Critical Factors and Staffing Options for the Deployment of an Additional Ambulance within the Colleyville Fire Department

Clinton R. Shelley

Colleyville Fire Department

Colleyville, Texas

CERTIFICATION STATEMENT

I hereby certify that this paper constitutes my own product, that where the language of others is set forth, quotation marks so indicate, and that appropriate credit is given where I have used the language, ideas, expressions, or writings of another.

Signed: _____

Abstract

The problem is the Colleyville Fire Department has only one staffed ambulance in service each day often creating delayed transport times for critically ill patients. The purpose of this research was to identify the critical factors used when making decisions to increase the quantities of ambulances in use each day, identify various staffing options for those additional ambulances, and whether or not any state or federal standards exist which dictate the number of ambulances in service each day. This evaluative research was conducted through the following questions: what are the factors and criteria to consider when determining the need for additional ambulances in a fire department based EMS system or private ambulance systems? What are the various staffing options used by other fire department based EMS systems with regard to additional ambulances? d) What state and/or federal regulations dictate or influence the number of staffed ambulances in a community and to what extent do they dictate or influence this situation? This research was conducted through an extensive literature review, nationwide survey, and personal interviews with peer city chief officers significant to Colleyville, Texas. The results of this survey indicate that call volume and response times are the two most critical factors to be considered when determining ambulance needs and the means with which those ambulances are staffed can be varied greatly dependent mostly on the wants and needs of the community being served. This research has identified a need to consider at least part time staffing of a second ambulance and full time staffing at a later date as financial resources will allow.

Table of Contents

Appendices

Critical Factors and Staffing Options for the Deployment of an Additional Ambulance within the Colleyville Fire Department

Introduction

Staffing and apparatus availability are two common problems that exist across the fire service today. Fire and Emergency Medical Services companies across America are closed or temporarily shut down due to short staffing on a regular basis. In small town America, fire department staffing in most cases has never been, nor will it likely ever be adequate to provide proper protection to the citizens and safety for the firefighters operating in these communities without assistance from surrounding agencies. Discussion among elected officials is rampant regarding reduction in staff and decreases in personnel costs, yet call volume and expectations from the fire service continue to increase.

According to International Association of Fire Chiefs [IAFC] (2005) 61% of survey respondents cited staffing as their greatest challenge moreover 23% cited increased service demands which are directly impacted by available staffing and resources as their greatest challenge. These numbers reflect equally in the fire department based EMS arena as well. Just like fire apparatus staffing, staffing appropriate numbers of additional ambulances is becoming more difficult day by day.

The problem is the Colleyville Fire Department has only one staffed ambulance in service each day often creating delayed transport times for critically ill patients. The purpose of this research is to identify the critical factors used when making decisions to increase the quantities of ambulances in use each day, various staffing options for those additional ambulances, and whether or not any state or federal standards exist which dictate the number

of ambulances in service each day. Through the evaluative research process, the researcher will attempt to answer the following questions: a) what are the factors and criteria to consider when determining the need for additional ambulances in a fire department based EMS system? b) What factors and criteria are considered when determining the need for additional ambulances in a private ambulance system? c) What are the various staffing options used by other fire department based EMS systems with regard to additional ambulances? d) What state and/or federal regulations dictate or influence the number of staffed ambulances in a community and to what extent do they dictate or influence this situation?

Background & Significance

The Colleyville Fire Department (CFD) is a suburban department located in the Mid-Cities area between Dallas and Fort Worth, Texas. The Department is bordered on its eastern limits by Dallas-Fort Worth (DFW) Airport. The Department began more than 50 years ago as an all volunteer agency and has transitioned over the last 25 years to an all career staff of 30 personnel with five additional administrative staff. Shift staffing is ten covering two engines, one ambulance, and a quint responding out of three stations. Colleyville is considered one of the most affluent communities in North Texas and is home to more than 24,000 people dispersed across more than 13 square miles. All Operations personnel work a standard three platoon rotation with one day on duty and two days off duty.

The CFD began providing transport ambulance service to its citizens in 1989 and continues that service now today. All but two operations personnel are paramedic certified and there are always a minimum of two paramedics on the ambulance at any given time. Despite Colleyville tripling in size over the last 20 years, the CFD is still only able to staff one ambulance each day. In addition to population growth, call volume has increased by more than

150% during the same time period (Colleyville Fire Department, 2008). Because of these population and call volume increases, the CFD has become increasingly reliant on neighboring communities to provide mutual aid assistance for ambulance transport. As our neighboring communities have grown in a comparable manner, their availability for mutual aid response has become less and less consistent over the previously discussed time period. It is for these reasons that this researcher felt it has become necessary to conduct this research effort. In addition, researching this issue for our organization complies with the United State's Fire Administration's operational objective of responding appropriately in a timely manner to emerging issues in the fire service (FEMA, 2008). While participating in the *Executive Leadership* class at the National Fire Academy, one of the units discussed was about *Developing Self as a Leader*. As the Interim Fire Chief, it is my obligation as a leader to use my background, experience, and professional influence to bring about changes in our organization through creating a shared vision and purpose. The purpose of this research is to identify whether or not a need exists to add a second ambulance to our response capabilities. This research will provide clarity to the Emergency Medical Services (EMS) portion of our customer service with a vision of what the needs are in this area both now and in the future. As an end result of this project, our City Council and City Manager will be intensely reviewing the findings of this research in order to determine an effective and appropriate implementation period for adding a second ambulance to our current response capabilities. With a vision and purpose in place, we will be poised to create an action plan to turn potential needs into service reality.

Literature Review

As with fire apparatus deployment and staffing, it is a constant justification process to demonstrate the needs of a community and a fire department relative to EMS response

capabilities and staffing of currently in use. This issue is further complicated when trying to justify addition and potentially deletion of resources in the area of EMS. The goal of this literature review is to adequately answer the following research questions from a more global standpoint prior to addressing the needs specific to the CFD based on current industry standards and local response protocols.

The literature review was developed from the four research questions being used for this research: a) what are the factors and criteria to consider when determining the need for additional ambulances in a fire department based EMS system? b) What factors and criteria are considered when determining the need for additional ambulances in a private ambulance system? c) What are the various staffing options used by other fire department based EMS systems with regard to additional ambulances? d) What state and/or federal regulations dictate or influence the number of staffed ambulances in a community and to what extent do they dictate or influence this situation?

The first question of this review is focused on critical factors utilized to determine additional ambulance needs within a fire service based EMS system. Without a clear set of determining factors to work from, this effort would be futile on the part of our department in addressing this potential need. According to Krakeel (1998) there are numerous factors affecting EMS to consider in addition to the typical mathematical and financial elements. These factors include: the presence or absence of competitive pressures, community desires regarding service providers, political philosophies regarding the organization's role, the evolution of services in the community, funding methods, and the design of the organization.

In La Crosse, WI, the mayor of the community wanted to add a city-owned ambulance to the fire department while retaining the long-standing private provider as well. He was met with

significant backlash from the community who raised concerns of property tax implications in doing so. The mayor's desire for better customer service through fire department involvement was met with stiff resistance from the citizenry of La Crosse. Despite the resistance and concerns of the community, the City Council passed the agreement (Marcus, 2008). From this situation, one can see that even though efforts are aimed at providing the best service possible for the community, sometimes the community does not want the service at the cost required.

In Charlottesville, VA, a Matrix Study was conducted by an outside agency and then reviewed by an internal EMS committee that concluded that the mixed service of city fire apparatus responding as first responders coupled with volunteer rescue squad transport services had a gap in both the number of ambulances needed and an adequate number of paramedics available to staff the needed ambulances. The result was the addition of two peak time ambulances with mixed staff of county volunteers and city paid personnel, as well as a full time paid ambulance of city fire personnel. The details of the Matrix Study were not available for review; however, the existence of such a tool could prove useful in determining response shortfalls as in Charlottesville (City of Charlottesville, 2008).

According to Cantu (2008) in Dallas, TX, the Fire Chief has recently released a plan to increase the number of ambulances on the street each day. Multiple reasons were cited including a 19.5% increase in call volume over an eight year period coupled with only a 3.5% increase in fire department staffing city-wide. During this same time period, the number of available firefighters per 1,000 calls fell 13.5%. The chief goes on to say that response times are not an issue currently as Dallas' response times are below the national average. The issue is that crews are being worked excessively. Dallas runs 44 ambulances each day and the average annual response volume is in excess of 4,600 calls.

According to the International City/County Management Association (ICMA) (2005) the most significant factors that contribute to the complexity of providing EMS are Service levels and response times, financial pressures, variety of agencies to contend with, changing labor environment, increases in service hours, abuse of the EMS system, disaster preparedness, and homeland security. Of these, service levels and response times are the most critical to patient outcomes and citizen satisfaction. In addition, ICMA (2005) reports that first response to critical calls is handled almost universally by the fire service, while 42% of all transporting agencies are fire service based.

Finally, ICMA (2005) goes on to identify the advantages and disadvantages of fire department based transport in EMS. The advantages were identified as: a) public confidence in the fire department b) integrated command and control c) public officials in direct control of the day-to-day operations and d) uses capacity currently available in the fire department. This document goes on to identify the disadvantages of fire service based EMS transport as: a) primary reliance on twenty-four hour shifts limiting the ability to match resources with demand b) complexity of labor agreements c) higher labor costs associated with cross-trained personnel d) requirements based on level of effort rather than on performance.

Unlike fire companies, which remain at constant staffing levels around the clock, the Fire Department of New York (FDNY) ambulances are staffed at 100% from 6 a.m. to 10 p.m. each day with a reduction to 65% staffing overnight as the call volume drops significantly. Ambulances also respond from street corners rather than fire stations so that starting points can be adjusted as necessary. The two primary factors used to determine the need for additional ambulances in New York City is call volume and response times. In addition, New York City is

anticipating a 15% increase in population over the next 20 years further driving the need for more EMS resources J.P. Martin (personal communication, August 27, 2008).

The second question used in this research effort centered on the same factors and criteria, only it shifted to non-fire department based ambulance transport providers. Once again, sources of information were readily available and their results are provided in the coming pages. ICMA (2005) applied the same factors contributing to the complexity of EMS service in the private sector and non-fire department based EMS system. Once again those factors were: service levels and response times, financial pressures, a variety of agencies with which to deal, changing labor climate, and increase in service hours and abuse of the system in general.

ICMA (2005) goes on to identify the various types of non-fire based EMS as the public utility model, third government service, private, for profit agencies, community based and/or non-profit agencies, and finally hospital based services. A brief synopsis of each type is provided below. The public utility model is a highly defined business structure where a public agency provides oversight of the service while contracting with a private entity for the day to day operation of the service. Elected officials often select the leadership of the organization and approve budgets. The third government service model is treated as a third uniformed service branch just as police and fire, but employs civilians in a separate department or district. The local or county government provides funding, capital equipment needs, maintenance, and other support functions just as any other department within the organization.

The third model discussed is the private, for profit agency. This format provides service through a contract with the local government entity which may or may not include rights to provide non-emergency services. This model may include contracts based on level of effort or performance. Clinical performance, assets, capitalization, and day to day operations are

managed wholly within the private sector. In the community based and/or volunteer non-profit model, service is provided by paid personnel, volunteers, or a combination of the two. The agency is governed typically by an independent board or committee. Service is often supported through donations, user fees, subsidies, or any combination of these types. Assets are often donated by the community, but controlled by the governing board or commission. The final model discussed in ICMA (2005) is the hospital based service. In this service model, the local hospital or a stand alone entity associated with the hospital provides the service. Contracts may be based on the effort level or performance. Services are frequently non-profit and draw on the hospital's clinical and administrative resources for support.

According to Leung (2008) the fire department and Southwest Ambulance, the area's private transport provider have settled recently on improvements to reduce response times. It goes on to identify improvements made as meeting regularly, adding more units to keep up with call volume, and plotting future ambulance stations to keep up with the explosive community growth being experienced in the area. In addition to the previously mentioned factors, two peak time ambulances were added to address high call volume times in the community.

In Colliersville, TN, managers with Rural Metro Ambulance are dealing with issues related to long response times and community outrage over the delays. While company officials accept and acknowledge that average response times have crept up to more than 9.2 minutes on priority calls, they have shifted a portion of the blame to the local hospital citing emergency room overcrowding and delays in patient drop offs as a cause for the long response times in the city. The area is currently serviced by six Rural Metro ambulances, and company officials acknowledge that more resources are needed (Bailey, 2008). Once again, response times and

community outcry come together to cause change in how an EMS service staffs a community and the quantity of resources with which it is staffed.

In Fort Worth, TX, a different culprit has surfaced as the cause of poor response time compliance by a non-fire based EMS transport service. Company officials with Med Star, the private service provider for EMS transport in Ft. Worth, TX and 14 neighboring communities have blamed a shortage of paramedics and the apparent inability of recruitment staff to fill vacancies in a timely manner for the decline in response times compliance. Currently, Med Star has an attrition rate of 30%. The current plan given by company officials is to hold a training academy for prospective employees to fill the current vacancies. Company officials also stated that current Emergency Medical Technicians (EMT) would be given the opportunity to attend paramedic school in return for a three year employment commitment to Med Star (Spangler, 2007).

According to City of Stillwater (2008) the recommendations of a citizen task force formed to address concerns for the city's ambulance service made the following observations and recommendations: a) stop manning ambulances with firefighters as soon as possible to eliminate paying the wages of a firefighter for driving an ambulance. The report identified a $41,000.00 difference in the average pay of an EMT in Oklahoma and that of a firefighter with the Stillwater Fire Department b) Contract with a local private ambulance provider or the local hospital to handle transport services currently handled by the fire department c) use the firefighters freed up from elimination of the ambulance service to fill the vacancies and new positions needed in the fire department currently. The root cause for creating this citizen task force was identification by members of the Fire Department staff that response times were poor regarding ambulances and delays in transport were frequent because of call volume increases.

In yet another twist to the already prevalent issue with response times being the driving force behind addition of services, American Medical Response (AMR) in Santa Clara County, CA has written into their contract to contract themselves with local first responder agencies in an effort to require those agencies to bolster their own services to help reduce response times. By taking this action, AMR has been able to not only save money on equipment and salaries, but it also enables and empowers the local first responders to recoup some of their expenses through the transport provider. If the first responder fails to meet response time requirements, AMR penalizes that agency much in the same way many communities penalize private ambulance providers for failing to meet response time requirements (Becknell, 2002).

The third research question defined for this effort centered on various staffing options for deployment of ambulances. The research pool was adequate to provide a footprint of how other agencies are currently providing EMS services and the multitude of ways in which that effort is accomplished. Currently, the CFD staffs its only ambulance with two paramedics each day. According to ICMA (2005) no study has shown that using two paramedics in one ambulance provides any advantages to the patients or the care providers.

In 2006, the Chicago Fire Department began utilizing a two tiered response to EMS calls. Two tiered response involves sending basic life support (BLS) ambulances staffed with EMT's to assess the patient and determine if advanced care will be needed. If advanced care is needed, an advanced life support (ALS) unit is requested which is staffed with two paramedics. In most instances, the BLS unit can handle the call and the ALS unit is able to stay in service for other emergencies. This program has been so successful; the fire chief is recommending increasing the BLS units by six before the end of the year (Spielman, 2006).

According to King County, WA (2002) during an update to their strategic plan, officials cited the following in their final report:

> "The regional tiered response system of 911, dispatch, BLS, and ALS enjoys an international reputation for innovation and excellence in out of hospital urgent and emergent care. For the past 30 years, the system has maintained the highest reported survival rates in the treatment of out of hospital cardiac arrest patients across the nation. Resuscitation rates averaging 16% for sudden cardiac arrest patients and 33% for those patients in ventricular fibrillation are typical in this region."

In Ft. Worth, TX, members of the Area Metropolitan Ambulance Authority who oversee the ambulance provider Med Star struck a deal with the City of Ft. Worth Fire Department to put Ft. Worth firefighters on some of Med Star's ambulances to curtail staffing shortages and long response times to outlying areas of the city. In addition, six brush truck crews have been spread out across the city outside of fire stations in distant portions of the city to reduce response times in those areas as well (Spangler, 2007). At the time of this decision, Med Star was short 16 of the 77 paramedics needed to accomplish full staffing. In addition, 22 of the 77 EMT positions also remain vacant (Spangler, 2007).

According to Compton (2007) more than 90% of fire departments across the country deliver EMS at some level to their citizens. He goes on to say "There is no system better situated for rapid multi-faceted response than the fire service based system." Compton (2007) goes on to identify the three types of fire service based EMS systems as: a) cross trained multi-role firefighters who provide care and transport b) fire department employees who are not cross trained fire suppression personnel, but accompany firefighters to provide care and transport c)

cross-trained multi-role firefighters who provide patient care, but transfer the patient to a private service with whom they contract for transport.

According to Stout, Pepe, & Mosesso (2000) an all ALS ambulance system provides complete operational efficiency. In addition, having a paramedic on every ambulance eliminates the need for dispatch triage capabilities and the need to call for ALS units such as in a two tiered system. However, Stout et al (2000) also suggests that all paramedic services may create a dilution of paramedic clinical experience due to more than 90% of EMS calls not requiring advanced care and treatment. This saturation of paramedics can have a reverse effect of creating decreased competence due to lack of skills practice and patient assessment exposures.

According to EMS Best Practices (2000) the state EMS office in Wisconsin sought to change a then 25 year old rule that required two paramedics on every ambulance in the state. The same situation holds true in areas such as Hennepin County, Minnesota which repealed its rule similar to that of Wisconsin in 1999. In 1995, Anchorage AK fire officials made the switch as well reducing the number of paramedics per ambulance from two to one. EMS Best Practices (2000) goes on to say that at the time there was no published research which clearly supports or negates single vs. dual paramedic systems.

According to ICMA (2005) the way an ambulance in a community is staffed and the type of system utilized is almost completely open to those in charge of the organization which will provide transport services. The following summation clearly explains this circumstance:

> "Staffing depends on the level of service provided. BLS ambulances are traditionally staffed with two EMT's. ALS ambulances have a number of staffing combinations, including one EMT and one paramedic, one EMT-intermediate and

> one paramedic; and two paramedics. Each ALS option has its advantages, but all can satisfy the need for paramedic care.
>
> Some communities use two paramedics because of the assumption that two advanced workers are better than one-and the belief that sharing the call volume will reduce burnout. But no study has shown that using two paramedics provides any advantage. Furthermore, a recent study by *USA Today* found that EMS systems with fewer paramedics actually save more lives."

ICMA (2005) goes on to say that there is no solid research information to suggest that one form of EMS system is better than any other. Single tier vs. dual tier is completely up to the providers in the service area. Each system has their benefits, but each also has their flaws. The right choice clearly depends on a host of local factors not pertinent to the systems themselves.

The final area of research on this topic centers on identifying any federal, state, and/or local laws or guidelines related to ambulance staffing and response. At the federal level, organizations such as the National Fire Protection Association (NFPA) and the National Institute of Health (NIH) are known to provide oversight recommendations coupled with response time requirements for ambulances. At the state level, the Texas Department of State Health Services provides operating guidelines and staffing requirements for various levels of ambulance service. At the local level, all directives for ambulance staffing and deployment are found in the individual department's Standard Operating Procedures.

According to NIH (1993) 90% of all top priority emergency medical calls should receive an ALS responses to the scene of the emergency in less than nine minutes of the initial call for service. The hope of this requirement is that a median ALS response of four to five minutes on average will be accomplished. There is no mention in this recommendation of an ambulance,

only that an ALS response must be made in this time frame. Currently all CFD fire apparatus are staffed each day with a minimum of two paramedics carrying a full complement of ALS supplies and equipment.

Another nationally recognized organization with a heavy involvement in EMS is the American Heart Association (AHA). This organization's principle goal is to reduce the number of deaths caused by coronary artery disease each year. They have created a chain of survival protocol which includes administration of ALS treatment as a component. This protocol defines onset of irreversible brain damage from cardiac arrest as having an onset time of four to six minutes. AHA recommends early arrival of ALS treatment, but offers no response time related information other than the times associated with onset of brain damage (AHA, 2008).

According to NFPA (2001) the five basic requirements of a fire department based EMS system are: a) initial response to provide treatment at the scene of the emergency b) BLS response ability c) ALS response ability d) patient transport in an ambulance or other properly equipped vehicle e) assurance of care provided through a quality management process. This document does stipulate that the fire department has a requirement to participate in any or all of these requirements. In other words, participation in all aspects of EMS service from first response through transport is not required. The only requirement is to the level set by the local jurisdiction having authority.

In addition to these requirements, NFPA (2001) goes on to set response time requirements as well. Fire department first response with Automatic External Defibrillator (AED) capabilities must be accomplished within four minutes 90% of all related calls. The requirement for arrival of ALS capable personnel and equipment is set at eight minutes from the time of dispatch also at 90% of the responses to cardiac related calls. Currently, the CFD has

AED capable full cardiac monitor/defibrillators on all fire apparatus. In addition, all Colleyville Police Department vehicles are equipped with AED's as well. Finally, NFPA (2001) requires that during an ALS response a minimum of two paramedics and two EMT's be on the scene of the emergency to render care.

Currently, the Texas Department of State Health Services (TDSHS) provides governmental oversight into the types of ambulance service levels and the minimum staffing requirements of those response vehicles. The three current ambulance certification levels are BLS, BLS-Mobile intensive Care Unit (MICU) capable, and MICU. In addition, the state of Texas recognizes five levels of EMS personnel certification as well. Those levels are Emergency Care Attendant (ECA), EMT, EMT-Intermediate (EMTI), Paramedic, and Licensed Paramedic (TDSHS, 2008).

The minimum staffing requirements for a BLS unit are two ECA's. The minimum staffing requirement for a BLS-MICU capable unit depend on the level to which to unit is currently functioning. When functioning as a BLS unit, the minimum staffing is again two ECA's, when functioning as an MICU; the minimum staffing requirements become one EMT and one Paramedic. The same staffing level is required for full time MICU apparatus, one EMT and one paramedic. There is no provision anywhere in the requirements for two paramedics at all times on the unit. Staffing requirements above these minimum levels are left up to the local authority having jurisdiction (TDSHS, 2008).

Our local direction is provided by the CFD Standard Operating Procedures (SOP) which dictates that one ambulance will be in service each day staffed with two paramedics (CFD, 2008). Currently our medical director has no requirement beyond compliance with state staffing mandates, but does suggest that two paramedics should be used on the ambulance when possible

to facilitate greater assistance to one another (J. Ansohn, personal communication, August 23, 2008).

Following review of available literature on the topic of this research, the researcher conducted brief interviews with chief officers from the seven municipalities directly bordering Colleyville. The cities interviewed included Bedford, Euless, Hurst, Grapevine, North Richland Hills, Southlake, and Keller. These cities are significant due to their frequent use as comparative entities in our area. These cities serve as benchmarks for many research efforts such as salary comparisons and service models. Because of their importance in our area and the frequency of their use for comparative purposes, the researcher felt it necessary and important to include them in this research. The seven chief officers were asked a series of eight questions during their interview process and a summary of their responses is included below.

The first interview question asked the chiefs to identify how many ambulances were currently in service in their cities. The cities of Bedford, Euless, Grapevine, and North Richland Hills each have three ambulances in service each day, while the cities of Hurst, Keller, and Southlake have two ambulances in service each day. The next interview question asked chiefs to identify the average annual response volume for their ambulances. Those averages ranged from 800 per year in Southlake to 2,000 per year in Bedford with an overall average of 1,200 calls per year per ambulance.

The third question asked interviewees to identify critical factors and criteria for determining when there was a need to add an ambulance. Though none of the interview participants felt their current organizations needed to add an ambulance, they identified the following as the factors to consider: call volume, response time, cost, out of service time, city growth and expansion, hospital times, other workload such as fire responses, and facilities to

house additional response resources. Of these responses, call volume, response time, and implementation costs were cited by all interviewees as significant.

The fourth question asked participants how their current ambulances are staffed. All interviewees except Bedford and Grapevine identified their staffing as two paramedics. The two exceptions, Bedford and Grapevine staff with two paramedics most of the time, but are able to use one paramedic and one EMT when necessary. The fifth question asked participants to identify any other staffing options used by their organizations to deploy additional ambulances. Without exception, all interviewees stated they do not have staffing plans for extra ambulances other than use of overtime resources for staffing during special events.

The sixth question asked participants to if fire apparatus are ever taken out of service to staff additional ambulances. The response to this question by all cities was "No" under any circumstances. The seventh question asked participants if they had ever considered use of an alternative ambulance provider such as a private source, all parties interviewed answered "No" to this question as well. The final interview question asked of all participants was whether or not an additional ambulance in Colleyville would be beneficial to their organizations, and all parties answered "Yes" to this question citing increased customer service and improved overall patient care as the main values of this added resource.

In summary, clear evidence has been found with which to move forward in resolving the current issue facing the Colleyville Fire Department. It is clear that response times, financial impact, and staffing concerns are the three major factors facing both fire service based EMS providers and private or independent providers. In addition, it is also clear that there are no widespread standard requiring two paramedics on an ALS ambulance; in fact, this research has found that this scenario is indeed the exception rather than the rule when it comes to staffing

ambulances across the country. It is also evident from this research that paramedic shortages are being felt all across the country and are contributing to the decisions being made not to use two paramedics. Finally, this researcher was surprised to find that other than response related suggestions and requirements, no clear program or system is in place to determine when and if additional staffed ambulances are needed in a community. Clearly, these decisions have been left up to the officials of the local jurisdictions to decide and implement as they deem necessary.

Procedures

In preparing to complete this research effort, the initial background research was conducted in the Learning Resource Center (LRC) while the researcher was attending his final Executive Fire Officer class. Searches within the LRC were done using the keywords "Ambulance Staffing" and "Adding Ambulances". An additional search was completed just prior to leaving the campus using the keyword "EMS Systems". Upon returning home, the next component of this research was completed by developing a survey instrument to aid in answering the four established research questions with current data relevant to the project goals. This survey was developed using the website www.surveymonkey.com. The survey was distributed to every state Fire Chief's Association across the country as well as being posted on the website of the National Society of Executive Fire Officers (NSEFO). A period of 60 days was used to collect this data with a total of 106 surveys being completed and returned. A copy of the survey instrument is available in Appendix A. Though the population of the surveys returned was less than initially hoped for, this researcher believes that the data collected still provided valuable information on current trends and practices pertinent to the subject matter. The information received provided a detailed list of factors to consider when determining the need for additional

ambulance resources, as well as a significant list of staffing options to utilize on additional ambulances in the organization.

The next step in the research process was to make an email request to the LRC for assistance with additional sources of information on the topic. Within approximately 30 days, a packet of information totaling more than 200 pages of material arrived in the mail. This process proved to be very lucrative in terms of useful information for the literature review portion of this project. Similar searches to what was conducted by the researcher at the LRC were done with expanded search criteria. The results were once again extremely beneficial to this project and this researcher would highly recommend using this service with any future research effort.

The final component of this research effort was to conduct interviews with seven local fire chiefs whose jurisdictions border Colleyville. The cities chosen are often referred to as our "peer cities" and information gathered from these communities is often utilized for statistical comparison on a variety of topics. The interviews consisted of an eight question form and the average interview took less than 15 minutes to conduct per city. A copy of the interview questionnaire is available in this document as Appendix B. The interviews yielded a great deal of valuable information which will prove to be crucial in seeing this effort through to reality. The weight our neighboring communities carry with our city staff and elected officials is significant and invaluable when showing a need such as the one related to this topic.

Limitations Noted:

While conducting this research effort several limitations beyond the control of the researcher were noted. The first of these is the population of the survey responses. The initial survey completion requests were sent out to 51 organizations all across the country. The surveyed population should have numbered in the thousands of possible responses, but the end

result only yielded 106 completed surveys. This disappointing yield in the opinion of this researcher can be tied to several factors including saturation of fire service professionals with survey completion requests, unwillingness on state associations to send out the requests across their organizations, and an overall attitude of being "too busy" to complete these instruments. It is the opinion of this researcher that future EFO students will struggle to gain adequate survey response populations for the reasons mentioned previously.

Secondly, the amount of information available on the topic of adding ambulances was minimal at best. The sources found and used in this research discussed factors related to addition of ambulances from related, but not exact approaches. The information was available, but it had to be extracted from sources and analyzed for meaning rather than providing a clear response to the question. In the end, the questions were able to be answered, but the information was difficult to retrieve in order for conclusions to be drawn. This researcher attributes this limitation to the fact that little or no current research information was available in a clear format on the topic used for this document.

Results

The results of this research effort were taken from a three fold approach. A comprehensive search and review of literature on the topic was completed, a nationwide survey effort was attempted, and finally interviews with local fire chiefs whose communities have the greatest impact on the Colleyville area were questioned on the research topic. A detailed analysis of the information gathered from this research effort follows.

The initial research question dealt with identifying critical factors and criteria utilized when determining the need for additional ambulances. In order to answer this question, a nationwide survey and interviews with local fire officers were utilized to gain a current

perspective against which to contrast the literature review. The only identifying features of the survey were in question #1 which asked for the name of the fire department and the city and state where it was located.

Question #2 asked respondents to identify whether or not their fire service organization provided ambulance transport service. The results are listed in the table below:

Ambulance Deployment and Staffing		
Does your fire department provide ambulance transport services?		
Answer Options	**Response Percent**	**Response Count**
Yes	78.8%	82
No	21.2%	22
	answered question	**104**
	skipped question	**2**

As one can see from the survey results roughly four out of five respondents provide ambulance transport service as a component of their service delivery. In addition, the CFD has provided ambulance transport since 1989 and all seven peer cities to Colleyville currently provide ambulance transport service.

Question #3 in the survey provided an opportunity for the departments who previously answered "no" to provide contact information for their ambulance transport provider. A total of 24 responses were submitted to this question despite only 22 respondents indicating that they did not perform ambulance transports in their department. Those results are listed below:

#	Response Date	Response Text
1	08/27/2008 19:10:00	Mast Ambulance (don't know an email for them)
2	08/27/2008 19:10:00	Patricia.Fields@nhhn.org
3	08/27/2008 20:21:00	jboyd@co.livingston.mi.us
4	08/27/2008 20:41:00	N/A
5	08/27/2008 21:01:00	it is provided by numerous private companies.
6	08/27/2008 21:10:00	amrcorporate@amr-corp.com & www.medicwest.com/
7	08/27/2008 22:02:00	Greg Bounds (greg.bounds@co.robeson.nc.us)

8	**08/28/2008 01:28:00**	jwillson@city.cleveland.oh.us
9	**08/28/2008 12:15:00**	lscivicque@brgov.com
10	**08/28/2008 15:33:00**	AMR Northwest, HQ in Portland, OR
11	**08/29/2008 16:33:00**	sweetwatermedics@live.com
12	**08/29/2008 16:37:00**	roy.hunter@clemc.us
13	**08/29/2008 18:57:00**	swheeler@jancare.com
14	**08/29/2008 19:03:00**	N/A
15	**08/31/2008 18:00:00**	Sedgwick County Ems
16	**09/02/2008 13:51:00**	phone -- 919-470-7351
17	**09/02/2008 16:05:00**	jlocke@mercyregionalems.com
18	**09/02/2008 22:24:00**	jsloop@budsambulance.net
19	**09/03/2008 15:16:00**	Private transport arranged by Hospital or patient's family
20	**09/04/2008 18:23:00**	http://budsambulance.net/
21	**09/09/2008 02:35:00**	MEDSTAR
22	**09/12/2008 01:50:00**	Alachua County Fire Rescue
23	**09/29/2008 21:44:00**	n/a
24	**09/30/2008 13:04:00**	sunstarems.com

The only one of the listed companies who responded to the request for survey participation was Patricia Fields and her survey responses are part of the summary tables. All other entities failed to respond to the survey within the 60 day window allotted for survey collection.

Question #4 asked respondents to identify which of the factors listed would have the greatest to the least impact on their decision to add an ambulance to their organization. The results are listed below:

Ambulance Deployment and Staffing

Please rank the following factors related to implementing additional ambulances in your organization from most impactful to least impactful.(1 being least impactful, 5 being most impactful).

Answer Options	**1**	**2**	**3**	**4**	**5**	**Response Count**
Personnel Costs	11	1	1	5	69	87
Equipment Costs	2	12	18	49	6	87
Insurance	25	21	24	9	5	84
Maintenance	5	43	24	7	5	84
Housing Capacity	44	9	20	13	5	91
					answered question	**95**
					skipped question	**11**

The results of the survey for this question make it very clear that the factor having the most impact on adding an ambulance to their organization is personnel costs. Following in a distant second is equipment costs followed by insurance and maintenance costs which tied for third. Last, but not least, was having the capacity to house the additional unit. In the interviews with peer city fire chiefs, other factors to consider included call volume, response time, other workload on employees, regularity of missed calls due to units being out of service on other emergencies, and again housing capacity for the additional unit.

Question #5 addressed any other factors of importance not listed in the survey instrument itself. A total of 35 additional responses were received and those responses are listed below:

#	Response Date	Response Text
1	08/27/2008 19:10:00	N/A
2	08/27/2008 20:41:00	Call Volume
3	08/27/2008 23:42:00	Service to our Citizens
4	08/28/2008 01:44:00	Should additional ambulances be ALS or just first out
5	08/28/2008 11:01:00	Considering the use of ALS engines
6	08/28/2008 16:46:00	Employee classification (safety or non safety)
7	08/29/2008 16:33:00	Chartered as a Fire Protection District;
8	08/29/2008 17:48:00	Interfacility transports
9	08/29/2008 19:19:00	Political support for additional capital assets
10	08/29/2008 19:19:00	We have a 4th ambulance set up for ALS and used in reserve
11	08/29/2008 19:19:00	Need vs total ambulances in area available ARA
12	08/29/2008 19:40:00	We have a strict ambulance ordinance since 2001
13	08/29/2008 19:41:00	Training Cost
14	08/29/2008 20:04:00	Relationship with 4 volunteer squads
15	08/29/2008 20:17:00	the last question was difficult to answer / rank appropriately
16	08/29/2008 21:15:00	based off the call volume.
17	08/29/2008 21:23:00	assessing the need would be the most impactful
18	08/30/2008 14:08:00	Additional ambulance not needed at this time
19	08/30/2008 15:32:00	we cut ambulances due to not enough medics to staff
20	08/30/2008 15:49:00	Extended transport time causing units to be out of service.
21	08/30/2008 18:37:00	Number of Times all ambulances are on calls.
22	08/31/2008 11:55:00	Continuing education, safety, rising fuel costs.
23	09/02/2008 13:51:00	Approval from County EMS Director
24	09/03/2008 22:38:00	The State Department of Health determines need.
25	09/04/2008 21:29:00	Utilization
26	09/05/2008 01:37:00	Mutual aid/sufficient coverage
27	09/08/2008 19:32:00	Number Of Ambulance Calls
28	09/24/2008 14:23:00	How frequently is mutual aid received.
29	09/24/2008 19:51:00	Justification based on call volume

30	**09/24/2008 20:00:00**	staffing & equipment costs
31	**09/29/2008 20:53:00**	Paramedics are becoming harder to recruit
32	**09/29/2008 21:44:00**	none
33	**09/30/2008 04:50:00**	Funding from our EMS Levy funded the last additional unit.
34	**09/30/2008 16:06:00**	Staffing is the major issue for us.
35	**09/30/2008 19:26:00**	Need

This list of factors provides a good additional base of consideration in moving forward in the future with this project.

Question # 6 asked participants to rate five additional factors on the degree of impact they would have on adding medical transport units to their operations fleet. The results are listed below:

Ambulance Deployment and Staffing

Please rate the following in terms of their impact on adding additional ambulances to your organization.

Answer Options	**No Impact**	**Little Impact**	**Neutral**	**Some Impact**	**Great impact**	**Response Count**
Call Volume	3	3	4	23	60	93
Response Times	3	5	6	33	46	93
Crew Exhaustion	10	26	14	37	6	93
Public Outcry	17	18	18	21	19	93
Direction From Elected Officials	11	9	21	23	29	93
					answered question	**93**
					skipped question	**13**

Based on the survey results above, call volume followed by response times would have the greatest impact on assessing the need for more ambulances. Crew exhaustion was considered by more than one third of respondents to have some impact on the decision as well. Public outcry was found to also have some impact on the decision while almost one third of participants felt like direction from elected officials would have a great impact as well. Interview responses from

local fire chiefs support the data from the survey in that call volume and response times would likely create the greatest impact on moving forward with requests for additional ambulances.

Question #7 offered respondents the opportunity to list any other factors which impacted their decision making to add ambulances. 21 additional responses were submitted and their summary list is provided on the next page:

#	Response Date	Response Text
1	08/27/2008 19:10:00	N/A
2	08/27/2008 19:42:00	Is there a real need for additional units.
3	08/28/2008 11:01:00	adding a 4th ambulance due to call volume and responses
4	08/28/2008 12:02:00	Out of service times due to longer transports
5	08/28/2008 16:46:00	Payor mix of population (no insurance/medicare/PPO)
6	08/29/2008 16:33:00	no
7	08/29/2008 17:41:00	Out of date units
8	08/29/2008 19:25:00	Flexible Deployment for Peak Demand Periods
9	08/29/2008 19:40:00	All are critical factors with significant impact
10	08/29/2008 19:41:00	Maintaining Training Requirments
11	08/29/2008 20:04:00	The units are breaking down more frequently
12	08/29/2008 20:17:00	deployment model
13	08/29/2008 21:23:00	Level of service is the most critical
14	08/30/2008 15:49:00	specifically having layers of units for secondary calls.
15	08/31/2008 17:37:00	Skilled nursing facilities and transport distance
16	09/02/2008 15:09:00	Calls transferred to another service
17	09/03/2008 15:16:00	WE only have one ambulance in service
18	09/24/2008 15:36:00	Union politics
19	09/29/2008 21:44:00	NFPA 1710
20	09/30/2008 04:50:00	City wide response time performance
21	09/30/2008 19:26:00	Overall Community Risk assessment

Once again, another detailed list of additional considerations has been provided by respondents who answered this question. These responses will serve to better prepare our organization for considering this move in the future.

Question #8 asked respondents to identify the manner in which their ambulances were staffed while in service. 91 participants answered this question providing a solid base from which to make considerations in the future. Their responses are listed in the table below:

Ambulance Deployment and Staffing		
How are ambulances in your organization staffed?		
Answer Options	**Response Percent**	**Response Count**
One EMT, One Paramedic	30.8%	28
Two Paramedics	49.5%	45
Two EMTs	9.9%	9
Other	17.6%	16
	answered question	**91**
	skipped question	**15**

As evidenced in the results, close to half of respondents who answered this question currently staff their ambulances with two paramedics. Another one third of participants staff units with one paramedic and one EMT. From this data it is clear that at least 80% of respondents are providing ALS level medical transport and potentially more in the "other" category. Only 10% of respondents indicate the staffing of a BLS unit. Currently, all seven fire chiefs in the local area are staffing their ambulances with two paramedics most all the time, while they have the capacity to run with one EMT and one paramedic in Bedford if they chose or needed to do so due to staffing.

Question #9 asked respondents to further explain their responses if they marked "other" in the previous question. Although only 16 respondents marked other in question #8, 21 participants responded to this question. The results of that response are below:

#	Response Date	Response Text
1	**08/27/2008 20:41:00**	N/A
2	**08/28/2008 11:01:00**	Staff with three people, critical calls need 2 P/M
3	**08/28/2008 11:06:00**	Rarely there are two medics- usually one medic one EMT
4	**08/28/2008 12:02:00**	2 Medics and 1 EMT
5	**08/29/2008 16:33:00**	will provide personnel for assistance as needed.

6	**08/29/2008 17:48:00**	EMT-Intermediate / Paramedic
7	**08/29/2008 18:57:00**	No ambulances
8	**08/29/2008 19:41:00**	N/A
9	**08/29/2008 20:04:00**	we staff all of our engines ALS first.
10	**08/30/2008 20:35:00**	3 Paramedic's
11	**08/31/2008 11:55:00**	We are only required to have 1 Para, 1 EMT-B.
12	**08/31/2008 17:37:00**	3- ALS engines staffed with one paramedic & 2 EMT-B's
13	**08/31/2008 21:15:00**	One Driver PM and one tailboard PM
14	**09/01/2008 04:08:00**	No ambulances in our organization
15	**09/03/2008 19:03:00**	EMT-I and EMT-P on two and P/M car
16	**09/04/2008 21:29:00**	Two Paramedic, One EMT
17	**09/24/2008 19:51:00**	we will use two EMT's if we are short paramedics on duty.
18	**09/29/2008 21:44:00**	n/a
19	**09/29/2008 22:14:00**	BLS is two EMT's, ALS is 2 paramedics
20	**09/30/2008 04:50:00**	ALS/BLS Tiered system
21	**09/30/2008 19:26:00**	Two Paramedics/One EMT

Once again, a thorough list of options has been presented which will increase choices and secondary considerations moving forward with this project.

Question #10 asked respondents to identify how ambulance crews are established within their organizations. The intent of this question was to identify any alternative ways of supplementing current resources other than full time staffing of an ambulance. The results are listed below:

Ambulance Deployment and Staffing		
How are ambulance crews established in your organization?		
Answer Options	**Response Percent**	**Response Count**
Dedicated crew at all times on all ambulances	61.5%	56
Staff ambulance from fire apparatus personnel as needed	35.2%	32
Call back personnel for staffing additional ambulances	8.8%	8
Other	16.5%	15
	answered question	**91**
	skipped question	**15**

As one can see, almost two thirds of those who answered this question staff their ambulances with a dedicated crew at all times. In addition, just over one third of respondents staff ambulances from fire crews as needed to bring on extra medic units. Lastly, just less than 10% of respondents use the call back methods for extra staffing on ambulances. Currently, the CFD staffs only one ambulance at all times and must call for a mutual aid response when that ambulance is occupied on another call. The peer city fire chiefs in their interviews all had similar answers to this question. Each city staffs all of their ambulances full time and calls for mutual aid when all ambulances are out of service on previous calls. In addition, all interviewees stated that they hire back overtime personnel when staffing up extra units for special events or emergency management related issues.

Question #11 allowed respondents who chose ”other” on the previous question to provide a more detailed answer to how they establish their ambulance crews. The results were as follows:

#	Response Date	Response Text
1	08/27/2008 20:41:00	N/A
2	08/28/2008 01:44:00	There are times administrative officers have to staff due to multiple calls
3	08/28/2008 11:23:00	First unit dedicated others staffed from other apparatus
4	08/29/2008 16:45:00	Single role providers & fire personal
5	08/29/2008 17:41:00	We are a combination department. Med Unit is staffed as call is received.
6	08/29/2008 18:57:00	No ambulances
7	08/29/2008 19:41:00	N/A
8	08/29/2008 20:04:00	Staff 17 24/7, with mixed crews (pd/vol)
9	08/29/2008 20:17:00	extend on duty +5 hrs, recall + 5 hrs ahead of shift for max of 15 hrs
10	08/30/2008 18:37:00	All Ambulance are staffed by fire crews on a rotation,
11	09/01/2008 04:08:00	No ambulances in our organization
12	09/03/2008 22:38:00	Dedicated Paramedic with rotating EMTS from the Engine Company.
13	09/05/2008 21:31:00	Dedicated crews on 2 ambulances and jump company on 3rd
14	09/24/2008 19:51:00	All personnel work on multiple units
15	09/26/2008 21:18:00	Staff some always/some fire crews/some vols.
16	09/29/2008 21:21:00	fire apparatus personnel staff 3 others as needed (cross-staffed)
17	09/29/2008 21:44:00	n/a
18	09/29/2008 22:03:00	Rotation of cross trained personnal from from fire to medic units
19	09/29/2008 22:14:00	paramedic unit always staffed

20	09/30/2008 04:50:00	All personnel part of the on duty fire suppression daily staffing
21	09/30/2008 19:26:00	Jump Company

Once again, a plethora of options has been presented by those who did not fit into the confines of the previous question options. It is evident that there are many ways to staff additional ambulances on an as needed basis without providing full time staffing on units which may be utilized less than other primary response units.

Question #12 asked respondents to identify whether or not their local jurisdiction and/or state had any requirements governing the number of ambulances on duty each day. The results are located in the table below:

Ambulance Deployment and Staffing		
Does your state and/or jurisdiction have requirements regarding the number of ambulances your organization staffs on a daily basis?		
Answer Options	**Response Percent**	**Response Count**
Yes	19.6%	18
No	80.4%	74
	answered question	**92**
	skipped question	**14**

As the results to this question show, less than 20% of survey respondents indicated that their state or local jurisdiction had any rules related to the number of ambulances staffed by an organization each day. After interviewing the peer city fire chiefs, there was unanimous agreement that the state of Texas has no such rules in place either. Those participants who answered “no” were asked in the next question to provide the name of the agency which enforces these requirements on the local jurisdictions.

Question #13 is the final survey question and serves as a follow up from question #12 in detailing out state and local entities which require pre-determined amounts of ambulances in a service area. The results are as follows:

#	Response Date	Response Text
1	08/28/2008 01:44:00	Department of Family Services Emergency Medical Division
2	08/28/2008 16:46:00	Meet response time requirements of 15 minutes code 2 90% of the time
3	08/29/2008 19:19:00	Illinois Department of Health
4	08/29/2008 19:40:00	EMS, Inc. - an oversight agency
5	08/29/2008 19:41:00	N/A
6	08/29/2008 20:04:00	We always staff our 11 24/7 pieces.
7	08/29/2008 20:17:00	Response time compliance drives the issue
8	08/29/2008 21:15:00	We have constantly staffing for three ambulances daily.
9	08/29/2008 21:23:00	This is determined by the level of service set by the local gov't.
10	08/29/2008 21:33:00	local deployment policies. Our EMS System reports to IL Dept of Public Health
11	08/30/2008 18:37:00	Texas Department of Health,
12	08/31/2008 17:37:00	Department Staff Policy
13	09/01/2008 04:08:00	Gallatin County Board
14	09/03/2008 22:38:00	Department of Health. The State funds the ambulance program in each county.
15	09/05/2008 01:37:00	Verdugo Fire District (Area C0
16	09/12/2008 16:42:00	Utah State Bureau of EMS
17	09/24/2008 14:23:00	Broward County, FL which defines the number of units we staff on a daily basis.
18	09/24/2008 20:00:00	James City County Fire/EMS
19	09/29/2008 21:44:00	n/a
20	09/29/2008 22:14:00	Washington Dept. of Health
21	09/30/2008 16:06:00	Oregon has service areas that are set by a committee at the county level.
22	09/30/2008 21:02:00	Department of Health & Family Services - EMS Division

In addition to local requirements, the majority of these additional responses indicate that state agencies are the progenitors of these quantity guidelines. The remaining responses indicate a fair amount of county influence which is not an uncommon situation in the eastern United States that relies more heavily on county government at the local level. However, in Texas, county governments are minimally involved in local government and even less involved in most cases with fire and EMS response agencies.

Though the number of survey responses was less than anticipated for this research project, a fair representation of how different parts of the country address EMS response needs was achieved. The interviews with peer city fire chiefs in our area clearly indicate our congruence in the way we currently operate both together and apart. Finally, a significant amount of options in multiple areas has been identified which will prove significantly useful to our organization in the days ahead as we delve into this effort to grow our response capabilities. The following section will provide a detailed analysis of how the survey and interview results compare to the live data received in the nationwide survey.

Discussion

At the onset of this research, it was the intent of this researcher to identify factors and criteria for determining the need for additional ambulances for both fire service based and private or independent providers in a given service area. In addition, identification of staffing options for additional ambulances as well as local, state, and/or federal requirements for the number of ambulances in a given community. This research effort has been accomplished through the use of an extensive literature review, a nationwide survey, and personal interviews with local fire chiefs closely associated with and impacted by the CFD.

The first two research questions addressed critical factors and criteria to consider in determining the need for additional ambulances in both fire based and private provider settings. ICMA (2005) identified 42% of EMS ambulance transport agencies as being fire service based, while survey results indicated roughly 80% of respondents were from fire service based ambulance transport systems. Locally, all peer cities as well as the CFD conduct fire department based ambulance transport service.

In the literature review, one factor brought forth by both Krakeel (1998) and Marcus (2008) was the need to consider the level of service desired by the community, and more importantly what they were willing to fund. Results from the nationwide survey support this finding as survey respondents felt that public outcry would have at the very least "some impact" on making decisions to enhance services. There has been no public outcry per say regarding this topic, however the frequency with which we are receiving questions and concerns from those who are waiting for mutual aid ambulances is increasing.

According to Cantu (2008) response time concerns as well as crew exhaustion have prompted the fire chief in Dallas, TX to add additional ambulances during peak load hours of each shift with a long term plan to add more full time ambulances to decrease overall workload on paramedics. ICMA (2005) supports this finding in that response times and increases in service hours are significant factors which contribute to the complexity of EMS service delivery. ICMA (2005) identifies service levels and response times as the two most critical factors affecting patient outcomes and citizen satisfaction. Survey respondents felt like call volume and response times would have a great impact on their need to add ambulances, but felt that crew exhaustion would only have "some impact" on the decision making process. According to J.P Martin (personal communication, August 27, 2008) response times and call volume are the two greatest factors used by officials to determine need to add ambulances. Crew exhaustion within the FDNY is minimized by EMS crews working only eight hour shifts rather than the 10 and14 hour shifts worked by firefighters. All members of the peer cities and the CFD work a three platoon schedule of 24 hours on duty and 48 hours off duty.

Currently, call volume is not a huge concern in Colleyville as our ambulance crews respond to only 650 ambulance calls per year. However, over the last few years we have seen

the frequency of multiple calls at a time increase resulting in an average of six to ten mutual aid ambulance calls per month and an average second ambulance response time in excess of 12 minutes (CFD, 2008). Crew exhaustion is also not an issue as our crews average a total of five or six emergency responses per day with an average of two to three EMS calls in that number. The only peer city who cited crew exhaustion as a potential concern was the city of Bedford which averages 2,000 calls per ambulance annually with a fleet of three front line ambulances (Richardson, J., personal communication, October 30, 2008).

According to Leung (2008), Southwest Ambulance, the provider of EMS transport services in Surprise, AZ recently re-negotiated their contract to address issues with long response times in their service area as well. Similar situations occurred with Med Star EMS in Ft. Worth, TX. According to Spangler (2007) Med Star not only has had significant issues with response time compliance in member cities of which there are 15, but is also experiencing a significant shortage of paramedics and a 30% turnover rate. In an effort to correct this shortfall, a training academy for new recruits is being conducted and firefighters from Ft. Worth FD are filling in on some ambulances to assist with the shortfalls.

In Colliersville, TN, private ambulance providers have blamed long response times on overcrowding in the local emergency room and delays in transferring patient care to hospital staff (Bailey, 2008). In yet another unique response time scenario, AMR ambulance in Santa Clara County, CA contracted with local fire departments to provide ALS first response to comply with contractual requirements for the arrival of ALS care. The private provider has the ability to penalize the local fire departments for failing to meet response time criteria in their own districts (Bucknell, 2002).

Response times from private providers do not directly affect the CFD or any of the peer cities as all are fire based systems, however, this confirms that response time issues are not specific to any one type of service and all are affected by this problem. The issue raised in Santa Clara County is also one that has been addressed in both Colleyville and all peer cities which currently provide ALS level care from all fire apparatus.

From these results it is the opinion of this researcher that response times and call volume are the two most significant factors to consider when determining a need to increase ambulance resources in a community regardless of whether it is a fire based system or some form of private model system. Though a multitude of other considerations has been acknowledged in the survey and interview results, these two factors far outweighed the others in both the survey, peer city interviews, and the literature that was reviewed for this project. In addition, costs for staffing and equipment as well as housing ability are factors that require attention once a decision to increase resources has been made.

The third research question focused on identifying staffing options used to place additional ambulances in service. This question was analyzed from two angles which included the means by which staffing is accomplished, as well as the certifications of the crew on the ambulance. Survey results for this portion of the research indicated that almost two thirds of respondents have dedicated crews on all their ambulances at all times while another one third staff up additional units from existing fire crews as needed.

Research within the literature review indicates that two primary types of EMS systems exist in the service today. Those two types are all ALS and the two tiered BLS/ALS system. Arguments were made for both sides and no clear cut system is shown to be the best. ICMA (2005) indicates that no studies exist which show that having two paramedics on an ambulance

together provides any advantage to the providers or the patient. King County, WA (2002) identifies the two tiered system as having an international reputation for innovation and excellence in out of hospital urgent and emergent care. Compton (2007) reports that there is no better system situated for rapid multi-faceted response than a fire based EMS system.

Survey results indicate that close to 80% of respondents provide transport services from a fire based system. Additionally, over 80% of respondents indicated that they operated an ALS level service. The split between dual paramedic and one paramedic/one EMT was roughly 50% for dual medic and 31% for one medic and one EMT. Currently Colleyville offers an all ALS dual paramedic transport service as well as frontline ALS first responders. This mimics the area peer cities which provide the same levels of service as Colleyville. In addition, the literature review suggests that true two tiered systems that work efficiently are only found in large urban areas with a large number of resources. The two tiered system is not a practical application in Colleyville. Stout, Pepe, & Mosesso (2000) identified the all ALS system as being a model of complete operational efficiency. This model has proved to be very successful in Colleyville having paramedics on all frontline apparatus.

Though the overwhelming majority of survey respondents and peer city interviewees indicated that they function within an ALS system, the value and cost of dual medics systems is a topic of debate. EMS Best Practices (2000) identified communities in Minnesota and Wisconsin who were either working to repeal or had repealed existing laws and ordinances which required them to staff ambulances with two paramedics. In addition, this same source indicated that fire department officials in Alaska had reduced the number of medics on ambulances from two to one in another cost cutting move to maintain service levels to the community. This reduction has not been considered at this point in Colleyville or most neighboring peer cities.

Though there is no clear evidence establishing all ALS as the best service level or dual paramedic as the most efficient, the majority of research from interviews and survey responses indicates that this is case, while research from the literature review indicates a clear split in support for or against an all ALS versus two tiered system. Though the survey responses indicate a vast variety of other options to consider as well before moving forward with recommendations to our elected officials and city management, only two of the peer cities interviewed consider staffing with less than two paramedics when necessary.

The final research point was identifying federal, state, and local governing forces which require or establish minimum numbers of ambulances in a community or service district. No entity exists in the state of Texas outside of the local governing body that establishes the number of in service ambulances. None of the peer cities suggested any source for this requirement beyond their own fire administration or city management office. However, survey responses indicate that this is not the case across the country. More than 20% of survey respondents indicated that a state or county agency dictated to them how many ambulances to staff, and in some cases where to place them.

The only regulatory guidelines for ambulance placement found during the literature review were found in NFPA (2001) and NIH (1993) which both require arrival of ALS care to the scene of an emergency in eight to nine minutes respectively. Furthermore, NFPA (2001) goes on to detail out the certifications and quantity of said personnel necessary to handle these emergencies. In addition, AHA (2008) includes ALS care as a component of its “chain of survival” and remarks that irreversible brain damage begins onset in four to six minutes of cardiac arrest. The goal of NIH (1993) is to have a median ALS response time of four to five minutes on most emergencies.

Once again, the greatest factor to consider when dealing with the issue of this research is response time of emergency crews to the scene of the emergency. The lives of our patients truly depend in some instances on our ability to make a rapid response with life saving skills and equipment to the scene of an emergency. If we have the appropriate number of resources staffed and available, the likelihood of our successful response as well as the probability of the patient's full recovery are higher. One cannot place a value on a human life, but it is what is asked of communities all across this country each and everyday as they strive to meet the needs of their communities with less and less resources to do so. It is the belief of this researcher that an additional ambulance is needed in Colleyville, Texas, however, the full time status of that ambulance and in what manner it will be staffed is still undetermined at this time. Continued monitoring and further analysis of the problem will likely be necessary before moving forward with a recommendation to the city management staff of our community.

Recommendations

Based upon the findings of this research effort through an extensive literature review, nationwide survey, and interviews with chief officers from neighboring communities, it is the recommendation of this researcher that the following be given consideration for current or future implementation:

- Maintain current all ALS response capabilities including frontline first responder apparatus.
- Continue monitoring the present situation for monthly mutual aid calls for ambulance transport and the impact these response times have on our citizens and their end outcomes.

- Be cognizant of the burden placed on neighboring communities when continually calling for mutual aid ambulance responses.
- Annual tracking of overall ambulance call volume statistics as well as total out of service times for hospital transports.
- Consider placement of the reserve ambulance at fire station 3 to be staffed when necessary utilizing the crew of Quint 243 when they are in the station and a second EMS call is received.
- Analysis of potential revenue gains based on previous statistics of missed ambulance transports.
- Addition of a second full time ambulance at fire station 3 to not only decrease missed EMS transports in Colleyville, but to further amplify Colleyville's role in the NE Tarrant County area with our peer cities.
- Consideration given to utilizing EMT's on ambulances in lieu of the current double paramedic staffing arrangement as necessary.
- Consider evaluating the cost of utilizing a private provider for ambulance transports versus the current annual costs for in house EMS transport capabilities and the potential added cost of increasing current service levels.

The impact of these recommendations would likely serve to improve the availability of EMS transport service within the city of Colleyville, Texas. While there will likely be costs associated with any potential change or increase in service levels, it must be remembered that human life is invaluable and the perceived negative impacts of not having resources available when they are needed is a significant issue that is only amplified in an affluent community such as Colleyville.

This researcher would recommend the following points to consider before beginning a research effort on this topic:

- Identify initially if there is a delay in transport times and a re-current issue with current resources being unavailable when secondary emergencies are received.
- Consider limiting survey efforts to communities the same size as your community to provide a more even level of comparison versus that used in this research.
- Utilize the opinions and feedback of your immediate neighboring communities with whom you most often respond to mutual aid assistance calls.
- Determine if other options are available in your area that would have less impact on your current operations.

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Appendix A: Survey Instrument

Ambulance Deployment and Staffing

1. Default Section

1. Please provide the following information:

Department Name:

City/Town:

State:

2. Does your fire department provide ambulance transport services?

- Yes
- No

3. If you answered "No" to the previous question, please provide a contact email address for the organization that does your EMS transport.

4. Please rank the following factors related to implementing additional ambulances in your organization from most impactful to least impactful.(1 being least impactful, 5 being most impactful).

	1	2	3	4	5
Personnel Costs					
Equipment Costs					
Insurance					
Maintenance					
Housing Capacity					

5. Please list any other factors related to the previous question that your organization considers important.

6. Please rate the following in terms of their impact on adding additional ambulances to your organization.

	No Impact	Little Impact	Neutral	Some Impact	Great Impact
Call Volume					
Response Times					
Crew Exhaustion					
Public Outcry					
Direction From Elected Officials					

7. Is there any other issue(s) which impacted the decision to add an additional ambulance to your fleet?

Ambulance Deployment and Staffing

8. How are ambulances in your organization staffed?

- ☐ One EMT, One Paramedic
- ☐ Two Paramedics
- ☐ Two EMTs
- ☐ Other

9. If you answered "Other" in the previous question, please explain further below:

10. How are ambulance crews established in your organization?

- ☐ Dedicated crew at all times on all ambulances
- ☐ Staff ambulance from fire apparatus personnel as needed
- ☐ Call back personnel for staffing additional ambulances
- ☐ Other

11. If you answered "Other" in the previous question, please explain further below:

12. Does your state and/or jurisdiction have requirements regarding the number of ambulances your organization staffs on a daily basis?

- ○ Yes
- ○ No

13. If so, please list the name of the agency which sets these requirements.

Appendix B: Interview Questionnaire

Ambulance Deployment and Staffing

Interview Questionnaire

Name: _____

Department: _____

1. How many ambulances do you currently have deployed within your operations division?

2. What is your average annual call volume per ambulance?

3. What critical factors and criteria do you believe are important when deciding on the need to add an ambulance to your present response capabilities?

4. How do you currently staff your ambulances?

5. Do you ever employ different staffing options for deployment of ambulances? If so, what are they?

6. Is a fire apparatus ever taken out of service in order to staff an additional ambulance?

7. Has your organization given any thought to other options for ambulance transport services?

8. If the Colleyville Fire Department had a second ambulance in service, would it benefit your organization as well?

Appendix C: Survey Respondent List

Salt River Fire Department	Scottsdale	AZ
Vista Fire Department	Vista	CA
Los Angeles Fire Department	Los Angeles	CA
Alhambra Fire Department	Alhambra	CA
San Francisco Fire Department	San Francisco	CA
Orange County Fire Authority	Irvine	CA
DC Fire & EMS	Washington DC	DC
Largo Fire Rescue	Largo	FL
Delray Beach Fire-Rescue	Delray Beach	FL
North Lauderdale Fire Rescue	North Lauderdale	FL
Gainesville Fire Rescue	Gainesville	FL
David Woodside	Boca Raton	FL
Alachua County Department of Public Safety	Alachua County	FL
Clay County Fire/Rescue	Green Cove Springs	FL
Tampa Fire Rescue	Tampa	FL
Hawaii Fire Department	County of Hawaii	HI
McHenry Township FPD	McHenry	IL
Elk Grove Village Fire Department	Elk Grove Village	IL
Lincolnshire-Riverwoods FPD	Lincolnshire	IL
McHenry Township FPD	McHenry	IL
Midlothian Fire Department	Midlothian	IL
Elwood Fire Protection District	Elwood	IL
Riverdale Fire Department	Riverdale	IL
Hillside Fire	Hillside	IL
New Haven Vol FD	New Haven	IL
Des Plaines Fire Department	Des Plaines	IL
Crete Township Fire Protection District	Crete	IL
Stickney	Stickney	IL
Highland Park Fire Department	Highland Park	IL
Arlington Heights Fire Department	Arlington Heights	IL
La Grange Park Fire Department	La Grange Park	IL
Stone Park Fire Department	Stone Park	IL
Hinsdale Fire Department	Hinsdale	IL
Gurnee Fire Rescue	Gurnee	IL
Frankfort Fire District	Frankfort	IL
Countryside Fire District	Vernon Hills	IL
Berwyn Fire Department	Berwyn	IL
Geneva Fire department	Geneva	IL
Edwardsville Fire Department	Edwardsville	IL
Algonquin Lake in the Hills Fire	Lake in the Hills	IL
Elgin Fire Department	Elgin	IL
Hanover Park Fire Department	Hanover Park	IL
Joliet Fire Department	Joliet	IL
Lawrence Fire	Lawrence	KS

Kansas City, KS Fire Department	Kansas City	KS
Emporia Fire Department/Lyon County EMS	Emporia	KS
Wichita Fire Department	Wichita	KS
Overland Park Fire Department	Overland Park	KS
Paducah Fire Deptartment	Paducah	KY
Caddo Fire Dist 1	Shreveport	LA
St. George Fire Department	Baton Rouge	LA
Norfolk Fire Department	Norfolk	MA
Centerville-Osterville-Marstons Mills Fire-Rescue	Centerville	MA
Frederick County Division of Fire and Rescue Services	Frederick	MD
Hamburg Township Fire	Hamburg	MI
Edina Fire Department	Edina	MN
Sni Valley Fire Protection District	Oak Grove	MO
CJCFPD	Blue Springs	MO
N. Kansas City FD	N. Kansas City	MO
West County EMS & Fire Prot. Dist.	Manchester	MO
Kansas City Fire Department	Kansas City	MO
Durham Fire Department	Durham	NC
Lumberton Fire Department	Lumberton	NC
New Hanover Regional EMS	Wilmington	NC
Wilmington Fire Dept	Wilmington	NC
Lincoln Fire & Rescue	Lincoln	NE
Derry Fire Department	Derry	NH
Merrimack Fire Rescue	Merrimack	NH
Haddon Fire Co. #1	Haddonfield	NJ
Bernalillo County FD	Albuquerque	NM
Central Lyon County Fire District	Dayton	NV
Clark County Fire Department	Las Vegas	NV
Miami Township Division of Fire/EMS	Miamisburg	OH
Cleveland Fire Dept	Cleveland	OH
Stillwater Fire Department	Stillwater	OK
Lebanon Fire District	Lebanon	OR
Memphis FD	Memphis, TN	TN
Nashville Fire Department	Nashville	TN
River Oaks Fire Department	River Oaks	TX
Garland Fire Department	Garland	TX
College Station Fire Department	College Station	TX
North Richland Hills FD	North Richland Hills	TX
Denton Fire Department	Denton	TX
Bedford Fire Department	Bedford	TX
Webster Fire Rescue	Webster	TX
Flower Mound Fire	Flower Mound	TX
Roanoke Fire Department	Roanoke	TX
Grapevine FD	Grapevine	TX
Hurst Fire Department	Hurst	TX
Murray City Fire Department	Murray	UT

James City County Fire/EMS	Williamsburg	VA
Chesterfield Fire and EMS	Chesterfield County	VA
Bellevue Fire Department	Bellevue	WA
Lynnwood Fire Department	Lynnwood	WA
Puyallup Fire & Rescue	Puyallup	WA
Renton Fire and Emergency Services	Renton	WA
Vancouver Fire Dept.	Vancouver	WA
Town of Madison Fire Dept.	Madison	WI
Kenosha Fire Department	Kenosha	WI
Watertown Fire Department	Watertown	WI
Beckley Fire Department	Beckley	WV
Sweetwater County Fire District #1	Rock Springs	WY
Fairlawn Fire Department	Fairlawn	

Appendix D: Peer City Interview Participants

1. Deputy Chief James Richardson, Bedford Fire Department
2. Fire Chief Steve Bass, Grapevine Fire Department
3. Fire Chief Chuck Blankenship, Keller Fire Department
4. Assistant Chief David Palla, Hurst Fire Department
5. Fire Chief Robert Isbell, Euless Fire Department
6. Fire Chief Mike Starr, Southlake Fire Department
7. Assistant Chief Michael Rawson, North Richland Hills Fire Department