



The Determinants of Urban Emergency Medical Services Privatization

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This paper undertakes an analysis of the decision to utilize public or private providers for the local provision of Emergency Medical Services (EMS) in cities. We provide a historical overview of the EMS industry from the mid-1860s to the present day. EMS services are commonly broken into two components: first response and transport. While first response is generally kept within the purview of local fire departments, transport is maintained in-house by public agencies, contracted out to private providers, or provided by some combination of the two. The decision to employ public or private providers for EMS transport services involves a fundamental trade-off between incentives for innovation/flexibility among private providers and infrastructural advantages posed by maintaining in-house transport services. The degree to which cities value the competing advantages of each method of provision is a result of a number of city-level factors, including population, urban density, population age, health status, the likelihood of major emergency events, crime levels, the location of fire departments and trauma centers, and the strength of labor unions. This paper poses a number of hypotheses regarding how each of the above factors is likely to affect incentives to utilize public or private EMS providers. Some of these interactions are examined empirically using data on EMS contracting decisions in the 200 largest U.S. cities. We conclude by discussing the strongest relationships between city-specific characteristics and the method of EMS provision and identify avenues for future research in this arena.

In an era of highly publicized terrorist attacks and natural disasters, Americans have placed increased value on Emergency Medical Services (EMS). These service providers not only save lives and limit casualties after large-scale catastrophic events, but also they stabilize and transport patients who experience more common forms of trauma, such as heart attacks, car accidents or acts of violence. Like many public services, an increasing number of U.S. cities are starting to privatize EMS. As the U.S. population ages and experiences escalating rates of chronic conditions and heightened threats of terrorist attacks, cities will rely increasingly on public and private EMS networks to meet these challenges¹.

Local governments are legally responsible for EMS and allocate emergency resources through contracts to public entities or private ambulance providers. When they award these contracts, city officials consider the cost of creating the necessary infrastructure and the incentives for providers to implement emergent technologies. This fundamental tradeoff between infrastructure costs and innovation extends beyond the everyday role of EMS to include more infrequent terrorist attacks, natural disasters or industrial

accidents. Although infrastructure upgrading improves system deployment and collective response, flexibility and preparedness are also important. Catastrophic events require far more personnel and equipment than normal operations.² Public chaos increases onsite treatment and commute time, rendering pre-hospital medical care imperative.³ Since the tradeoffs between infrastructure costs and flexibility vary across different cities, this paper explores the evolution and extent of EMS privatization nationally as well as the determinants of local decisions to contract with private companies or public entities.

The Evolution Of Urban Emergency Medical Services

Civilian urban ambulances first appeared in the US in the 1860s (Post and Treiber 2002). Initially they were run by hospitals such as the Commercial Hospital of Cincinnati (1865) and the Bellevue Hospital in New York City (1869), but over time services developed in a relatively decentralized manner. Often a number of different entities, including fire agencies, volunteer organizations, and taxi companies, shared transport burdens. For instance, when local fire departments expanded their rescue and transport operations, taxi cab and hearse companies added these services as supplemental activities (Sucher 2002). During this period, EMS operators did not provide pre-hospital care; generally drivers lacked medical training and were charged solely with the task of transporting patients.

The passage of the Emergency Medical Service Systems (EMSS) Act of 1973 drastically changed these conditions. The act created standards for providers, supported the regional development of EMS systems, and most importantly, established extensive federal funding (Swor 2002). It delegated responsibility for emergency response to municipalities and helped cities become the dominant EMS providers (Poole 1995). The ambulance industry transformed from a purely transportation-based entity into a source of pre-hospital emergency care. Fire departments, which previously focused exclusively on fire fighting, incorporated emergency services provision into their agendas.

These developments compelled innovations in EMS design, including a well-defined two-tiered system of *first response* and *transport*. While a first response unit arrives quickly at the scene of all EMS calls to provide basic, stabilizing care, transport providers carry individuals to health care facilities. Since they are deployed, equipped, and staffed individually and perform complementary roles, different city entities can fill these two functions. Fire departments were ideally suited to carry out first response duties because of their existing infrastructure and quickly became the dominant provider of these services.

However, the vehicle types and level of required medical care for transport services were different from those offered by fire departments. Private firms were on equal footing with public agencies. Financial developments, which allowed

Medicare and Medicaid to reimburse these companies, further motivated private entities to provide these services (Sucher 2002). Simultaneously, cities experienced fiscal distress as federal funds dried up (Poole 1995).⁴ As a result, private ambulance services expanded, promising quality service with greater cost effectiveness.

Since most private ambulance companies emerged from other transportation firms, such as taxi cab and hearse companies, they were generally locally-owned family businesses. However, a few organizations recognized the profit potential of transport provision and began to acquire smaller firms and consolidate the industry. They expected that consolidation would produce economies of scale, improve infrastructure, and ultimately increase revenues. Four major EMS transport firms emerged: Rural/Metro, American Medical Response (AMR), MedTrans, and CareLine. Throughout the mid-1990s, these companies acquired hundreds of smaller businesses and competed against each other in what was described as a “feeding frenzy” (Sucher 2002).

EMS Privatization: A Conceptual Framework

EMS systems operate under various financial packages, levels of medical provision, operational structures, and local and state mandates. Due to the urgent nature of the services, research on the causes and effects of this variation is critical to the successful functioning of our country’s public

health system. However, no systematic research on the determinants and consequences of these decisions currently exists (Delbridge et al. 1998). While medical EMS research has focused on scientific and clinical topics, such as injury prevention, infectious disease, disaster medicine, and toxicology, operations management research has concentrated on the mechanics and structure of emergency medical systems (e.g. Hall 1972 and Fitzsimmons 1973).⁵ Neither field has addressed issues such as resource allocation, financing, physical and human capital investment, the role of incentives, or the scope of services provided by the government. There are widespread and conflicting arguments over who should provide paramedic services (Poole 1995). There also are theoretical controversies over which public services lend themselves to private provision versus those that do not -- the “contracting out” versus “in-house provision” debate (Shleifer 1998). To date, no rigorous economic analysis of emergency medical services exists, let alone the determinants of provider type.

As discussed earlier, fire stations originally were established according to the geographic and demographic characteristics of cities. Combined with their highly trained staff and 24 hour workday, this factor rendered fire departments particularly suitable to provide EMS first response services. Figure 1 below shows that 192 of the largest 200 US cities utilize public agencies, such as fire departments, to carry out these functions.

Figure 1 illustrates that the choice of

Figure 1: Provider choice for first and second response in largest 200 cities.

	First Response	Transport
Public	96%	41%
Private	2%	45.5%
Mix	2%	13.5%

Source: 2004 Journal of Emergency Medical Services 200 City Survey.

provider for EMS transport services is neither obvious nor uniform. Although first responders engage in some life support, transport teams give most medical care, which is enhanced by proper training and equipment investment. On one hand, providers with the ability and, more importantly, the *incentives* to invest in new technology (including trained personnel and flexible fleet deployment) can offer better care in “second response,” i.e. transport. On the other hand, if the infrastructure costs of creating a more flexible transport system are sufficiently high, it may be more desirable to use a less innovative, cheaper transport system. Since many of these organizations also provide first response services, they will experience lower infrastructure costs and incorporate a larger number of stations and personnel.

Broadly speaking, private EMS providers have greater financial incentives to develop and implement medical and operational technologies than public firms. While a public EMS provider, such as a fire department, is an organization that

exists only in that particular locality, a private EMS provider often carries out services and reaps revenues in several cities or nationally, as in the case of companies like American Medical Response. Such a broad scope of service makes it more economical for private firms to invest in the up-front capital costs of medical and EMS research and technology, which we generally refer to as “innovations”. In turn, these additional innovations and technologies give private firms the flexibility to provide more sophisticated medical care.

However, for an EMS provider to have the incentive to develop and implement innovative improvements, the contracting city government must reward the firm financially. Post-contract negotiations often determine compensation, giving private firms another advantage over public firms. Following the analysis presented in Hart, Shleifer and Vishny (1997), private firms, being fundamentally independent from their contracting governments, have superior control rights over the innovations they develop compared to public agencies, which are essentially “owned” by these governments. During renegotiations, private firms command more favorable compensation for their implemented innovations than public firms, further increasing their incentives to create and utilize improved technology and processes.⁶

Indeed, current research suggests that private firms generally adhere to performance measures more than public ones. They also exhibit faster rates of technology adoption and have more

flexible system designs (Shleifer 1998).⁷ Private EMS systems are more likely to use tools such as peak-load staffing, event-driven deployment, and flexible production strategies, which employ both basic and advanced life support teams (Balaker and Summers 2003). Conversely, public agencies often lack the contractual incentives to develop and implement such technologies-- both the performance-enhancing medical infrastructure and the cost-minimizing flexible system design. Secondly, as discussed above, public firms often receive less compensation for the development and implementation of technologies (Hart et al. 1997).

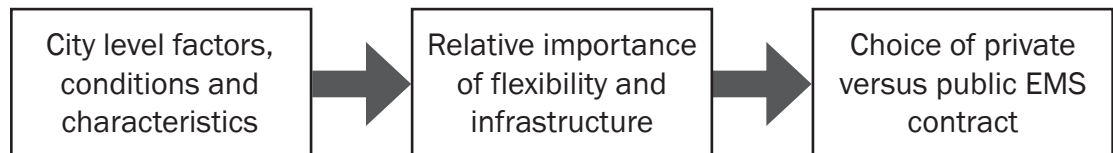
Given that public agencies, such as fire departments, often provide first response, there likely are synergies that reduce the additional costs of also providing transport services. Thus, a city's preference for public or private service provision is integrally linked to the competing advantages between service innovation/flexibility and lower infrastructure costs, which often arise from first response-transport provider continuity.⁸ Since there is neither a predominance of public nor private firms in transport provision, we conclude that there are city-specific characteristics that determine which competing advantage is more important for

a particular locality, and hence, which provider type is preferred. The concept is illustrated in Figure 2 below:⁹

City-specific characteristics include: 1) population density, health status, and age; 2) weather conditions and the likelihood of a massive industrial accident, natural disaster, or terror attack; 3) crime levels; 4) the geographic distribution of fire stations and trauma centers; and 5) the nature of local politics and the strength of local unions.

The next section discusses how these factors help determine a city's preference for flexibility/innovation versus infrastructure, which shapes their decision to privatize transport services. It is important to note that while each of these factors can generally be identified as strengthening the importance of either flexibility/innovation or infrastructure, they are only one of many influential parameters. No one factor is completely explanatory in determining a city's EMS provider type, because all factors affect the city's preferred provider type simultaneously and in potentially competing directions. It is the net result of these factors that point to a city's preferred EMS provider type. Thus, the following discussion of city-level factors' effect

Figure 2: Conceptual Framework



on the relative importance of flexibility/innovation versus infrastructure, and hence on private versus public provision of EMS, should be considered *holding all other factors constant*.

The Determinants of EMS Privatization in Cities

Urban Density, Population Age, and Health Status

Urban density is a key factor for localities faced with the question of whether to contract transport services with governmental entities or private ambulance providers. In crowded cities, emergency departments are often closer to trauma centers, which minimizes transport time. Proximity renders sophisticated pre-hospital medical care less important and thus favors public EMS. As evident in Figure 3 to the right, denser cities tend to employ public providers. Specifically with respect to trauma centers, of the 200 largest U.S. cities, those that employ a public EMS transport provider have, on average, 1.9 trauma center hospitals per 100 square miles, while those with a private EMS transport provider have only 1.3 trauma centers per 100 square miles.¹⁰

On the other hand, cities with difficult terrain, severe weather conditions, traffic problems, poor access to emergency care, or low urban density are more likely to contract with private providers, since these circumstances increase transport travel time and require high-quality pre-hospital care.

In addition, cities with severe weather and heavy traffic need innovative ambulance fleet organizations to negotiate environmental challenges. Unlike public firms, private providers have the contractual incentives to provide superior medical technology and logistical flexibility.

As Figure 3 illustrates, there is also a relationship between a city's overall health level and their contracting decision.¹¹ Less healthy cities tend to use public providers, whereas healthier cities tend to use private providers. Interestingly, many cities with a high percentage of seniors tend to employ a mix of providers. Pure public contracting subsists in only three of the ten cities with the highest proportion of elderly individuals (Hollywood, FL, Warren, MI, and Miami, FL). On one hand, elderly individuals are more prone to suffer from medical conditions that require immediate attention (e.g. heart attacks, strokes, etc.), which make transport time critical and ultimately favor flexibility and quality. On the other hand, a higher proportion of elderly individuals may also increase the frequency of non-emergency inter-facility transfers, which depend almost entirely on transport infrastructure. The confluence of these two factors may ultimately favor a mixed equilibrium rather than support one method of provision or the other.

Major Emergency Events

Dense, populous cities face higher risks of experiencing and sustaining substantial damage from large-scale emergencies, such as terrorist at-

Figure 3: EMS contracting in top ten cities - by density, population age, and health

Population per Square Mile			Percent Population above 65		
Rank	City	EMS	Rank	City	EMS
1	New York, NY	Public	1	Cape Coral, FL	Public/Private
2	Paterson, NJ	Public	2	Honolulu, HI	Public/Private
3	San Francisco, CA	Public	3	St. Petersburg, FL	Private
4	Jersey City, NJ	Private	4	Hollywood, FL	Public
5	Chicago, IL	Public	5	Warren, MI	Public
6	Santa Ana, CA	Public	6	Miami, FL	Public
7	Boston, MA	Public	7	Scottsdale, AZ	Public/Private
8	El Monte, CA	Private	8	Hialeah, FL	Public/Private
9	Hialeah, FL	Public/Private	9	Pittsburgh, PA	Public/Private
10	Newark, NJ	Private	10	Evansville, IN	Private
Healthiest Cities			Least Healthiest Cities		
Rank	City	EMS	Rank	City	EMS
1	San Jose, CA	Private	1	New Orleans, LA	Public/Private
2	Washington, DC	Public	2	San Antonio, TX	Public
3	San Francisco, CA	Public	3	Cincinnati, OH	Public
4	Seattle, WA	Public/Private	4	Cleveland, OH	Public/Private
5	Salt Lake City, UT	Private	5	Orlando, FL	Private
6	Oakland, CA	Private	6	Columbus, OH	Public
7	Sacramento, CA	Private	7	Detroit, MI	Public
8	Orange County, CA	Public	8	New York, NY	Public
9	Denver, CO	Public/Private	9	Las Vegas, NV	Private
10	Austin, TX	Public/Private	10	Indianapolis, IN	Public/Private

Source: US Census 2000 and <http://www.bestplaces.net/docs/studies/healthy.aspx>; note: Population per Square Mile excludes Cambridge, MA, Inglewood, CA and Daly City, CA; Percent Population above 65 excludes Clearwater, FL, Livonia, MI, and Pueblo, CO due to missing data on EMS contracting.

Figure 4: EMS contracting, likelihood of severe thunderstorms, hurricanes, earthquakes and terrorism in selected cities

City	EMS	Thunderstorm	Hurricane	Earthquake	Terrorism
Cincinnati, OH	Public	Medium	Low	Low	Low
Milwaukee, WI	Private	Medium	Low	Low	Low
Pittsburgh, PA	Public/Private	Medium	Low	Low	Low
Buffalo, NY	Private	Medium	Low	Low	Low
Phoenix, AZ	Public	Medium	Low	Low	Low
Rochester, NY	Private	Medium	Low	Low	Low
San Diego, CA	Public/Private	Low	Low	Medium	Medium
Las Vegas, NV	Private	Low	Low	Medium	Medium
San Antonio, TX	Public	Medium	Medium	Low	Low
Salt Lake City, UT	Private	Low	Low	High	Low
Philadelphia, PA	Public	Medium	Low	Low	Medium
Detroit, MI	Public	Medium	Low	Low	Medium
Los Angeles, CA	Public	Low	Low	High	Medium
Washington, DC	Public	Medium	Low	Low	High
New Orleans, LA	Public/Private	Medium	High	Low	Low
Chicago, IL	Public	Medium	Low	Low	High
New York, NY	Public	Medium	Medium	Low	High
San Francisco, CA	Public	Low	Low	High	High
Boston, MA	Public	Medium	Medium	Low	High
Miami, FL	Public	Medium	High	Low	Medium
Seattle, WA	Public/Private	Medium	Low	High	High

Source: Risk and Insurance magazine "The Nation's 10 Safest Cities: Big City Catastrophe Risk" at <http://www.riskandinsurance.com>.

tacks or natural disasters, and tend to prefer public transport agencies. Since catastrophes are unpredictable, a successful response requires far more personnel, equipment, and coordination than normal operations. Thus, in these events, large urban public service systems with higher constant levels of basic support and superior infrastructure are likely preferable to more flexible yet decentralized private providers offering a higher sophistication of care, but with less maximum capacity and without synergy with other emergency agencies. For example, the Los Angeles Fire Department's infrastructural, capacity, and coordination advantages enabled their quick and effective response to the 1994 Northridge earthquake, even though average call volume increased by 300% (Eckstein and Pratt 2002). Cities that face higher probabilities of such events tend to prefer public, rather than private, transport provision, even if the latter is more cost effective. This trend is illustrated in Figure 4 to the left.

As evident from Figure 4, cities with high likelihoods of catastrophic events, such as Los Angeles, New York, San Francisco, and Miami, tend to employ public transport services. In contrast, cities with low likelihoods for such events, such as Las Vegas, Milwaukee, Buffalo, and Rochester, tend to utilize private transport services.¹²

Crime

The spatial distribution of EMS is highly correlated to neighborhood crime levels. For

example, medical emergencies resulting from drug overdose, alcohol poisoning, and assault are more common in lower income areas. High crime communities are challenging for EMS teams. Not only do they encounter more physical and financial risks, but also they must employ a more complex set of skills. Often cities find that public infrastructure is more important than efficiency in these situations. Beyond stabilizing a victim of a violent crime, there is little a paramedic can do in a pre-hospital setting, no matter how well-trained or equipped. Thus many high crime cities value superior infrastructure over higher quality care and choose to contract to public providers. Figure 5 presents public or private contracting decisions for the top ten safest and most dangerous cities by size.

Figure 5 illustrates that these cities demonstrate a great deal of heterogeneity in terms of public versus private contracting decisions. Nevertheless, public EMS provision exists in two-thirds of the most dangerous cities, while only one-third of the safest cities use the public model.

Location: Fire Departments and Trauma Centers

Speed is the single most important factor for successful first response. Since fire departments already invest in the infrastructure necessary to provide rapid service, they are the natural candidates for "first tier" EMS provision. Cities also use fire departments to provide first response to prevent a wasteful duplication of manpower and equipment, especially in light of the declining

Figure 5: EMS contracting in top ten safest and most dangerous cities by size

Cities of 500,000 or more population					
Safest			Most Dangerous		
Rank	City	EMS	Rank	City	EMS
1	Honolulu, HI	Public/Private	1	Detroit, MI	Public
2	San Jose, CA	Private	2	Baltimore, MD	Public
3	El Paso, TX	Public	3	Washington, DC	Public
4	San Diego, CA	Public/Private	4	Memphis, TN	Public
5	Austin, TX	Public/Private	5	Dallas, TX	Public
6	San Antonio, TX	Public	6	Philadelphia, PA	Public
7	New York, NY	Public	7	Nashville, TN	Public
8	Denver, CO	Public/Private	8	Columbus, OH	Public
9	San Francisco, CA	Public	9	Milwaukee, WI	Private
10	Los Angeles, CA	Public	10	Indianapolis, IN	Public/Private
Cities of 100,000 to 499,999 population					
Safest			Most Dangerous		
Rank	City	EMS	Rank	City	EMS
1	Amherst, NY	Missing	1	Atlanta, GA	Private
2	Thousand Oaks, CA	Private	2	St. Louis, MO	Public
3	Simi Valley, CA	Private	3	Gary, IN	Missing
4	Sunnyvale, CA	Private	4	Flint, MI	Public
5	Sterling Heights, MI	Private	5	Miami, FL	Public
6	Irvine, CA	Private	6	New Orleans, LA	Public/Private
7	Livonia, MI	Missing	7	Tampa, FL	Public
8	Sioux Falls, SD	Private	8	Kansas City, MO	Public
9	Glendale, CA	Public	9	Jackson, MS	Private
10	Provo, UT	Missing	10	Richmond, VA	Public/Private

Source: The Morgan Quitno City Crime Ranking <http://www.morganquitno.com/cit00pop.htm> (derived from FBI data).

prevalence of structural fires (Eckstein and Pratt 2002). Indeed, Figure 1 illustrated that fire departments provide first response in virtually all of the 200 largest US cities.

When a public agency provides first response, there are potential synergies from employing the same public agency to provide transport EMS. Not only does improved operational performance arise from better communication and cooperation between first response and transport tiers, but also dual-purpose facilities and personnel provide cost savings. These benefits compose the infrastructural advantages of public transport provision.

However, there are limitations to full public EMS. The inherent infrastructure synergies of fire departments are stronger in first response than in transport. Although first response vehicles are generally not EMS-specific (they can be fire engines, fire SUVs, police cars etc.), transport response almost always is provided by medically-equipped ambulances, which fire departments do not necessarily own. Thus transport tier EMS does not share the same degree of synergy with fire response as first response EMS. Secondly, unlike fire stations, trauma centers are not distributed according to the population distribution. While standards for first response range from 4 to 15 minutes, patient transport often requires considerably more time. One recent study attempted to assess the access of U.S. residents to trauma centers within 45 and 60 minutes (Branas et al. 2005). They found

that between 70% and 84% of U.S. residents had access to a level I or II trauma center within 45 and 60 minutes respectively.¹³ However, these figures displayed wide geographic variation. From their analysis, we can conclude that in areas with fewer trauma centers and longer transport times, the importance of pre-hospital care and sophisticated ambulance fleet management increases. These areas will prefer to employ private firms, since they often have greater incentives to implement innovative systems and services.

City Population and the Scale of EMS

Earlier we established that private firms have a superior level of medical and system innovations, because they are compensated across multiple cities and communities. They are able to “spread” the high fixed cost of investment in such innovations across a larger client base than an individual city. Also, a multi-city private firm can reduce costs by purchasing equipment in bulk, training paramedics in centralized locations, and reduce redundancies that are not needed separately in each city the firm services, such as a billing department. These factors constitute the “scale” advantages of a private firm.

However, if a city is sufficiently large, it may have approximately the same number of EMS-needing citizens as several smaller cities combined, which makes additional quality advantages desirable and allows the public agency to buy large quantities of EMS equipment at a reduced price, etc. In this

case, the local public EMS provider enjoys many of the “scale” advantages of a private firm, weakening the private firm’s advantage. Therefore, large cities will tend to use private EMS providers less frequently, while small cities, limited by their population size, will tend to utilize a private provider. This trend is illustrated in Figure 6 below.

We see that only one of the ten largest U.S. cities employs any type of private firm for transport EMS, while seven of the ten smallest cities use a private provider. In fact, it is possible to aggregate the total population covered by the three major transport companies in the 200 largest U.S. cities. AMR covers 7,879,902 individuals, Rural/

Metro covers 1,737,921, and Southwest covers 1,373,377. As an interesting contrast, the total population of New York is 8,104,079, the population of Los Angeles is 3,845,541, and the population of Chicago is 2,862,244.¹⁴

Labor Unions

Technician and paramedic unionization also plays a role in a city’s privatization decision. Even though payments rates for transport services have shrunk considerably over the past few years, they still constitute a significant revenue source. Also, as fire incidences have decreased, medical

Figure 6: EMS Transport Provider Type for the Largest and Smallest 200 cities

Largest Cities			Smallest Cities		
Rank	City	EMS	Rank	City	EMS
1	New York, NY	Public	1	Abilene, TX	Private
2	Los Angeles, CA	Public	2	Waco, TX	Private
3	Chicago, IL	Public	3	Simi Valley, CA	Private
4	Houston, TX	Public	4	Columbia, SC	Public
5	Philadelphia, PA	Public	5	Joliet, IL	Public
6	Phoenix, AZ	Public	6	Lansing, MI	Public
7	San Diego, CA	Public/Private	7	Evansville, IN	Private
8	Dallas, TX	Public	8	Vallejo, CA	Private
9	San Antonio, TX	Public	9	Stamford, CT	Private
10	Detroit, MI	Public	10	El Monte, CA	Private

Source: Journal of Emergency Medical Services, 200-City Survey (2005).

response has occupied an increased proportion of emergency calls (Eckstein and Pratt 2002). In a climate of public sector cutbacks, cities have become more reliant on EMS as a source of revenue. Single-role fire departments have had difficulty justifying their cost effectiveness, and their unions have fought hard to keep EMS within the purview of public agencies.¹⁵ In this context, we would expect cities with powerful public sector unions to have a higher incidence of public EMS provision.

However, the level of unionization among EMS employees is heterogeneous and uneven. In a recent JEMS workplace and salary survey, about 60% of respondents were not unionized, 25% were members of the International Association of Fire Fighters, 2% were members of the International Association of EMTs and Paramedics, 1% were members of the Professional EMTs and Paramedics, and 12% were members of another union (Williams 2005). Although union membership and influence has declined over the past forty years, union activity varies considerably according to location. In fact, unionization rates in the Midwest and Northeastern states are over three times as high as in the South. New York, the most unionized state, had a union membership rate eight times that of North Carolina, the least unionized State (25.3 percent versus 3.2 percent) (BLS, 2000). Union presence also influences city budgeting and systems maintenance. When New York City public officials closed six firehouses as a part of 2003 budget cuts, union leaders managed to increase staffing in 2004 and moved from a four-man

engine to a five-man engine. As evident from this example, union strength not only contributes to public EMS provision, but also to its labor intensity and cost.

Summary

Throughout this section, we explored the effects of various city-specific characteristics on a municipality's choice to value EMS flexibility/innovation or infrastructure and consequently publicly or privately contract. However, even though these conditions influence EMS contracting, their actual effects are more complex. Moreover, to the extent that the organization of pre-hospital care in a city does not affect its geographical distribution of trauma centers, the relative importance of high quality transport increases as it becomes more difficult to access the emergency hospital care system. Of course, we do not claim that any one of these factors will predict a city's choice of EMS provider deterministically. Rather, it is the net effect of these factors, including possible interactions between two or more of the factors, which makes flexibility/innovation or infrastructure relatively more important in a given city, and hence whether a private or public firm will be preferred.

Discussion

In this paper, we have argued that there is a fundamental link between the competing advantages of flexibility versus infrastructure and the

choice between private versus public EMS transport provision. Private providers generally offer greater operational flexibility, technological innovation, and medical care sophistication than public agencies. Such advantages stem from the ability of private firms to reap large returns from innovations by introducing them in multiple cities, thus giving them superior financial incentives to develop and implement improvements, as compared to public providers, who are restricted to servicing only their own city. On the other hand, public providers have infrastructural advantages, such as more personnel and continuity synergies, which allow them to respond more effectively to large scale emergencies, such as terrorist attacks and natural disasters.

Given these competing advantages, we have identified six fundamental city-specific characteristics that influence a city's decision to contract privately or provide EMS through a public agency: 1) population density, health status, and age; 2) weather conditions and the likelihood of a massive industrial accident, natural disaster, or terror attack; 3) crime levels; 4) the geographic distribution of fire stations and trauma centers; 5) returns to scale, which we measured using the city's population; and 6) the nature of local politics and the strength of local unions. A number of hypotheses were developed suggesting how each factor is likely to affect the strength of a public or private provider's relative advantages as well as the degree to which a city would value these differing provider attributes. The net result of the competing advantages, weighted by each city's characteristics, ultimately decides the

public versus private question. On the basis of the data presented, we find strong evidence that public EMS provision tends to be preferred in populated, dense cities that have a high likelihood of catastrophic events and higher levels of crime. There also appears to be a strong positive relationship between public contracting and trauma center density.

With respect to our hypotheses relating to the health status of a city's residents and the proportion of residents over 65 years of age, the trends confirmed our intuition to some extent, but were clearly more ambiguous than many of the other factors. Interestingly, this ambiguity could be related to a lack of consensus among emergency medicine experts as to the actual effectiveness of extensive pre-hospital medical care. Perhaps even more scrutinized is the cost-adjusted effectiveness of various EMS systems. Uncertainty regarding both EMS' exact role within the broader health care field and the level of service that should be provided, and hence financed, could be leading to differing provider choices even between cities that are geographically and demographically similar. Determining more precise correspondences between EMS inputs, such as system design, technological innovations, and provider characteristics, and EMS outputs, such as medical effectiveness and financial efficiency, is a vital area for future research.

The ambiguity regarding EMS effectiveness relates to another compelling issue-- the influence of political incentives on EMS provider choice and system management. We addressed this

topic in our discussion of labor unions but, due to difficulties obtaining precise data, did not arrive at a conclusive position. More generally, however, the current lack of reliable measures of EMS effectiveness hampers the mandate of public officials who wish to improve their community's EMS and enables self-interested politicians to make decisions that are not necessarily in its best interest. Due to the level of uncertainty regarding effectiveness, these decisions often are made without much criticism.

Ultimately, our approach of considering urban characteristics and their impact on a cities' EMS privatization decision presents a unique perspective as compared to most economic literature on the general public versus private provision topic. We hope that it provides a more structured analysis of the EMS provider industry than has previously existed in the emergency medicine literature. Further analysis using this approach will not only improve our understanding of the determinants of EMS provision, but also help local officials construct systems that provide the highest quality of care to their citizens.

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Notes

¹ 62 million Americans will be age 65 and older by 2025 compared to 35 million in 2004. Source: U.S. Census Bureau. According to the Department of Homeland Security there are 155,000 registered emergency medical technicians (EMT) and over one million firefighters in the U.S.

² Bomb-blast victims, for example, are very different than standard end users of EMS, since these patients often require different medical interventions than burn or car-crash victims.

³ The pressure on local hospitals in such events may result in longer transfer times to emergency rooms, and hence increase the relative importance of pre-hospital care quality.

⁴ The financing of EMS is always a challenge for cities. Factors like a city's wealth and the proportion of its insured residents can determine provider type by superseding the flexibility versus infrastructure debate. If a city cannot finance a private EMS system, it may be forced to use public services even if the city's characteristics make a private system preferable. Additionally, it is worth noting that cities generally decide whether to use public or private providers, contract accordingly, and then decide the levels of financing that will be available to fund these services. Because the two variables are jointly determined, we have opted not to include the likely influence of financing as a determinant of EMS contracting decisions in favor of other factors that exert external influences on the public choice model.

⁵ Most articles are published in emergency medicine-related journals. The *Annals of Emergency Medicine* is considered to be the leading journal in the field.

⁶ For municipal services in which technological change occurs at a relatively rapid rate, like EMS, these renegotiations are much more important than they are for services in which technological innovation is relatively slow, like garbage collection.

⁷ “For fire-based EMS agencies, the desire to be seen as a better choice than private-sector firms has renewed interest in performance measurements and benchmarking” Terry L. Schenk in an article titled “Measures for Medics”, *Fire Chief*, Jan 2001.

⁸ There are other distinctions between private and public providers, related to the nature of their personnel, which may generally support the flexibility versus infrastructure argument. Since firefighters are already on duty to respond to emergencies, and since the pay raise for a firefighter becoming EMS-trained is less than the cost of hiring a separate EMT or paramedic, the fire department/fire department provider combination may provide equal quality at a lower cost. However, firefighters may not seamlessly adapt to having a substantial portion of their duties involve emergency medical services. While the personnel argument suggests the increased superiority of private EMS providers in medical care quality by way of specialization, other research has found results that cast doubt on the actual effectiveness of the more sophisticated pre-hospital care administered by paramedics (Fish-

man and Branas 2004).

⁹ For a complete and formal discussion of the underlying modeling approach see David and Chiang, 2005. Public versus Private Provision of Emergency Medical Services.

¹⁰ 2004 Trauma Center data from the Trauma Information and Exchange Program (TIEP) and EMS provider type for the 200 largest US cities from the Journal of Emergency Medicine (JEMS).

¹¹ Data on the health levels in cities was collected from a variety of sources – including the U.S. Census Bureau, the Center for Disease Control, the American Medical Association, and the Bureau of Labor Statistics – and aggregated across five major categories: mental wellness, lifestyle pursuits, physical activity, health status, and nutrition.

¹² Many of these cities are also likely to have transportation problems resulting from snow and other weather conditions.

¹³ Among rural residents, only 8.4% had access to a trauma center within 45 minutes and 24.0% had access within an hour. Among urban residents, on the other hand, 72.7% could reach a trauma center within 45 minutes and 86.2% could do so within an hour.

¹⁴ AMR, Rural/Metro, and Southwest are also major players in smaller cities, communities, and rural areas. As a result, these estimates are downward-biased estimates of the populations that they serve.

¹⁵ For example, Poole (1995) notes the following:

“Because EMS is such a complex service, fire chiefs and fire unions may be able to present defenses of the status quo that sound reasonable to those not fully versed on the intricacies of EMS. They may also be able to recommend consultants who (in fact) specialize in preventing paramedic privatization, under the guise of being objective experts on EMS system operations. Successful modernization of EMS into a high-performance system is unlikely to be possible unless the relevant public officials take the time to understand the fundamentals” (18).

References

- Balaker, Ted and Adam B. Summers. 2003. *Emergency Medical Services Privatization*. Los Angeles: Reason Foundation.
- Branas, Charles C. et al. 2005. Access to Trauma Centers in the United States. *Journal of the American Medical Association* 293(21): 2626-2633.
- Bureau of Labor Statistics. 2000. Union Membership, by State. *Monthly Labor Review Online* 123(9), September.
- David, Guy and Arthur Chiang. 2005. *Public versus Private Provision of Emergency Medical Services*. Philadelphia: University of Pennsylvania.
- Delbridge et al. 1998. EMS Agenda for the Future: Where We Are ... Where We Want to Be. *Annals of Emergency Medicine* 31(2): 251-63.
- Eckstein, Marc and Franklin Pratt. 2002. Chapter 6: Fire. In *Prehospital Systems and Medical Oversight*, 3rd Edition, edited by Alexander E. Kuehl. Dubuque, Iowa: Kendall/ Hunt Publishing Company.
- Fishman, P.E. and Charles Branas. 2004. Urban Trauma Transport – No Need for Medical Personnel at All? In *Trauma and Emergency Surgery: Proceedings of the Sixth European Congress*. The Netherlands: Medimond S.R.I.
- Fitzsimmons, James A. 1973. A Methodology for Emergency Ambulance Deployment. *Management Science* 19(6): 627-636.
- Hall, William, K. 1972. The Application of Multifunction Stochastic Service System in Allocating Ambulances to an Urban Area. *Operations Research* 20(3): 558-570.

- Hart, Oliver, Andrei Shleifer and Robert W. Vishny. 1997. The Proper Scope of Government: Theory and an Application to Prisons. *The Quarterly Journal of Economics* 112(4): 1127-1161.
- Persse, David E. 2002. Chapter 19: Response Choices. In *Prehospital Systems and Medical Oversight*, 3rd Edition, edited by Alexander E. Kuehl. Dubuque, Iowa: Kendall/Hunt Publishing Company.
- Poole, Robert W. 1995. *Privatizing Emergency Medical Service: How Cities Can Cut Costs and Save Lives*. Los Angeles: Reason Foundation.
- Post, Carl and Marsha Treiber. 2002. Chapter 1: History. In *Prehospital Systems and Medical Oversight*, 3rd Edition, edited by Alexander E. Kuehl. Dubuque, Iowa: Kendall/Hunt Publishing Company.
- Rural/Metro Corporation. 2002. 2002 Annual Report. Securities and Exchange Commission Form 10-K, June 30.
- Shleifer, Andrei. 1998. State versus Private Ownership. *Journal of Economic Perspectives* 12(4): 133-150.
- Sucher, Michel A. 2002. Chapter 7: Private. In *Prehospital Systems and Medical Oversight*, 3rd Edition, edited by Alexander E. Kuehl. Dubuque, Iowa: Kendall/Hunt Publishing Company.
- Swor, Robert A. 2002. Chapter 13: Funding. In *Prehospital Systems and Medical Oversight*, 3rd Edition, edited by Alexander E. Kuehl. Dubuque, Iowa: Kendall/Hunt Publishing Company.
- Tadelis, Steven and Jonathan Levin. 2005. Contracting for Government Services: Theory and Evidence from U.S. Cities. Working Paper. Palo Alto, CA: Stanford University.
- Williams, Dave. 2004. *Journal of Emergency Medical Services* 200 City Survey. *Journal of Emergency Medical Services* 30(2): 38-53.