appendix E) will now be explored in-depth, along with pertinent organizational implications. Quadrant I: Cardiac Arrest Survival Acceptable

Quadrant I consists of EMS systems having knowledge of two parameters: current cardiac arrest survival rates (CASR) that are acceptable to the community, and a documented advanced life support (ALS) response times of 8 minutes or less on 90% of all responses to out- of-hospital cardiac arrest.

These systems should implement expanded scope of practice using on-duty personnel. By doing so, system resources are maximized. Simultaneously, prospective evaluation of the effects of the preventive services can be measured against any negative impact on existing cardiac survival rates.

As an example, influenza can have a high morbidity and mortality rate on the elderly population. If thirty fewer cases of elderly influenza are prevented annually due to an aggressive EMS-based immunization process, illness and mortality – along with health care costs – may decrease. This would have positive social and economic value.

However, if EMS providers are not responding to cardiac arrest calls as quickly as before because of their on-duty involvement in the immunization process, death from out-of-hospital cardiac arrest may *in*crease, having a negative social and economic impact. Now, however, the community has the data necessary to make an informed decision on how it desires EMS resources to be used. Is the lower mortality and morbidity from influenza worth a few more deaths from cardiac arrest? Or, is it more

beneficial to have fewer people die from cardiac arrest and accept the health care costs associated with an influenza epidemic? Or, can we have both? If we use on-duty personnel for immunizations, what would it cost to maintain the current response time? Should we increase staffing or is it more effective to use off-duty personnel and pay overtime costs?

Quadrant I represents only a handful of EMS systems highly evolved in their ability to properly monitor cardiac arrest, thus proving the benefit of their system (Spaite, 1997). From an organizational perspective, the implications are clear: quadrant I systems are solving additional problems for customers. In this case, the perception customers have of an EMS system capable of meeting their needs in an emergency are augmented with a system willing to provide a value-added non-emergent service: immunizations at a convenient location. Belasco and Stayer maintain that "customers have lots of problems. Organizations have limited resources. Choose the right problem on which to focus" (Belasco and Stayer, 1993, pg. 170).

Clearly, becoming a dual-role EMS provider would be focusing on the right problem, given Spaite's earlier premonition of dwindling resources for EMS funding.

Providing a cost-effective service will be imperative for future survival. In this regard, quadrant I systems (and providers) will have a competitive advantage over less sophisticated systems.

Quadrant II: Cardiac Arrest Survival Unknown

This quadrant represents EMS systems unaware of CASR's yet having effective ALS response times. The most important step these systems must take is determining CASR's. Simultaneously, quadrant II systems should initiate expanded scope of practice activities with off-duty personnel and/or allied health professionals, such as licensed practical nurses, registered nurses, and physician assistants. The advantage of using off-duty and/or allied health professionals is it allows expanded scope activities

to begin while not impacting CASR's through response time delays inherent when using on-duty personnel. A disadvantage is the overtime costs accrued if using off-duty personnel to provide expanded scope services.

Once the CASR data becomes available, a system re-evaluation should occur. If the CASR is acceptable to the community, then quadrant II systems should become quadrant I systems and continue expanded scope processes using on-duty personnel – with prospective evaluation as outlined for quadrant I systems.

If the CASR is unacceptable, expanded scope processes should occur with off-duty and/or allied health professionals. However, since response times are within the time-frame necessary for cardiac arrest survival, the question becomes "why are cardiac arrest survival rates poor?" Possible causes include lack of public awareness of the chain of survival concept. Training issues with EMS personnel relating to proper use of equipment might also be explored. Improper measurement of response times may mislead investigators into believing response times are within acceptable parameters when, in reality, they are not.

As an example of this last possibility, perhaps response times are being measured from the time the call is received in the telecommunications center and ending when EMS providers arrive on-scene. In that case, a prolonged patient access interval of a minute or more may cause poor CASR's.

The most important organizational implication of being a quadrant II system is that it forces agencies to begin measuring CASR's simultaneous with providing expanded scope of practice services. This is in disagreement with Spaite's proposal. According to Spaite, EMS systems unaware of current CASR's should not expand service levels (Spaite, 1997). However, I believe the ability to expand service levels can occur in quadrant II systems if current response times are not affected by service expansion.

Therefore, using off-duty and/or allied health professionals meets this criteria. The quadrant II systems within this model are actually a hybrid of Spaite's "approach 2" found in appendix D. The significant difference is that expanded scope of practice processes can occur simultaneously with CASR data collection in this model; in Spaite's model it cannot.

Quadrant III: Cardiac Arrest Survival Poor

Quadrant III systems have knowledge of CASR's and have also established that ALS response times are longer than 8 minutes on a majority of all cardiac arrest calls. As expected, CASR's are generally poor.

A quadrant III system was described in one study performed by Lombardi (Lombardi, 1994). A review of 2,329 cases in New York city over a six month period revealed a CASR of 1.4%. Researchers attributed the poor CASR to lengthy response times and poor public education regarding knowledge of cardio-pulmonary resuscitation (CPR).

Therefore, quadrant III systems should determine if response times can be reduced to less than 8 minutes. If so, these systems could then move into quadrant II. If not, an expanded scope of practice process should begin immediately by using on-duty personnel, since prolonged response times will have no impact on an already dismal CASR.

Is there any hope that quadrant III systems will ever have acceptable CASR's? Lombardi observed that police officers typically arrived on scene prior to EMS. Therefore, he recommended that New York City implement a tiered EMS system, whereupon police officers are trained to provide early defibrillation with automated external defibrillators (AED's). Quadrant III systems should explore this approach.

The organizational implications are that multiple-agencies, such as third service EMS organizations, first responder fire departments, and police agencies must work together to accomplish this mission. If successful, the community would realize similar benefits found in quadrant I systems: a dual-role EMS system offering acceptable cardiac arrest survival and expanded scope services.

Quadrant IV: Dysfunctional System Constraints

In this last quadrant are found EMS systems having no knowledge of CASR's as well as poor response times. Most EMS systems within this category recognize that response times are so prolonged that CASR's, though not measured, are practically zero. Examples include rural systems, urban systems experiencing extreme congestion and traffic patterns, or a combination of both. In quadrant IV systems, administrators are constrained by events beyond their control .

Quadrant IV systems should determine if response times can ever be improved. Simultaneously, an expanded scope of practice process should begin immediately with on-duty personnel. In the unlikely event that response times can be improved to eight minutes or less, CASR's should then be evaluated. Until response times can be improved, however, resources should not be wasted measuring CASR's. Instead, a tiered EMS response using AED's or implementing public access defibrillation would be more cost-effective.

The organizational implications of each of the four quadrants as they pertain to fire-based EMS systems have been discussed throughout this section.

The organizational implication specific to the SVFD is clear. Cardiac arrest survival data has not been collected. Response time performance data is available, yet not documented. Our department desires to expand EMS service delivery into preventive medicine without knowing how effective the current EMS system is. Therefore, using the decision matrix developed by this author, it is clear the

SVFD does not currently fall into any of the quadrants. However, the decision matrix will prove useful after an analysis of response time performance is concluded.

Recommendations

Three recommendations impacting fire-based EMS systems in general may be stated based on the results of this research. This will be followed by three recommendations specific to the SVFD.

First, fire-based EMS systems must begin the process of prospectively evaluating current EMS processes. Specifically, two parameters must be measured: response time performance as defined in this project and out-of-hospital cardiac arrest survival data. Collectively, these two measurements form the foundation of clinical effectiveness within EMS.

Secondly, the outcome data of solid prospective evaluation must propagate research that is characterized by the use of unbiased, random controlled trials that can thus be called confirmatory in nature.

Finally, the consideration to expand the EMS scope of practice must be given top priority by fire-based EMS systems. This expanded scope of practice must occur, however, in an intelligent and well-planned manner.

The reason to do so is clear: cardiac arrest is the only condition in which EMS is known to have an impact. With so little influence on patient outcomes, we in EMS cannot afford to continue to delude ourselves into believing we save lives on a daily basis. Fire-based EMS systems must instead focus on providing services that have proven to reduce morbidity and mortality. These include immunizations, cholesterol screening, and injury prevention education. We will still be saving lives, although not in as dramatic a fashion as we have been historically depicted.

However, one important caveat must be followed when beginning an expanded scope process. Prospective evaluation of expanded service levels must occur simultaneous with monitoring of the impact on response times and, in quadrant I and II systems, cardiac arrest survival.

There are three recommendations the SVFD should follow as a result of this research project.

First, our agency must determine the ALS response times for all emergency calls for service. The EMS expanded scope of practice decision matrix developed as a result of this project cannot be used until this occurs. The data is available from patient care reports located in our central station. A concerted effort must be made to determine what it is telling us.

Second, the SVFD must attempt to determine cardiac arrest survivability within the community. My recommendation specific to this point is to retrospectively analyze data from out-of-hospital cardiac arrest for the past five years. This analysis should utilize the most currently accepted criteria for cardiac arrest research.

Finally, the SVFD should plan an expanded scope of practice process using off-duty and/or allied health personnel. This process would be implemented during the next fiscal year. By doing so, we will be providing a service to our customers having proven medical benefit. We will also not impact our current emergency response, since on-duty personnel will be excluded from performing expanded scope services.

Once response time data is evaluated, the decision matrix presented in this paper can be used to re-evaluate the most appropriate delivery mechanism for continuation of the expanded scope process. A second re-evaluation should occur once cardiac arrest survival data is quantified.

Providing expanded scope of practice services as outlined in this paper will strategically position the SVFD to compete with private sector EMS providers currently offering similar services.

Simultaneously, it will allow our department to change the way EMS services are currently delivered that is in alignment with the health care industry nationwide.

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APPENDIX A

Expanding Your Services:
Issues to Consider Before Taking the Plunge

Final Applied Exercise for the Advanced Leadership Issues in EMS Class
National Fire Academy
March, 1996

1) ***A. The health conditions currently not treated in Sierra Vista are unknown to me at this time.*** Therefore, some type of information gathering has to take place to identify the answer to this question.

B. ***Health care services desired by the public are unknown***. Once again, I know of no data gathered which measures this issue. I would suggest that the following are expectations: emergency services, primary-care, specialized services such as oncology and cardiology, and ancillary services normally expected in a community of 40,000 people.

2 A) ***Reasonable or logical services that can be delivered by the SVFD can be broken down into 2 categories: existing and future programs.***

Existing programs:

- Current ALS transport services
- Public education services (CPR to businesses and the public)
- Public safety education, such as the car seat loaner program

Futuristic/value added:

- Non-emergent interfacility transport service
- Health care screening for private industry and life insurance companies
- AED education program for industry
- Disease/injury prevention programs
- **IMMUNIZATION FOR THE ELDERLY/PEDIATRIC POPULATION**
- **CHOLESTEROL SCREENING**
- IV restarts in the private residence
- Triage and referrals

B) Resources available

- Monetary resources, including the current SVFD budget
- Funds generated from our fee for service EMS delivery process

- Existing pool of health care providers within the community, including newly certified EMT's graduating from Cochise Community College
- Non-human resources currently available to the SVFD (equipment, supplies)
- Partnerships with local managed care organizations (Intergroup, Champus)

3A) Program effectiveness will be monitored in several ways:

- Information gathered from customer satisfaction surveys
- **RESEARCH DETERMINING IF IMMUNIZATIONS ARE MAKING AN IMPACT ON DISEASE PREVENTION WITHIN OUR COMMUNITY**
- **RESEARCH DETERMINING WHAT IMPACT WE ARE HAVING ON INJURY PREVENTION THROUGH PUBLIC EDUCATION**
- Healthcare providers offering feedback on program efficacy
- Admission records from the emergency department of Sierra Vista Community Hospital analyzed to determine if non-emergent related conditions are being seen with less frequency

4A) Additional issues to be considered

- Is there an ability, politically, to form a partnership with all constituents?
- How will current healthcare providers (nurses, doctors, paramedics, etc.) feel about this program? Will they feel threatened?
- **WHAT IMPACT WILL PROVIDING THESE SERVICES HAVE ON EXISTING SERVICE LEVELS?**
- What are the marginal costs of providing an expanded scope of practice within our EMS system?
- What will be the cost recovery associated with such a program?
- **FROM THIS PROGRAM EXPERIENCE, WILL WE BE ABLE TO PUT TOGETHER A COMPREHENSIVE REQUEST FOR PROPOSAL AND SUCCESSFULLY COMPETE AGAINST PRIVATE SECTOR EMS PROVIDERS?**

APPENDIX B

Executive Fire Officer Program
Applied Research Interview Questions

1. What clinical outcomes would you use to measure EMS system effectiveness?

2. In your opinion, how would you define the concept "survival from out-of hospital cardiac arrest?

3. What is the out-of-hospital cardiac arrest survival rate in Sierra Vista?

4. How often does the SVFD respond to EMS calls in eight (8) minutes or less?

5. Should the SVFD expand its scope of practice into prevention activities (immunizations, cholesterol screening, etc.) at this time?

Appendix C

Sierra Vista EMS System Effectiveness: Result of Interview Questions

Stakeholder	% of time EMS response < 8 minutes	Cardiac Arrest Survival Rate in Sierra Vista	Should SVFD Expand its' Scope of Practice?
Medical Director	**"fairly often"**	**"got me, < 5%"**	**"I think it's something to look into."**
Pre-Hospital Coordinator	**Unknown**	**Unknown**	**"Yes, as long a current service levels stay the same."**
Emergency Department Manager	**85%**	**"No stats – I think it's fairly good."**	**"No, I think it would overtax them."**
Deputy Chief of Operations	**92%**	**.25%**	**"Yes."**
EMS Educational Specialist	**99%**	**"my opinion – less than 3%"**	**"Absolutely."**
EMS Coordinator	**Almost 100%**	**"not very good – don't know the numbers, but less than 1-2%".**	**"Sure."**

Question # 1: **What clinical conditions would you use to measure EMS system effectiveness?**	"discharge from hospital with little or no neurological deficits."
	"any viable patient after a year from the incident."
	"appropriateness of treatment; thorough assessment; what was the outcome discharge?"
	"trauma aspects."
	"response times and success rate of skills."
	"disposition at discharge."

Appendix D

Expanded Scope Model: Spaite, et al

APPROACH 1: SYSTEM-WIDE EXPANDED SCOPE OF PRACTICE

This approach assumes that expanded scope of practice will be implemented throughout the EMS system. On-duty EMS personnel would perform a dual-role function of responding to both "9-1-1" calls and providing non-emergent expanded scope processes. This approach categorizes all EMS systems into three (3) possible EMS system types: Type A, B, and type C systems.

Type A System

Using cardiac arrest outcome data as the system monitor, type A systems implement expanded scope of practice processes and then determine what impact implementation has on existing service levels. Type A systems are those systems having a positive impact on cardiac arrest survival and have data justifying that statement.

Type B System

Type B systems are those systems having no data supporting system effectiveness. In other words, these systems do not know whether or not they have a positive impact on cardiac arrest outcomes. Type B systems should attempt to become type A systems prior to the initiation of any expanded scope of practice processes. Most EMS systems in the United States fall into this category.

Type C System

Type C systems are sub-divided into two groups. Group 1 systems have studied cardiac arrest outcome data and found it to be extremely poor. Group 2 systems, like type B systems, have not studied cardiac arrest outcome data but intuit poor outcomes because of uncontrollable system constraints such as rural settings, geography, and limited resources causing prolonged response times. Type C systems, regardless of their grouping, must determine if becoming a type A system is possible. If not, then expansion of practice into services that best meet the needs of their respective communities may be a more appropriate use of resources.

APPROACH 2: ADDING EXPANDED SCOPE WITHOUT ALTERING EXISTING EMS SYSTEM

In this approach, health care providers other than those providing emergency response for expanded scope processes are utilized. Nurse practitioners could be added to the existing system and used exclusively in the expanded scope role. Off-duty EMS personnel would also be an option in this approach. Both would allow EMS personnel to function with little or no impact to the EMS system.

One advantage of this approach is that EMS systems currently unaware of cardiac arrest save data within their communities -type B and type C systems - could add an expanded scope of practice with little, if any, impact on the EMS system response.

Appendix E

Expanded Scope of Practice Decision Matrix

	Cardiac Arrest Survival Rate Known	**Cardiac Arrest Survival Rate Unknown**
ALS Response less than 8 minutes	***QUADRANT I*** *CARDIAC ARREST SURVIVAL ACCEPTABLE* **Implement expanded scope of practice with on-duty personnel. Evaluate impact on cardiac arrest survival rates.**	***QUADRANT II*** *CARDIAC ARREST SURVIVAL UNKNOWN* **Attempt to determine cardiac arrest survival rates. In the meantime, begin expanded scope activities with ALLIED HEALTH (AH)/off-duty personnel. Re-evaluate once data is collected. If acceptable, see QUADRANT I. If data unacceptable, continue expanded scope with off-duty personnel and determine causes (public education, training, response times not properly measured).**
ALS Response more than 8 minutes	***QUADRANT III*** *CARDIAC ARREST SURVIVAL POOR* **Determine if response times can be reduced to < 8 minutes; If yes, move to QUADRANT II. If no, accept poor survival outcomes and begin expanded scope with on-duty personnel. Consider a tiered AED program with prospective evaluation.**	***QUADRANT IV*** *DYSFUNCTIONAL SYSTEM CONSTRAINTS* **Uncontrollable factors (urban traffic, rural responses, geography) prolong responses making survival from cardiac arrest unlikely. Implement expanded scope using on-duty personnel. If response time performance can be improved (unlikely) move to quadrant II. Meanwhile, consider resource allocation for tiered AED response or public access defibrillation.**