

Running head: FUTURE DEMOGRAPHIC CHANGE IMPACTS

A growing and aging population and its impacts to EMS service delivery for the city of

Lacey, WA.

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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 population of our fire district is changing demographically as the “baby boom” portion of the population starts to retire and their respective community expands significantly in Lacey, WA. The Lacey Fire Department (LFD) will be challenged to deliver EMS service to a growing and aging population, without increasing existing response resources to provide EMS service.

The purpose of this research is to evaluate how age change and size in the population in Lacey Fire Department service area will impact expected needs to LFD’s EMS service in the near future.

By evaluating predictors of population growth, age based pre-hospital care frequency, and standards of EMS coverage and response, this research should help estimate future EMS resource needs at LFD and when.

The findings indicate that the aging population through 2030 will have significant impacts on service delivery at LFD especially through disproportionate call volume increases due to the population shift. This includes the number of patient transports, the amount of time spent on scene providing care, increase in the amount of time to respond to scenes, and increased amount of time transporting patients to the hospital by EMS providers.

A series of recommendations are made including resource allocation and funding suggestions and the use of technology to manage and better deliver EMS service in the field.

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INTRODUCTION

Demographers call a bump or spike in the American population born in the period immediately after World War 2 as the “baby boom”. This population or generation consists of about 78.2 million Americans born between 1946 and 1964 (Wikipedia, 2008) and makes up roughly 25% of the population today according to the US Census Bureau (2008).

Lacey Fire Department (LFD) provides Emergency Medical Service (EMS) and other emergency services to a growing population covering over 77 square miles in urban and suburban Washington State at the bottom of Puget Sound. In 2007, Lacey Fire Department responded on 7% more calls over the total in 2006, yet reduced the number of responding units and personnel in 2008 (Lacey Fire Department, 2008).

In 2006, the US Census Bureau estimated that 13.6% the population in the City of Lacey was comprised of individuals 65 years of age or older. And further, in an 8-year period, growth of the total population in the City of Lacey has exceeded 21.8% (Hill, 2008).

Of specific interest in this research is in the disproportionate amount of growth in the population above the age of 65 and the even faster growth rate in the population above the age of 85. The significance is that higher age of a population correlates with higher consumption of pre-hospital care (Snyder/Christmas, 2003). For those who are over the age of 65, they use collectively 2 times more EMS services as compared to the younger

population, and for Americans over the age of 85 they collectively use 3-times more service (Blanda, 2008).

The purpose of this research is to evaluate how future population age shift to a significantly older community in Lacey Fire Department's response area will impact expected demands for EMS service in the near future. The evaluative method is used to examine collected data specific to this issue and answer the following questions:

1. How much will the population grow based on tested predictors in direct relationship to expected population shift?
2. What is the correlation of age as it relates to EMS demands based on known predictors?
3. What are the expected EMS service demands of LFD as it directly relates to population growth in the future?
4. If we have strong predictors of future EMS service needs, can Lacey Fire Department meet these needs without significant growth with of resources?

BACKGROUND AND SIGNIFICANCE

Lacey Fire Department responds on thousands of calls a year for emergency service with the bulk of these responses being for pre-hospital or emergency medical care. Call growth has been significant in the past 10 years and has been driven by several factors such as growth of the total population, more local development and construction, more traffic, a society that is living longer, and more. Clearly, the growth of the older American population, 65 years or older, has also come to Lacey, WA and local response growth or demand especially in EMS response has occurred and will continue to increase in the immediate future. In Lacey specifically, the fire

department provides pre-hospital care for several large retirement communities and an increasing disproportionate elderly and infirm population that is serviced in private residences as stand-a-lone licensed businesses that act as 24-hour nursing homes.

At the national level, several articles from prominent medical practitioners and authors, have indicated that the aging of the population will have a significant impact on EMS and pre-hospital admission both in the short and long term (Kuehl, 2002). Looking comparatively at the significant population growth in Lacey from past levels to now, and then examining new forecasts that have come out regarding a significant increase of our population through 2030 (Holcomb, 2008) the study has not been immediately made as it pertains to pre-hospital care and the growth of the older portion of the local population or immediate service area for Lacey Fire Department.

The agency on the receiving end of EMS, Providence Health System (St. Peters Hospital) increased its emergency room in 2007 with a \$64 million upgrade to handle 27,000 cases in 2003 took more than 64,000 cases in 2007 (Batcheldor, 2008). This is a significant increase of more than 230% in 4 years of use. Further, they have just recently committed to add another \$40 million to expand on that capacity based on their own projections (Batcheldor, 2008). This is significant because St. Peter's hospital is the primary regional hospital and receives the bulk of all emergent patient transports from Lacey Fire Department. Yet, while other agencies such as the local hospital and other adjacent fire department expect and are actively expanding capacity, LFD has recently reduced staffing and response and will do so again in only a few months due to budget cuts and failed voter levy tax-initiatives.

The importance of this project is that it should clearly identify whether LFD will have enough resources to adequately provide pre-hospital care to customers in the future especially in the wake of local population growth and age-shift. The issues addressed are not only important to Lacey Fire Department, but it also addresses the requirement by the United States Fire Administration to study and research 'an appropriate response in a timely manner to emerging issues' (FEMA, 2004). Further this project also relates to Unit 1: Executive Development course of the National Fire Academy's Executive Fire Officer program where by the project addresses assigned objectives in the research practicum, change management, service quality, and applied research (U.S. Department of Homeland Security, 2008).

It can be argued that the inability of Lacey Fire Department to not have sufficient resources to handle significant growth in call volume would have a detrimental impact to many new residents and future EMS patients/customers. Further, the national rate of EMS transport reimbursement continues to fall and governmental based organizations are intervening or increasingly taking over patient transport from private ambulance companies (Kuehl, 2002). This is important because Lacey Fire Department transports the most sick patients (advanced life support care or ALS) and some of the less sick patients when a private ambulance company cannot provide the transport (for basic life support or BLS). So not only will LFD be seeing more patients and transporting the most sick patients but if the ambulance company no longer finds it profitable to transport the less sick patients as they do now it is logical that the work load could fall on the fire department as the agency of choice to replace the private ambulance firm. This event would further increase LFD's work

load and response time as units slow in becoming available again because they are responding and also providing transport to the appropriate hospital instead of just initial response and field treatment (Kuehl 2002).

LITERATURE REVIEW

In reviewing the literary body regarding this subject, it became immediately evident that it was necessary to narrow the subject down into two areas. The reason for this was that there are tens of thousands of documents, books, web pages, presentations, videos, and a myriad of periodicals, that discuss or are dedicated too the generation of the “baby boom” and the impacts that it will have on society. A simple Google Internet search limited out at over 75,000 different titles of varied relevance to the topic at hand. Thus in looking at the literature, the project focused principally on the impacts the baby boom generation will have on medicine with even a more focused search on pre-hospital care. This continued to be a surprising challenge to a degree because much of the available body of work focused heavily on actual hospital admissions instead of pre-hospital care or emergency medical service (EMS). Further, caution is necessary in looking at hospital admission data because the geographic footprint can vary significantly depending on location, specialty, and more for each hospital. This is especially true for this project because the primary delivery facility for Lacey Fire Department’s admission is a regional hospital and thus their data is potentially skewed because they service an area substantially larger that that of the projects scope.

The second major area to evaluate to some degree is accurate census information that was specific to the population of this projects research. The United States

conducts a national census every ten years and data sometimes specific to a defined area or community is clearly obsolete or not specific enough. For the purpose of this project, a specific estimate conducted by demographers and statisticians is used where by estimates of total population growth specific to neighborhoods, local geographic boundaries, and even subdivisions of government; in this case the appropriate fire department service response area is optimal. Much of the other population data on growth is simply too general and non-specific as it relates to whole geographic areas such as states or the country as a whole.

In looking at the body of work specific to pre-hospital care and EMS, and the impact of the baby boomer generation, fire service periodicals such as *Firehouse* have offered some valuable findings applicable to this project. Identifying that several impacts beyond just higher call volume will occur; including that 30 to 45% of the patients that are transported (depending on your location) are Medicare beneficiaries and with Medicare expected to go broke in 2019 if not sooner, the ability to pay for service must be considered. Gary Ludwig (2008) suggests that many private EMS companies without government subsidy will go broke because Medicare doesn't fully reimburse costs of transport. Based on Mr. Ludwig's article and previously identified research (Kuehl 2002), this project will now consider this scenario for Lacey Fire Department and examine patient loads for all transport, not just ALS transport services as it currently provides.

Perhaps the most valuable research from the literature is to identify rates of EMS load as it directly relates to the aging population. One study identifies that currently 36% of all ambulance transports involve the elderly and that by 2030 that

20% of the population will be over the age of 65 or equate to 70 million persons. This is up from the 35 million 65+-year olds that were identified in 2000. The impacts of this study state that EMS call volume for a patient over the age of 65 years old is double the use of pre-hospital care over a younger individual and this triples when for the population over the age of 85 (Colwell, Murphy, Bryan, 2006). Further, the elderly population also brings with an increased complexity of care with over 80% of that segment of that population having at least one chronic illness and the financial impacts of the increased treatment have resulted in the bulk of all increased Medicare spending. Due to the success of treatment for these chronic illnesses it adds an additional characteristic to this study as it identifies that not only are more people joining the ranks of being 65 years or older in America but they also are living much longer and continue to consume medical services (Institute of Medicine, 2008).

Research also identifies unintended impacts from the increase in EMS demand through emergency department “saturation” from increased in-bound patient transport. Because of the increase in the number of transport times, it has become common on the national scene to see EMS crews detained and blocked from responding to new calls for service because they are unable to clear from the receiving facility or hospital. In some cases EMS crews are used to transiently provide emergency room care services due to the busy hospital staff (Eckstein, et al. 2005). This is potentially important because it indicates that the potential exists that as EMS call volume grows, that additional delays will also occur if receiving facilities cannot accept incoming patients and return EMS units to service.

For this project, it is also important to look at known standards of response especially when it comes to EMS. Initially, only raw call volume was going to be compared but a search of standards that addressed just call volume or the number of calls a unit should make were not evident. Instead standards focused on response times versus raw calls, which intuitively make sense in that comparing raw calls from one department to the next would be potentially a poor way to measure service. As an example, if two departments covered identical populations and identical areas but had the difference of double the response resources in one department versus another, simply comparing call volume or raw numbers of response would tell us nothing. Instead the literary body offered response times as a paradigm of measurement or standard rather than call volume. With a desired product of this document being to evaluate if LFD will continue to meet standards of response as the population changes then it is important to identify standards.

The first standard offered is from the American Heart Association (AHA) (2008) which offers a worst-case scenario or a benchmark at least by identifying brain death following a cardiac arrest. Cardiac arrest or simply the stopping of the heart following a terminal heart rhythm is a common 911 call in the EMS field especially in the older population who are more prone to common forms of cardiac disease. In fact, cardiac arrest from heart disease will occur over 310,000 times outside of the hospital setting in the field with over 80% of these occurring in the home of the resident (AHA, 2008). The benchmark offered is that anoxic brain death or death from the heart not pumping from a heart attack will take place in four to six minutes (AHA, 2008). It is important to note that people can survive occasionally longer from

not having a cardiac effort but the issue remains the maximum six minute window for certain brain injury or brain death.

A second standard offered comes from Washington State Law, which directly identifies a set of response times for agencies such as Lacey Fire Department for providing EMS service or specifically “verified aid service” at least for major trauma events. In the Washington Administrative Code (WAC) (1992) they define EMS response jurisdictions as rural, sub-urban, or urban and then they identify the acceptable time parameters for EMS service (WAC, 2000). The following table identifies how the jurisdictions are defined and then the time standards per Washington state law:

Table 1

EMS or verified aid service response time requirements per Washington State Law

Jurisdiction Type and definition	Response Time standard
Rural area jurisdiction have less than 10,000 people or with a density of less than 1000 people per square mile	45 minutes or less, 80% of the time.
Sub-urban area jurisdictions have less than 29,999 people but more than 10, 000 people or have a density of 1001 to 2000 people per square mile.	15 minutes or less, 80% of the time.
Urban area jurisdictions are incorporated over 30,000 people or higher density than sub-urban.	8 minutes or less, 80% of the time.

Lacey Fire Department would fall into both sub-urban and urban response depending on jurisdiction definitions and boundaries and further, urban and sub-urban should both be considered because future population growth could cause more areas that in the past were defined as sub-urban to become urban and thus evaluated under law under a different standard.

National standards should also be considered and the literature offered a hard national standard, a consensus standard used by 'most urban agencies', and an average response time from 200 of America's most populace cities. The National Fire Protection Administration (NFPA) offer code number 1710 (2004) as a hard national standard that establishes a series of benchmarks for career fire departments in providing EMS services. NFPA establishes that a turnout time, or the time from call received to the vehicle moving to the call address, must be less than sixty seconds and further mandates that all EMS calls should have a basic response of at least two medically qualified people on scene in less than four minutes, 90% of the time (NFPA, 2004).

A "widely used" response time standard was found for urban areas whereby aid/medical response time standards were measured from the time a request for service call was received with enough information to react to a unit responding on scene is set at eight minutes and fifty-nine seconds 90% of the time (Fitch, 2005) An important note when comparing standards is that the nine-minute standard includes 911 call processing while the NFPA standard addresses call processing in a different standard (1221) and thus the NFPA 1710 standard applies to only "turnout" and travel time.

It became clear in evaluating the literature that “response time” means different things to different EMS providing organizations. This is important in validating standards and answering if the standards are legitimate or workable, or are they impractical per some of their critics. The issue comes from not only when do some organization start and stop the response time clock, but do they value and record when the first responder arrives or when the first transport unit arrives. So if an organization says they have a 5-minute average response time for example and thus meet a theoretical standard, they in fact may have a much higher response time because they could omit or not record portions of the response time. Examples of this could include EMS organization that choose not to document the period of time between when the 911 call is received and when the wheels of the EMS vehicle start to turn to the address. Or most agencies document only when the EMS vehicle arrives at the address and not necessarily when the care provider reaches the patient (Williams, 2008).

In looking at response times from a national comparative perspective from the JEMS 200 survey (Williams, 2008) helped put Lacey Fire Department response times into perspective. It also helped to validate the previously mentioned standards especially if they are to be considered “realistic” to Lacey Fire or other comparing organizations. Again, many critics state that national standards are not reasonable or realistic especially in light of department or area differences. The following table shows the results of this recent JEMS 200 survey as it pertains to average response time goals and is specific to first responding personnel or the arrival of the first

qualified EMS professional in career departments for both urban and sub-urban areas (Williams, 2008):

Table 2

EMS agency response time performance goals (national survey)

Response Times	Urban Areas (77)	Suburban (36)
<3:59	7.8% (6)	2.8%(1)
3:59	27.3% (21)	13.9%(5)
4:59	18.2% (14)	22.2% (8)
5:59	16.9% (13)	25.0% (9)
6:59	10.4% (8)	11.1% (4)
7:59	13.0% (10)	11.1% (4)
8:59	5.2% (4)	8.3% (3)
9:59		
10:59		
11:59		2.8% (1)
12:59	1.3% (1)	
13:59		
14:59		
>14:59		2.8% (1)

The review of the body of the literature left it absolutely clear that the aging population will have far wide reaching effects on the United States for decades to come and that the impacts of an “Aging America” are only starting to be understood

on the surface. The breadth of some of the challenges facing this country especially in funding and managing the health care needs for the country with the retiring “baby boom” generation are significant. The impacts to the fire service and other EMS providing organizations are clearly going to be important especially with call growth and increasing service demand. The most significant impact to this project was the examination and differences between consensus and NFPA standards, and the fact that Washington State has standards for EMS response written into law. Also surprising is that most agencies, that at least reported to a major survey, appear to meet national standards or at least have standards that are higher than the national (or even Washington State) standards.

As a final note, a review of past National Fire Academy, Executive Fire Officer Applied Research Projects on file at the National Fire Academy’s Learning Resource Center found one prior similar research project that addressed cumulative response impacts to an individual department. In this case they focused on fire and EMS response and found that an increase in the “number of calls will necessitate an increase in the department’s EMS transport capability and overall EMS provider capability” (Lowman, 2006).

PROCEDURES

The step in answering these questions through research was to develop understanding of the issue and to be cognizant that this portion of the research body is changing very quickly. This meant that the initial goal of research was to review documents that were 2004 or newer with data sets being used to be absolutely new as possible. The review of literature at the National Fire Academy’s Learning Resource

Center (LRC) found that the topic has really taken on a new interest since 2000 and that data sets, applicable research, and perhaps of a reasonable understanding of the complexity of the issues is finally just taking place in the last few years.

All of the questions involved were dependent on getting a close to possible prediction of population growth that would be applicable to Lacey Fire District's response area. In this case, Lacey Fire District utilized a study that had come out in early 2008 that was generated by Thurston Regional Planning Commission (TRPC), and was specific to the department's response areas zone by zone. Further, this study provided a breakout of benchmarks respective of 5-year increments that would become the comparative benchmarks for this study. (Holcomb, 2008)

The limitation to the TRPC estimate (it's technically not a forecast) is that it was inclusive to all age groups and did not breakout demographics in anyway. The growth prediction instead was designed principally to allow planners to estimate where the population centers would be, or where growth would occur in specific portions of the county through 2030. To breakout age it was necessary to find research that was local and applicable to the area. A review of conventional census documents such as those by the US Census Bureau offered snap shots or estimates in the short term, but did not offer anything beyond 2010 and definitely did not offer anything specific to the fire district's response area of study. Further, the study needed to be very recent because this census or population survey couldn't be like most and base its conclusions from the 2000 US Census. The study used for this project was a document created in 2007 as a tool for local and state governments to understand population growth and change specific to Washington State. The Office of Financial

Management's "2007 Forecast of The State Population" (2007) did two things in that it provided a basis to estimate future population growth of two demographic areas of between 65 to 84 year age, and 85 year old plus population, and did so in multiple benchmarks including those used every five years, 2005 through 2030.

With a reasonable estimate for population that was reasonably sensitive to time, age, location, and also very current, it was important to identify the specific relationship of age and call volume for Lacey Fire District. This became difficult because going back into archives found only 3 years worth of EMS reports that were automated or electronic in any fashion. A check in to Washington State Department of Health records specific to EMS or the associated national reporting system found that we either did not report all EMS events to either database or just did not participate. The 2006 record sets available were in a retired database, and 2007 to present were in the current use database that was on-line for emergency responders. The 2006 database utilized all EMS patients treated from January 1, 2006 to December 31, 2006 for all stations and responders in Lacey Fire District and produced the age of the patient at the time of the call (Lacey Fire Department, 2007). The second set of data was a complete data dump of all incidents from January 1, 2007 to November 12, 2008 and again represented each individual patient contact for that period of time (Lacey Fire Department, 2008). A table was created that took the specific population estimate of Lacey fire department broken out by age and utilizing the state demographic profile estimates, and then calculated also as a percent of the total population. This also is plotted out in a graph or figure to present trends appropriate to demographic population shift in Lacey Fire Department's service area.

It should be noted that at no time was any information other than approximate age and date of service ever reviewed during the research of this paper and all appropriate privacy laws were followed.

With a strong estimate of population change and an estimate of demographic change specific to age for the population in hand, the project then looked at call volume change. In this case, it was taking the data sets and evaluating them to determine existing relationships from the 2006 to 2008 data and identifying indices of incidents by age. Or specifically, since we had the approximate population broken out by age in 2006-08, and knew how many EMS patients were seen and their age, we were able to identify a indices or the rate or EMS call requests appropriate to age in the Lacey Fire District response area. The desired product was to not only to find how many initial requests for service would be generated by the population growth of those 65 years of age or older, but also to provide a basic measurable estimate as the population grew. And also how frequently could the future 65 year old plus population generate EMS calls if the indices remained consistent to how it occurs now. The assumption is that patients of 65 years of age or older will continue to utilize 911 at the same rate in the future as they currently do today. Additionally, this project assumes that will not start calling 911 for any different reasons or rates in the future.

For question 3 or the specific demographic change, the data organized and evaluated to answer the first two questions is now compared by using the indices or rate of occurrence for appropriate age populations and applying these to the population estimates of the future as identified in our estimate for Lacey Fire

Department. Simply put, as the population grows and also ages, the rate of response is calculated for the larger populations that utilize 911 more frequently. This is the key to this project because most calculations that are available simply assume that the population characteristics remain largely constant and thus demands for service remain constant at the same rate, which is clearly wrong.

Also utilized at this point is a comparison to evaluate the total number of actual transports for 2007 to 2008 based on the population and provide some estimate of the future number of possible transports for the department. Again, this is using the Emergency Reporting software report function and then comparing current transportation load in similar ratio for 2007 to 2008 for the near future. In this case, the estimates were only carried out until 2020 because of the probability of significant change in how patients are potentially treated and transported. For example, if protocols change or the rules change in which governs which patients are taken to hospital or some of the major nursing homes decide to establish in-house non-emergent care at a greater capacity than currently used, it could significantly change response numbers. It appeared likely that the more distant the estimate was drawn that error would compound and would significantly reduce the value of this specific estimate.

To answer the last question, the study focused on if the department could handle the future growth with existing resources. Of value then was using the existing data set that focuses on existing resources (2007-08 data) and developing comparison that was available from the database that specifically could be utilized by planners to help determine staffing and resources in the future. One item to compare that was available

was getting Lacey Fire Department's average time spent committed on an EMS call (Lacey Fire Department 2008) for 2007 to 2008 and taking the average time a unit was committed from dispatch to available and then calculating a new number if EMS calls increased as previously described. The output could show an estimate on how much more time would the department potentially spend on EMS scenes in the future.

Finally, response time is evaluated for the principle reason that so many regulations and standard benchmarks focus on response time as a performance. This is probably the most "broad-brush" evaluation in this project because true response time characteristics can depend on so many variables. Typically GIS, or geographic information systems, handle this the best because thousands of inputs; for example one station being unavailable for response frequently, road congestion, or resource adjustments can influence the outputs of something as broad and variable as a fire department response time. However, understanding that substantial error exists because of multiple variables, but also understanding that if call volume increases typically so does response time, then it seems appropriate to compare Lacey's response times estimated with more call volume.

An evaluation of response time started with looking at three pieces of apparatus and assuming that most of the response characteristics such as staffing and other department units availability would remain constant. As a limitation, the time frame was shortened to the year 2015 and an answer given based on the first standard deviation as the "plus and minus" time number. In this case, the three fire engines average response times to EMS calls only in their response areas only for 2007-2008 (Lacey Fire Department 2008) are identified and the assumption then is response

times increase at the same rate of call volume as identified earlier. So for Engine 31 in 2010, the formula for trying to identify response time is using the 2007 average, plus the 2008 average, plus the 2010 estimate which is a composite estimate of 07-08 times plus the additional percentage identical to call growth and then generating a statistical variance of 1 standard deviation for a likely response time. The purpose of the formula is to adjust for variance rather than the actual number when making the comparison. The response time for 2015 is developed by the same methods except variation includes the 2010 estimate as a number in helping to determine variance. This is also finally compared in a graph that spells out national expectations with existing response times and future response times.

Some critical limitations to note is that this project is a statistical process of evaluation, which means that variance exists in the numbers and that each new statistical element brought to this study brings a degree of error. Specific error and limitations include such things as the demographic data that is provided on a state basis and then applied to just the fire district for the study. It is likely that averages in the age estimate study will be just that and reflect expected differences at state perspective and not just a portion of a single county. Further limitations include the belief that the department will continue to handle and process EMS calls like they do now with the same amount of resources. Response resource reductions, especially to those resources that are compared, in this document would clearly skew the numbers used as perspectives for immediate impacts from demographic change.

The biggest limitation identified is the obvious error perceived in the response times. Simply because the inputs that impact actual response time are many and that

the estimate of increased response is just that: an estimate of response time based on one perceived variable. Other limitations include EMS response data error where by in some cases the age was not recorded (dead or unconscious patient, or patient unwilling to provide data) or error in response times. In some cases responders respond on EMS calls and document these as an EMS response, yet they arrive to find no medical need (non-injury car accident for example) or the patient has left the scene. The most glaring data problem is that of CAPCOM, or Thurston County Department of Communications (Thurston County 911), that provides the basis of response times inputted into the databases used, they do not accurately record the time between call received and dispatch. Frequently the time from when a 911 call is received to dispatch is single digits in seconds, which indicates an error in process of time recording and not actual times. The issue is that when a 911 call is received, the clock doesn't start until the nature of the call is ascertained and entered as an actual event and the units are listed as dispatched in times even though station alerting systems and personal pagers have not alerted the respective EMS crew to the emergency.

Results

Question #1 was, "how much will the population grow based on tested predictors in direct relationship to expected population shift?" This as described earlier meant taking two critical studies that were directed at population growth and another looking at age shift, respectively. The following output from the first step of the procedures and is reflected in the following table:

Table 3

Lacey Fire Department population growth with age shift considered.

Year	Total Pop	65-84	% total	85+	% total	65+	% total
2005	86,603	8401	9.70	1438	1.66	9839	11.36
2010	101,104	10,353	10.24	1860	1.84	12213	12.08
2015	114,843	13,839	12.05	2159	1.88	15998	13.93
2020	128,763	18,284	14.20	2446	1.90	20730	16.10
2025	140,162	22,636	16.15	2873	2.05	25509	18.20
2030	150,058	25,855	17.23	3706	2.47	29561	19.70

Figure 1

Lacey Fire Department's total population growth estimate against 65+ year old population growth estimate displayed by percent.

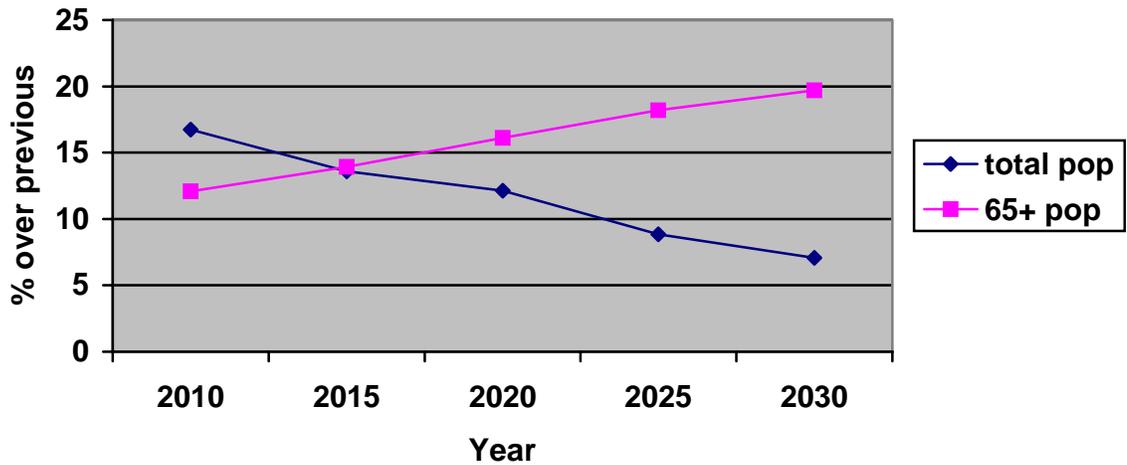


Table 3 identifies growth of Lacey Fire Department from 2005 until 2030 and then shows the estimates of the population based on the same ratios as identified in the state Office of Financial Management Study. As demonstrated in the table that the population older than 65 years of is rapidly growing and as seen in figure 1 will eclipse the 0-64 years of age population in terms of actual percentage of growth by 2015.

For question 2 “What is the correlation of age as it relates to EMS demands based on known predictors”, the output of this evaluation is reflected by showing a total number for patients aged 65 to 84 and again for 85 years of age and older. A percentage is also shown.

Table 4:

Total EMS patients seen by age for 2006-2008 for Lacey Fire District #3.

Year	Total N	65 to 84	65-84 %	85+	85+%	65+ %
2006	6512	1674	25.7	757	11.6	37.3
2007	6162	1463	23.7	832	13.5	37.2
To 11/08	5604	1494	26.6	862	15.4	42.0
Average %	N/A	N/A	25.3	N/A	13.5	38.8

Table 4 shows not only the total number of calls in 2006 and 2007 but specifically breaks out the call volume as it corresponded with the patient’s age. This leads to question #3 because the obvious impression is that the 65+ populations represent a disproportionate amount of the department’s call volume for being a smaller total subset of the general population. Please also note that even though the population of

85+ represents less than 2% of the population it clearly is responsible for a substantially higher percentage of the total call volume.

For question 3 “What are the expected EMS service demands of LFD as it directly relates to population growth in the future?” the data from question 1 and 2 are evaluated with the following output reflected chart and graph. Table 5 reflects the future estimates of population and change with the output of total call growth estimates reflected. Also considered is a “linear” estimate, which is simply to ignore demographic change and equate raw population with call volume. It is important to note that this project was intentionally aiming to not consider “linear” call growth and thus use age as a predictor for having a bigger impact than a simple trend assuming an “non-aging” population.

Table 5

EMS patients seen estimates with demographics evaluated as a factor

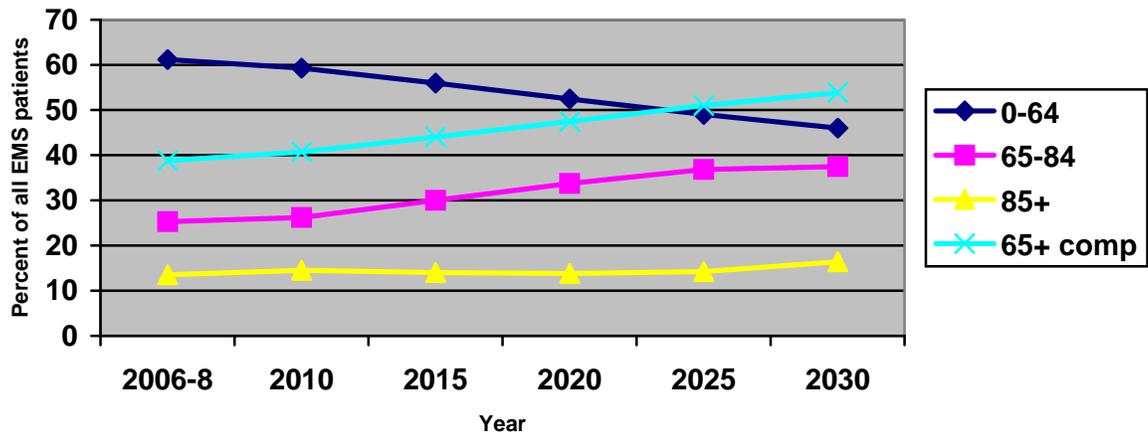
Year	Number	LFD %*	Incidence
2006-8 avg.	3832	61.2	.05
total * 0-64	(6202)		
2006-8 65-84	1588	25.3	.19
2006-8 85+	842	13.5	.58
2010 0-64	4445	59.3	
2010 65-84	1967	26.2	
2010 85+	1079	14.5	
2010 linear	7310	---	
2010 adj.	7491	Dif 2.4%	

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2015 0-64	4943	56%
2015 65-84	2630	30
2015 85+	1252	14
2015 linear	8635	---
2015 adj.	8825	Dif 2.2%
2020 0-64	5402	52.5%
2020 65-84	3474	33.7
2020 85+	1419	13.8
2020 linear	9881	----
2020 adj.	10295	Dif 4.0%
2025 0-64	5733	49.0%
2025 65-84	4301	36.8%
2025 85+	1667	14.2%
2025 linear	10538	----
2025 adj.	11701	Dif 10.0%
2030 0-64	6025	46%
2030 65-84	4913	37.5%
2030 85+	2149	16.4%
2030 linear	11282	----
2030 adj.	13087	Dif. 13.8%

Figure 2

Estimate in percentage of EMS patients seen by age including composite of 65+ years of age.



The above table and figure clearly depict that if the rate of EMS utilization remains constant for the age groups even though demographics change, that the aging of the population will clearly utilize 911 and Lacey Fire Department’s pre-hospital care more frequently. Of note, in 2024, Lacey Fire Department is estimated to see more patients over the age of 65 years of age than those under the age of 65. Also of note is the indices of EMS utilization for the population in Lacey Fire Department which indicate that in 2006-8, that the population of those 65 years of age and older were substantially more likely to be seen than those under the age of 65.

Question 4’s intention was to identify impacts to the organization, and to do this meant to develop figures and estimates that could be compared with national

standards previously identified in the study and also numbers that would help identify future resource needs. Measurables considered for this question included an estimate of potential change in the amount patients transported using demographic impacts. And following that figure provide an output of how much total time will the LFD crews spend along with a rate of growth in transporting patients. As a final output, an estimate would be made on response for three units if response times were correlated only with increased response or followed the same rate of growth as the calls induced by the older population. Again, actual response time will vary and change on many potential factors.

Table 6

Patients seen compared to patients transported:

Year	Total patients	Patient transports	%
2007	6162	3917	63.6%
2008*	5604	3659	65.2%
2010	7491	4824	64.4%#
2015	8825	5683	
2020	10295	6630	
2025	11701	7535	
2030	13087	8428	

*2008 is not a complete year

#2010 and later are estimated using average 2007-08 transport percentage

Table 7

Lacey Fire Department performance by time spent on scene:

Year	Total time in min. on EMS calls only	Average per call	Additional time need for on scene time	Average increase over previous
2007	183365	29.70	---	
2008*	165821***	29.95	---	
2010	223456	29.83**	42561 (710hr)	19.05%
2015	263250	29.83**	39794	15.11%
2020	307099	29.83**	43849	14.27%

*2008 not complete. Done through 11//12/2008

** Average for 2007-2008 is 29.83

*** Average for 2007-2008 if 2008 remains on pace for entire year is 180895

Table 8

EMS average response time predictions for specific apparatus.

Year	2007	2008	07-08 avg.	2010	2010 1SD	2015	2015 1SD
Eng. 31	6.78	7.55	7.17	8.53	8.14-8.92	9.81	9.16-10.46
Eng. 33	7.42	7.46	7.44	8.85	8.45-9.25	10.19	9.54-10.85
Eng. 34	7.46	7.07	7.65	9.11	8.57-9.65	10.49	9.71-11.28

Figure 3

Estimate of Lacey Fire Department response times national benchmarks:

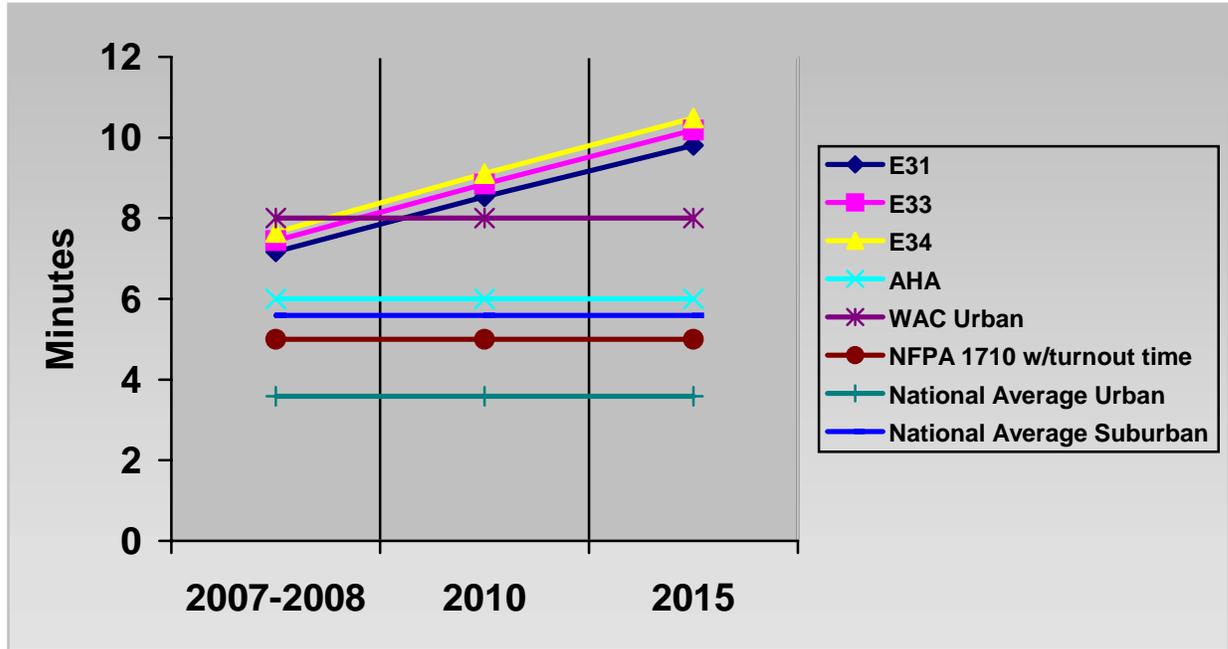


Table 8 uses three pieces of apparatus that are always staffed and in service and provided a strong, dependable basis for times. Of note was that many of the previously mentioned identified response standards are already passed without any need to interpret an estimate of when the benchmarks will be passed. Figure 3 is a listing of the national average benchmarks for both urban and suburban agencies as identified in the *Journal of Emergency Medical Services 2007 National Run Survey* (Williams, 2008), the NFPA 1710 standard (NFPA, 2004), and the Washington State Administrative Code standard (Washington Administrative Code, 2000). The American Heart Association’s implied standard for when brain death or injury occurs is also listed as a benchmark.

For this question, the estimate provided indicate that if nothing changes versus 2007-08 response resources and other variables and that if call volume increases as estimated, that if response time increase at the same rate, that significant response time

growth would occur at least in the three fire engines identified. Further, we should expect significant increases in the number of patient transports in addition to the amount of time personnel remain committed on incidents. This is important because without additional resources, decisions will need to be made on how to allocate resources and their “other” assignments and duties outside of call response.

Discussion

The research found that the demographic shift with the coming baby boom population is major and will have a significant impact to operations, or at least EMS response, at Lacey Fire Department. When one compares this project’s findings with that of Assistant Chief Lowman’s work in Coral Gables, Florida, (Lowman, 2006) its evident that the expanding senior population will effect Coral Gable’s population in much the same way as it will in Lacey. While estimates of the population shift are much more significant in Florida than Washington (US Census, 2006) it seems reasonable that the impacts that he describes and what we are starting to see across all levels of government as well as the fire service should raise immediate concerns to policy makers. Lowman’s research shares similar comparables with EMS but his research goes further into other aspects of the subject and shows that increased demands for services from the demographic shift impacts all aspects and types of service response for their respective fire department (Lowman, 2006).

In looking at the expanding growth of St. Peter’s Hospital especially in the emergency department (Batcheledor, 2008), it was found that not only do the authors anecdotal observations of listening to ambulance crews getting diverted or having to wait at the hospital match with documented descriptions of emergency room delay (Eckstein,

et al. 2005). But these delays should again raise concern to policy makers that growth in domestic emergency services especially in EMS should match growth in hospital care as the two services are linked.

With money and funds being of importance it is also central to expect agencies and health care companies that are directly affected by Medicare reimbursement to continue to decline or struggle (Ludwig, 2008). In this case, Lacey Fire Department must be aware that the private ambulance companies will be impacted not only by providing more service with a decreased revenue stream but that the stream will continue to get smaller with a 10.6% reduction effective July of 2009 unless that is amended by the new president or congress prior to taking affect (VascularWeb, 2008). The hit to private EMS service that responds with Lacey Fire District is that the growth of the older population in Lacey will likely be directly affected by Medicare cutbacks especially in ambulance reimbursement. This project found that in Lacey Fire Department, the majority of patients seen by 2024 would be over the age of 65 and thus likely dependent on Medicare. However, Medicare is currently slated to go broke by 2019 (Kuehl, 2002) and regardless, cutbacks in EMS are coming. It seems evident from the research that that BLS transport provided by a 3rd private party will become unprofitable at some point in the future and will either fall on the shoulders of the fire service, some other government agency, or require subsidy for the private ambulance service to continue.

The project also looked at demographic shift in relationship to EMS response growth. The increase in the population and the prediction for increased calls in a linear fashion is impressive. This is to say that if we ignored the demographic shift and just said that our response increases will be directly related to the total population growth alone,

then the near doubling of our response area population in 22 years is amazing especially considering Lacey Fire Department's immediate past growth. The realization that the demographic shift will increase calls disproportionately higher triggers all sorts of recommendations. The findings of Colwell, Murphy, and Bryan, (2006) identifying the impacts of the 65 to 84 year age range being twice as likely to need EMS response and those above the age of 85 using EMS response three times as frequently initially seemed excessive except that this study indicated that this segment of the population appeared to use EMS services even more frequently in Lacey Fire District. Interestingly enough, the impacts of seeing patients with more chronic and significant medical problems more frequently indicates all sorts of training needs and perhaps even organizational structure changes in how EMS is provided. The identification that we will be seeing older patients more frequently, who live longer and with more complicated medical problems (Institute of Medicine of the National Academies, 2008) indicate that EMS providers nationwide and at Lacey Fire Department will be significantly impacted by demographic change. The oldest patient found in the records from 2006 to 2008 was 104 years of age.

As a final discussion point, there should be significant concerns about continued cut backs of EMS response capability. The author understands that the numbers and statistics created would cause particular readers to interpret these findings as "reserve capacity" or the ability to absorb further cuts at Lacey Fire District. The numbers indicate to the author that the organization will continue to get busier and that reducing the availability of resources will cause critical shortages and even death in the future. If brain death occurs within 6 minutes, per the American Heart Association in a cardiac arrest, it would seem to me that the defibrillator that most EMS units carry almost becomes an

academic device when response times are what they were identified as currently and where they will go. Response benchmarks as identified need to be addressed and improvement in response times need to be a priority.

Recommendations

The first order of business should be to identify a short and long term plan with the City of Lacey, Thurston County Medic One, and Lacey Fire Department's, executive personnel to address one thing: funding. The ability to add capacity at the end of the day beyond reorganization, cost cutting, and other administrative remedies will depend largely about putting "boots on the ground" to provide patient care. The EMS calls are coming and they will occur in very complex patients who will likely need to be transported more frequently, and this requires resources to happen.

Second, consider the enhancement of Advanced Life Support service at Lacey Fire Department. The basis for this is simply the expanding patient/medical complexity identified in the research from the aging population with significant incidences of chronic illnesses. The Coral Gables study observed that their fire department's 90% ALS uniformed staff capability was a significant benefit when dealing with their elder population, which is responsible for 60% of the total calls (Lowman, 2006). As a note Coral Gables Fire Department used 142 fire fighters/EMT/Paramedics to respond to 3600 patients a year.

Third, consider developing a program or working group, both internal and external to the department, which works with this growing segment of the population to collectively to develop solution to these issues. Such items could include prevention and outreach programs, or specific efforts aimed at assisting in maintaining the health of the

senior citizen. Other examples include campaigns to do blood pressure, blood sugar, or cholesterol or cetyl reactive protein (CRP) checks in the field or events. Should the department go further and even offer these services routinely at community fire houses it could help reduce 911 calls for less acute patient conditions.

Fourth, consider revision of the EMS curriculum, especially for basic life support providers, to focus more on geriatric issues. Being able to identify critical issues that are more common in the older patient should be considered. Additionally, further education in chronic issues should also be considered as the root problem on many of these calls is more of a chronic nature rather than the acute symptom that the EMS provider is dispatched to see.

Fifth, consider re-organization of the current EMS system so that transportation of patients to the emergency department is reduced. Such things to consider are revision of the protocol to give responders more tools and the ability to not send the non-acute patient to the emergency room. This could seem radical as I am suggesting using technology to potentially allow the emergency room to come to the patient via the EMS provider, which could reduce hospital transports. Or perhaps the department should start staffing a duty physician's assistant (PA) or nurse practitioner (ARNP) that can respond with or after the initial response to provide prescriptions or referrals to general care practitioners for follow up care. The idea is to reduce transports and simply provide care a reduced cost to the system.

Finally, but not least important consider further study on the issue and consider the adoption of a more enhanced data management system specifically to track response times, resource utilization, address customer needs, and more. Utilizing such tools as

geographic information systems (GIS: how the population tool for this project was made) and building a broad-brush database that will help decision makers better place resources, would be invaluable. This goes beyond perhaps what we have now or have been considering as I would suggest tools such as Los Angeles Fire Department's and Wilson Fire Department (NC) use; they make decisions constantly about such things as resource move up, personnel call back, borderless dispatching, disaster scenarios, etc., and manage response resources at a level that dramatically exceeds are own. In short, these departments use data constantly through GIS to make not only immediate tactical and resource distribution decisions, but make long term decisions about resource placement performance through dozens of potential scenarios and variables.

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