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Abstract

This study investigates how ownership and/or management affects ambulance services across the United States. We investigate whether ambulance quality, measured by patient transportation time, varies by organization type. We estimate the effect of ownership structure on response time variables using data from the National EMS Information System (NEMSIS) for the years 2010–2015, the most comprehensive data set on emergency medical services. Focusing on ground transportation (as opposed to air and water transportation) and on Medicare-eligible (age 65 years and older) patients, we find that, on average, ambulance services owned by fire departments respond faster than those managed by other types of ownership. Specifically, fire-department-owned medical emergency services located in urban areas are approximately 12 percent or six minutes faster than those owned by community nonprofit organizations, and are around five minutes faster than those owned by government agencies. Using some admittedly crude measures of costs, we find no evidence of significant cost differences by ownership structure. Based on evidence from other sources, we find some weak evidence that private-sector ambulances are better than other types of ambulances at collecting payment from patients, private-sector insurance companies, Medicare, and Medicaid. In the end, the strongest conclusion is that few reliable data are available to guide local governments that are trying to decide how to structure emergency services in their region.

I. Introduction

While the first ambulance service in the United States was initiated in 1865, the federal government got involved in emergency medical services (EMS) only in the 1970s. According to a comprehensive report on EMS (Institute of Medicine of National Academies, 2007), since the early 1980s, federal support of EMS agencies has declined rapidly. Today, the report claims, local governments are primarily responsible for managing and financing EMS systems. The local

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and regional EMS systems are overseen by the state EMS agencies. However, the report suggests that the lack of federal structure and the presence of this local control has led to fragmentation and large variability in the level of EMS service offered across regions in the United States. In the postwar era, municipal hospitals, fire departments, and funeral homes were primarily responsible for transporting patients (Institute of Medicine of National Academies, 2007). Today, numerous entities provide ambulance services across the United States. Such entities include community nonprofit organizations, fire departments, government (excludes fire departments), hospitals, and private nonhospital organizations. Yet, little is known about potential differences in the performance of EMS by organizational structure.

However, knowledge of the most efficient way to organize an ambulance service is important for local governments, because as support from the federal government declines, ambulance services risk being scaled back or completely dissolved. For instance, Letcher County, Kentucky, reduced funding to its ambulance service because of the loss of revenue from the coal severance tax (Estep, 2017a). One way communities can conserve resources is by directing them to the most efficient ambulance service and continuing to ensure that their residents have access to ambulance services. Our study is an early attempt to address this lack of knowledge by examining how the ownership structure of an ambulance service affects the quality of emergency service delivery to the community. We believe that the results from this paper could better inform communities on how to choose the most efficient way to provide ambulance services.

To examine the performance of ambulances, we use response times as a proxy for quality. Broadly, we want to answer the question of how prehospital emergency care affects patients' health outcomes. Several studies have found a significant relationship between response times and patient outcomes (Pons et al., 2005; Wilde, 2013). Furthermore, emergency service providers use response times to track and assess their performance and to vie for contracts (McCallion, 2011).

Our study utilizes a unique, restricted access data set containing information on emergency ambulance calls at the national level. This database is maintained by the National Emergency Medical Services Information System (NEMSIS), a national registry of emergency ambulance 911 calls. NEMSIS integrates and standardizes the data collected by EMS across the

United States (NEMSIS, 2016). Until NEMSIS came into existence in 2001, there were no data available on ambulance calls at the national level.

In this study, we find that ambulance services operated and owned by fire departments are the fastest in responding to an emergency ambulance call when compared to all other ownership types. In urban areas, the fire department EMS response times average five to six minutes faster (12 percent). We also find that all types of ambulance services tend to use similar vehicles and staff ambulances with personnel with similar training, which provides some crude evidence that they have similar costs. We also draw on several different articles to provide weak evidence that for-profit ambulances are better at being reimbursed by patients, private insurance companies, or federal programs such as Medicaid or Medicare, meaning local taxpayers may face less of a burden in financing these types of ambulances. Our main conclusion is that, given the amount of money being spent on ambulance services in the United States, it is surprising that data on the performance and costs of ambulances are almost nonexistent. Local governments have little evidence to use when deciding how to organize their local ambulance services. While our results provide some evidence on one measure of quality, it would be useful to have other measures of quality as well as costs, so it seems worth investing additional resources to collect this additional information.

The following section provides an overview of the related literature. Section 3 describes the data and descriptive statistics for the variables used in our analysis. The methodology is discussed in section 4. Section 5 presents the results and robustness checks. Section 6 discusses other topics to consider for our analysis. Section 7 concludes.

II. Previous Literature

Scant literature exists on the effect of ownership type on the quality of ambulance services. The US Government Accountability Office (GAO) (2012) uses the results from a national survey of ground ambulance providers to examine the impact of ambulance provider ownership and other ambulance provider characteristics on total cost per transport among providers. It finds that ownership had no significant effect on differences in cost per transport.

The decision for a community to utilize either a private or public entity for ambulance service might depend on several factors. Chiang, David, and Housman (2006) analyze theoretically and empirically how some city-level factors such as population, population age,

urban density, health status, and crime levels affect the decision of using either a public or private provider in urban areas. Holian (2009) develops a public choice model to identify variables that determine whether a city outsources its ambulance service. He finds that cities with mayors as opposed to city managers were more responsive to elderly voters when it came to ambulance outsourcing.

Perhaps the closest study to ours is Déziel (2017), which investigates the relationship between the ownership of the organization that provided the ambulance service and the likelihood of their engaging in patient transport. Taking into account 4.6 million 911 ambulance requests from 2009 to 2013 in Virginia, this study finds that private for-profit ambulance services were 4.5 times more likely to transport a patient than publicly owned ambulance services. Additionally, private nonprofit organizations were two times more likely than private for-profit organizations to transport the patient.

Our study differs from Déziel (2017) by using data from a national database of EMS activities, which includes information provided by all but four states. We examine the relationship between ownership of the ambulance service provider and quality of the services provided, measured by response times. To our knowledge, no study to date investigates this relationship.

Since studies on ownership of ambulance services are rare, we also examined studies of hospital ownership and its effect on quality of care. For instance, Duggan (2000) studies the effect of ownership of hospitals on organizational behavior and quality of medical care. This study, by exploiting an exogenous change in a government policy called the Disproportionate Share Program (DSH), implemented in 1990, examines how private for-profit, private not-for-profit, and public hospitals used the financial incentives provided by this program to improve the quality of medical care. It finds that private not-for-profit hospitals were no more likely than for-profit hospitals to use the funds to enhance the quality of medical care for poor patients.

Ultimately, the question is how the ownership type of the ambulance service is related to patient health outcomes. While we cannot directly try to answer this question here, we can examine the time it takes to transport a patient to the hospital, which recent work suggests is a good proxy for patient outcomes. Wilde (2013) points out that several studies look at the relationship between response times and patient outcomes for patients suffering from acute myocardial infarction or cardiac arrest (e.g., Newgard et al., 2010; Pons et al., 2005). These

studies find no significant relationship between response times and patient outcomes. Nichol et al. (1996) find modest increases in survival to hospital discharge with a decrease in response times for cardiac arrest patients. In an urban setting, Blanchard et al. (2012) examine whether the eight-minute EMS response time goal, an industry standard (National Fire Protection Association, 2016), has any impact on mortality for life-threatening calls.[3] They find no significant effect of response time on mortality. For patients suffering from physiologic abnormality identified at the scene, Newgard et al. (2010) fail to find any association between response times and mortality. Blackwell, Kline, Willis, and Hicks (2009) analyze life-threatening, priority-one calls and compare the outcomes of a treatment group of patients for whom the response time was greater than 11 minutes with a random sample of a control group for whom the response time was less than 11 minutes. They, too, find no significant impact of response time on patient outcomes.

However, a more recent study by Wilde (2013), using 2001 data from Utah's Bureau of Emergency Medical Services and Preparedness, finds a strongly significant impact of response times on mortality. The author points out the potential endogeneity of response times in previous work because response times to a particular scene might be affected by the ambulance driver and paramedic who makes the decision on how quickly to respond to a call based on the perceived severity of the case as described by the dispatcher. Wilde argues that failing to take into account such endogeneity may result in finding no significant relationship between response times and mortality. Wilde uses an instrumental variable approach to deal with the endogeneity, where the instrument he uses is the straight-line distance from incident to closest provider agency. Wilde argues that this instrument is correlated with response times but not correlated with the error term.

Jena, Mann, Wedlund, and Olenski (2017) study the change in mortality of Medicare-aged patients who suffered a heart attack and took an ambulance to a hospital during the time around a marathon being held in a city. They analyze the data for 11 cities across the United States and find that in cities during the race, heart attack patients were delayed in an ambulance

[3] According to McCallion (2011), National Fire Protection Association (NFPA) standard 1710 stipulates a response time standard of within four minutes for fire department first responders and basic life support units, 90 percent of the time for all incidents. In this case basic life support is viewed as a first responder, especially in the case of patients having heart attacks and cardiac arrest. For advanced life support, NFPA 1710 sets a standard of within eight minutes for all EMS calls. See also Wilde (2013).

by 4.4 minutes, which is a 32.1 percent longer trip. Their findings suggest that for delayed patients, the five-week mortality rate increased from 24.9 percent to 28.2 percent.

Various studies have examined other factors that might affect the response times of ambulances. For 127 large US cities, Lambert, Min, and Srinivasan (2009) use a Tobit model to identify factors that can influence EMS average response times and find that cities that are more densely populated, geographically dispersed, and have higher income levels have higher quality EMS than other cities. Courtemanche, Friedson, and Rees (2018) exploit the variation in uninsured rates at the county level for the pre-Affordable Care Act (ACA) period to explore the association between implementation of the ACA and response times for motor vehicle crashes. Their study finds that after the ACA was implemented, a 1 percent increase in insurance enrollment was followed by an increase of 22.8 percent in response times.

To date, no study systematically examines the differential effects of provider ownership in rural versus urban areas. Rural EMS agencies have their own set of challenges that can negatively affect the quality of EMS (Lambert et al., 2009). The characteristics of providers serving rural areas are shaped by the challenges posed by these areas. The volume of trips tends to be much lower in rural counties compared to their urban counterparts and results in higher costs per trip due to the fixed costs of operating an ambulance service (GAO, 2003).[4] Rural ambulance services are also characterized by longer travel distances, heavy reliance on Medicare payments, and shortages of volunteer staff, all of which can lead to longer response times (GAO, 2000).[5]

Traditionally, rural ambulance providers have been more heavily dependent on volunteers than urban providers have (Institute of Medicine of National Academies, 2007). Ott and Hasanen (1995) analyze findings from a study conducted by the Wyoming Department of Health for 1982–1992 and conclude that volunteer recruitment and retention is one of the biggest challenges facing rural EMS agencies. Freeman, Patterson, and Slifkin (2008) find that as the level of rurality went up, the percentage of respondents reporting difficulty in retaining staff

[4] On average, in 2001, the volume of trips in urban counties was around eight times that in rural counties (GAO, 2003).

[5] On average, in 1998, 44 percent of the annual revenue for rural providers came from Medicare; the figure was 15 percent in 1989. Also, around 50 percent of rural providers depend on volunteers, whereas 24 percent of urban providers rely on volunteers (GAO, 2000).

increased, too. In our study, we also analyze how the quality of ambulance service is affected by the staffing of the ambulance provider.

III. Data

This study uses data from NEMSIS, a national repository of EMS data. The data are de-identified individual patient and incident data on a single EMS use from 2010 through 2015. The reportable geographic information is limited to the nine Census divisions and the urban/rural location of an ambulance service. The NEMSIS data are a convenience sample, meaning the data are voluntarily collected from each jurisdiction in a state. In 2015, EMS in 47 states and Washington, DC, reported data to NEMSIS. Four states—Delaware, Massachusetts, Ohio, and Texas—have never reported data to NEMSIS. Figure 1 shows the year each state started reporting some data to NEMSIS. Some states report data on the majority of calls and others report only a portion of calls. NEMSIS (2016) indicates that data "probably" contain a disproportionate number of agencies with greater resources and more informed leadership with the ability to adopt reporting standards. They also believe that reporting agencies and states "have demonstrated a commitment to monitoring and improving care of patients treated and transported by EMS" (NEMSIS, 2016). NEMSIS does not examine whether there are differences in reporting by ownership type.

For each ambulance call, NEMSIS data include information on the characteristics of patients and the ambulance service, such as the patient's age, gender, whether it was a 911 call, and whether there was transport to a hospital. The data also include the highest level of ambulance staff that could respond to an incident, as well as the duration of different portions of the call: time to incident scene, time at incident scene, and time to emergency department. We limited our analysis to calls involving Medicare-aged patients 65 years and older who were transported to a hospital in an ambulance after a 911 call. We chose this sample because we want to restrict the analysis to a subset of individuals who face similar insurance rules for ambulance calls and similar emergent health issues. We also chose the sample to concentrate on transports to an emergency department in a hospital.

Using these sample selection criteria, there were approximately 21 million observations containing data on the following variables: ambulance response times for 911 calls; ownership type of the ambulance service; patient's gender, race, ethnicity, and age (65 years or older); and

other ambulance agency-related variables such as staff medical status, staff composition, service level as defined by the Centers for Medicare and Medicaid Services (CMS); and ambulance agency locations such as Census division, Census region, and urban/rural area. We dropped race and ethnicity because they contain many missing values. Moreover, the data on race are believed to be unreliable in emergency situations (Hsia, Dai, Wei, Sabbagh, & Mann, 2017). For location, we included Census division and whether the ambulance service is located in an urban or rural area. Below, we explain the variables in more detail.

The ownership types for ambulance services are distinguished by the primary funding source and management. Ambulance services are categorized into five types: fire department, government, community nonprofit, hospital-based, and private nonhospital. Fire-department-based ambulance services are a unit of the government and are managed under the fire department and possibly other emergency units. EMS employees are often trained for both working on an ambulance and other emergency duties. Government agencies are part of the local government, but are organized as separate, free-standing departments unconnected to a fire department or as a subunit of another department such as the public health or police departments. Community nonprofit agencies are not a part of the local government; they are managed by a separate community organization. The government contracts with these agencies to provide ambulance service, and these agencies are usually monitored by a medical director from the government. They are often recognized as nonprofit organizations by the Internal Revenue Service.

Hospital-based ambulance services are managed by hospitals and may be for-profit or nonprofit, depending on the management of the hospital. EMS personnel are hospital employees. Private, nonhospital agencies are for-profit companies not affiliated with a hospital and assume complete control of delivering ambulance services to a community. A government may choose to contract with a for-profit company when the government does not want to assume the financial burden of maintaining an ambulance service. Private companies include American Medical Response (AMR), the largest for-profit ambulance service in the United States. Gunderson (2015) provides a good discussion of the advantages and disadvantages of each organization type.

The funding of these ambulance organization types varies. Patients generally do not directly pay for fire department and government ambulance services, but they do pay for access

through taxes. Community and hospital-based services also rely on taxes, but additionally rely on other sources, such as insurance reimbursements, payments from Medicaid and Medicare, donations, and grants. These agencies are expected to be more financially self-sustaining. The private service is a fee-for-service model reliant on medical insurance reimbursements, payments from Medicaid and Medicare, and the collection of fees from patients, including insurance copays and self-payments (National Emergency Medical Services Advisory Council, 2012). All funding models struggle to cover the cost of providing ambulance service, and some have found creative ways to fund their operations, such as crowdfunding and membership programs (Avsec, 2016).

Table 1 describes the distribution by organization types of all ambulance trips reported to NEMSIS in 2010–2015, with transport to a hospital for patients 65 years and older. The largest category of trips is by ambulances operated by fire departments, with private nonhospital companies and government as the next two most frequent servicers.

The NEMSIS data summarized in table 1 reflect the number of ambulance calls, but not the number of ambulance service companies or organizations. Table 2 shows the percentage of companies by organizational type based on a 2011 national survey of ambulance organizations conducted by the National Association of State EMS Officials (NASEMSO) (Federal Interagency Committee on Emergency Medical Services, 2012). The greatest number of ambulance companies are fire-department-based services with government and private services being the next most popular organization types. All states responding to the NASEMSO survey had fire department-based services somewhere in their state. The other common types are government and private nonhospital. While most states have some hospital-based services, they are a small percentage of the total.

We are interested in four ambulance response times that are included in the NEMSIS data. Our primary response time is *Total Response Time*, defined as the time from when the unit is notified by the 911 dispatch to when the patient arrives at the hospital. This time is the sum of *Time to Scene*, *Scene Time*, and *Transport Time*. *Time to Scene* is the time from when the EMS unit is notified by the 911 dispatch and the unit arrives at the scene. *Scene Time* is the time from when the EMS unit arrives at the scene to when it leaves the scene. *Transport Time* is the time between when the EMS unit leaves the scene of the incident and the patient arrives at a hospital.

For all the call times considered in our analysis, NEMSIS recorded some zero, negative, and very large positive values. According to NEMSIS, one of the main reasons for these errors is keying in the wrong date and/or time. NEMSIS also reports that when the agency does not report a time, the system automatically gives it a default value, which can result in large negative and positive values.[6] For some calls, the agencies report the same time for different call time variables, which results in a response time of zero. These errors can sometimes also occur due to cancelled calls. To avoid measurement error due to these errors, we drop observations with total response times of less than 10 minutes and greater than 120 minutes. Since *Total Response Time* is the sum of *Time to Scene*, *Scene Time*, and *Transport Time*, each of these times also has to be less than 120 minutes. Limiting the sample this way results in dropping 409,704 observations.

The staff composition variable contains the data on the composition of staff employed by the ambulance agency. Some agencies are staffed by volunteers (unpaid staff), some by nonvolunteers (paid staff), and some by a mix of nonvolunteers and volunteers. Volunteer workers usually have similar training as paid workers, but in general do not sleep at the agency facility and work fewer hours than paid workers. Also, their training is often paid for by the agency. The definitions of volunteer and nonvolunteer are based on state and local definitions (US Centers for Medicare and Medicaid Services, 2016). In 2015, about 76 percent of all trips were staffed by nonvolunteers, a few trips were all volunteers, and about 21 percent were a mix of volunteers and paid staff.

The agencies also report to NEMSIS the highest level of credentials of medical responders available to send on each call. These medical responders can be a first responder, nurse, physician, emergency medical technician (EMT)-Basic, EMT-Intermediate, or EMT-Paramedic. Table 3 provides definitions for first responders and the various types of EMTs. In 2015, for over 89 percent of the trips, an EMT-Paramedic was the highest level available across all EMTs.

NEMSIS provides data on the CMS-defined level of service provided for each call. The levels of ambulance service are: Basic Life Support (BLS); BLS Emergency; Advanced Life Support (ALS); ALS Level 1 Emergency; ALS Level 2 Emergency; Paramedic Intercept (PI); Specialty Care Transport (SCT); and air ambulance services–fixed wing and rotary wing. Our study focuses on ground transportation; hence, we exclude observations for air ambulance

[6] This information came from email correspondence with the NEMSIS staff in August 2018.

services (44,579 observations). The categories PI and SCT account for few observations (16,736 of approximately 21 million), so we drop them from our analysis as well. CMS-defined service levels provided by ambulance agencies are described in table 4.

NEMSIS data also indicate whether an ambulance service is located in an urban, suburban, rural, or wilderness area based on the zip code of the ambulance service. These designations are based on the 2003 US Department of Agriculture (USDA) Urban Influence Codes (UIC) (USDA ERS, 2013). In our analysis, we combine the urban and suburban locations into a single location designated as urban, and we combine the rural and wilderness designations into a single location designated as rural.

IV. Methodology

Our main estimation model specification is as follows:

$$lnY_{ijkt} = \alpha + \boldsymbol{A}_{ijkt}\beta_{jkt} + \boldsymbol{X}_{ijkt}\delta_{jkt} + \gamma_j + \tau_t + \epsilon_{ijkt}$$

where lnY_{ijkt} is the natural log of *Total Response Time*, *Scene Time*, *Time to Scene*, or *Transport Time* for the ambulance call *i*, with ownership structure *j*, located in Census division *k*, in year *t*. We measure response times in logs because it provides a better fit with the data and allows us to interpret the coefficients as percent change. We estimate separate regressions for each response time so we can see where possible differences in the response times occur. These call times are proxies for quality of the ambulance service.

$\boldsymbol{A}_{ijkt}$ is a matrix of

- variables related to the type of ambulance responding to the call, including dummy variables for the categories of ownership of the ambulance service provider: community nonprofit, fire department, government, hospital, and private nonhospital;
- an interaction between a variable indicating if the ambulance service is located in an urban area and the ownership type dummy variables;
- dummy variables indicating staff medical level: EMT-Basic, EMT-Intermediate, EMT-Paramedic, nurse, physician, and first responder;

- dummy variables indicating the staff composition—all volunteer, all paid staff, and a mixture of both volunteer and paid staff; and
- the CMS service level of the ambulance: BLS, BLS Emergency, ALS Level 1, ALS Level 1 Emergency, and ALS Level 2.

$\boldsymbol{X}_{ijkt}$ is a matrix containing variables on patient characteristics, including a dummy variable indicating if the patient is female and the patient's age. γ_j is a set of dummy variables for different Census divisions, τ_t are year dummies, and ε_{ijkt} is the error term. We include dummies for Census divisions to account for different conditions in the regions. We include year dummies to account for national time trends such as business cycles that are common to the Census divisions, but vary over time. The coefficients on the ownership variables, as well as the coefficients on our interactions between ownership structure and the urban dummy, are the parameters of interest. They denote the average impact of ambulance provider ownership on the quality of ambulance services, while controlling for other variables.

To account for the within-Census-division correlation on the response time variable, using equation (1), we cluster the standard errors by Census division. This approach relaxes the assumption of independence of observations, although it requires the observations to be independent across the clusters. The reason for clustering here is that we believe both the regressors and the errors might be correlated within a Census division.

Our final sample used in the regression analysis is a reduced version of the original NEMSIS dataset. The original dataset contained 21,931,701 observations. As mentioned above, we focus exclusively on ground transport and exclude the PI and SCT and air transports, which results in dropping 61,315 observations. We also drop an additional 813,311 observations by limiting the total response time to a range from 10 to 120 minutes. We additionally drop 8,573,881 observations with missing CMS service level, 595,398 observations where staff medical status was missing, 53,995 observations where gender was missing, and 198,087 observations where the urban/rural variable was missing. The final sample we use in our analysis contains 11,635,714 observations. Table 5 presents summary statistics based on our final sample used in our analysis for all of the variables.

V. Main Results

The main results from our regressions of ambulance response time on ownership structure are found in table 6. In column (1), we present the results when the natural log of *Total Response Time* is the dependent variable; column (2) shows the results when the natural log of *Time to Scene* is the dependent variable; the results when the natural log of *Scene Time* is the dependent variable are found in column (3); and the results when the natural log of *Transport Time* is the dependent variable are in column (4).

Starting with the results in column (1), based on the value of the intercept, we see that among community nonprofit ambulance services located in rural areas (and controlling for the other variables), the average natural log of *Total Response Time* is 3.66, which translates to an average total response time of approximately 39 minutes (this is calculated as *e* raised to the power 3.66). Looking at the coefficients on the other ownership structure variables, we see that ambulances that are part of fire departments operating in rural areas have the fastest response time, approximately 18 percent or a little over seven minutes faster than community nonprofit ambulances, and this difference is statistically significant. Ambulances run by local governments that are not part of fire departments are 5 percent, or approximately two minutes, slower than community nonprofit ambulances. Finally, the coefficients show that ambulances run by hospitals and operated by private companies are both faster than community nonprofit ambulances, but the differences are small and not strongly significant.[7]

Examining the results for ownership type interacted with the urban variable shows that ambulances that are part of fire departments remain the fastest, arriving at a hospital on average five to six minutes faster than any other ambulance service. Among the other types of ambulances, there is little difference in total response time for ambulances located in urban areas, where almost 90 percent of the runs originate; all take on average 37 to 39 minutes to get to the hospital after initially receiving the 911 call.

Looking at the coefficients on the other variables in the regression, we see that ALS ambulances average more total time per run. This is not surprising since, as we described above, these ambulances are equipped with the most sophisticated life-saving equipment, staffed by more highly trained workers, and likely spend more time at the scene. In addition, they are sent

[7] With over 11 million observations, we primarily focus on meaningful differences and not results that are, at best, marginally significant.

out on calls that dispatchers believe are the most life threatening (Institute of Medicine of National Academies, 2007). Looking at the staff medical status variables, it appears that ambulances where a first responder is the highest level of staff that can be on the ambulance are faster than the other categories. Most of the other categories are not faster than ambulances with EMT-Basic staff. Ambulances staffed entirely with volunteers tend to be the slowest ambulances at all portions of the calls.

The results in columns (2) through (4) show that the primary reason that ambulances that are part of fire departments are faster than the other types is that they are significantly faster to the scene once they receive a 911 call, and they are somewhat faster from the scene to the hospital—although in urban areas the difference in the time from the scene to the hospital is much smaller. The actual time on the scene is similar for ambulances regardless of ownership structure. One possible explanation for why ambulances that are part of fire departments tend to be faster to the scene is that municipalities tend to locate fire departments close to where people live to reduce the time it takes to respond to a fire (Institute of Medicine of National Academies, 2007), which in turn could reduce the distance between the ambulance and the scene of a typical call.[8]

We estimate several additional regressions as a robustness check on our main results. First, we estimate our regressions separately by year to see whether changes in which states report data to NEMSIS affect our results. Overall, we find results similar to those reported in table 6. We also estimate regressions where we drop the CMS service level variables from our analysis, since these are the variables most likely to have missing values. Doing so allows us to increase our sample size to 19 million observations. Again, this does not change our basic results. In addition, we estimate models using the *Total Response Time* variable as constructed by NEMSIS, without dropping values that are less than 10 minutes or greater than 120 minutes.[9] While this changes the significance of more of the coefficients, it does not change the basic patterns we see. Finally, we estimate models where we restrict the data to only calls that used ALS ambulances, since these are the most widely used type of ambulance. When we do this, there is no longer any significant difference in total response time by ownership type for

[8] This would not account for why ambulances that are part of fire departments are faster from the scene to the hospital, but as noted, this difference is much smaller for ambulances located in urban areas.
[9] Since we take the natural log of the *Total Response Time*, values of zero are dropped.

ambulances located in urban areas. All of these results are available from the authors upon request.

Using the time it takes to transport a patient to the hospital as our measure of quality, and with the exception of ambulances that are part of fire departments, our primary conclusion from these regressions is that there does not appear to be much variation in the quality of service provided by ambulances with differing ownership structures. This being the case, it would appear that differences in costs would be a primary factor in determining which ownership structure would be the most efficient for an area.

When thinking about the costs of operating an ambulance service, it is important to recognize that many of the costs are essentially fixed. Ambulance services are required to have equipment and staff available to answer 911 calls 24 hours a day, 7 days a week. So increasing the number of runs an ambulance goes on leads to a decline in the average cost per run, at least initially.[10]

One issue with trying to compare the costs of different types of ambulance services is that few cost data are available for providers in this industry.[11] However, a recent GAO report (2012) estimates that over 60 percent of ambulance providers' total costs are for personnel, while another 14 percent are for vehicles (excluding fuel) and for supplies and equipment.[12] So one way to compare the costs of different types of ambulance services is to compare the types of personnel used to staff the ambulances as well as the types of vehicles and equipment they use. Table 7 does this by presenting the percent of ambulance runs by staff medical status, staff composition, and CMS service level by ownership structure. On ambulances operated by community nonprofit organizations, a larger percentage of ambulance calls are staffed with EMT-Basic and first responders, and ambulances operated by hospitals have a slightly larger percentage of nurses. However, other than these differences, ambulances appear to carry similar medical staff regardless of ownership structure. We can also see that ambulances run by

[10] See GAO (2012) for an estimate of the average total cost curve for ambulances services. This figure indicates that average total costs fall quite quickly initially, but also shows very little change after relatively few runs in a year.
[11] A recent report to Congress by the US Department of Health and Human Services (HHS) concludes that, due to lack of data on ambulance costs, they are unable to provide Congress with any recommended legislation for reimbursement policies for ambulances (HHS, 2015).
[12] One limitation of this study is that it does not have costs for ambulances that are part of fire departments or hospitals because these agencies claim that they cannot separate the costs of ambulance services from the costs of providing other services.

community nonprofit organizations and fire departments are more likely to use volunteers, which suggests that these ambulances may have lower costs.

In the final section of table 7, we present the percent of runs by type of ambulance and ownership structure. The GAO (2007) presents data showing that ALS ambulances are more expensive to operate than BLS ambulances because of the former's more sophisticated life-saving equipment and their staffing with more highly trained workers. Table 7 shows that ambulance services run by community nonprofits are more likely to use BLS ambulances, but there is little difference in the types of ambulances used by other types of ambulance services.

In the end, from these data, we see some evidence that ambulance services operated by community nonprofits may have lower costs, which may help account for their lower quality of service based on response times. Beyond this, it is difficult to draw any strong conclusions about the efficiency of different forms of ambulance services based on the very crude cost measures available in our data.[13] Unfortunately, as noted above, there do not appear to be good data easily available on the cost of running an ambulance service. In the absence of any cost information and given our measure of quality, there do not appear to be large differences in quality across organization types. Local governments will have to rely on other factors when trying to select the most efficient form of EMS. In the next section, we discuss other factors to consider.

VI. Further Factors Affecting Ambulance Efficiency

Presumably, one of the main benefits of a private-sector ambulance service is that it is more likely to bill the individuals who are consuming the services and less likely to rely on taxpayer subsidies, which reduces the expense to local governments. Some evidence supports the hypothesis that government-sponsored ambulance services are less likely to file claims for reimbursement with Medicare, Medicaid, and private insurance companies even when they are eligible to do so (Avsec, 2016). Further, the GAO (2012) attributes much of the rise in measured ambulance transports from 2004 to 2010 to an increase in billing for Medicare services by local governments. Part of the difficulty with filing for reimbursements is that fire departments and other government ambulance services are not used to filing claims for services, so they do not

[13] GAO (2012) does find that taxpayer subsidies are associated with higher costs of operating ambulances, which would seem to suggest that private sector ambulances would be more efficient, but the GAO is careful not to draw any causal interpretations based on this finding.

have staff who are trained to file claims, resulting in a larger number of claims being rejected or not filed at all (Avsec, 2016).

Another issue that affects the efficiency of ambulance services is the incomplete reimbursement of costs by some insurers. The GAO (2007) estimates that, on average, Medicare reimbursements only covered 94 percent of the costs of transporting patients, meaning that EMS must cover the rest of the costs through a cross-subsidy from other payers, primarily private-sector insurance companies or self-pay patients.

A related issue is nonpayment for services. The GAO (2012) reports that ambulance services fail to collect on 26 percent of runs. There are several reasons why companies cannot collect. First, it is often difficult for ambulance staff to collect from patients the information needed to file a claim because, for many patients, their condition does not allow them to communicate with the staff. Second, ambulances get reimbursed from Medicaid, Medicare, and most private insurers only if they actually transport a patient to the hospital.[14] Not transporting patients to the hospital can occur for a number of reasons: the patient may die before the ambulance arrives on the scene, or the patient may refuse to be transported. Finally, some patients do not have insurance and simply refuse to pay for the services provided. There is some evidence that EMS run by private companies are more willing to cross-subsidize Medicare and Medicaid recipients by charging higher fees to patients with private insurance or no insurance, are more aggressive in trying to obtain the information necessary to file a reimbursement claim, and are much more aggressive in pursuing claims against people unwilling to pay, although recent articles in the *New York Times* and the *Washington Post* suggest that there may be some political costs from this more aggressive behavior (Bailey, 2017; Ivory, Potress, & Bennett, 2016).[15]

Based on this previous work, there seems to be some weak evidence to suggest that private-sector ambulances might be better at obtaining payments for services from the people

[14] This rule might lead to some perverse incentives such as ambulance staff providing too much medical care to keep the patient alive until they reach the hospital or the staff not providing ample care at the scene that would negate the need to travel to a hospital.

[15] As an example of local governments' unwillingness to collect from patients who owe for ambulance services, see the *Lexington Herold Leader* (Estep, 2017b) for a story about Clay County, Kentucky, one of the poorest counties in the country. It has accumulated over $1.9 million in unpaid bills for ambulance services. Also, the *New York Times* article (Ivory et al., 2016) suggests that in some instances, private-sector companies provide lower-quality services than other ambulance services. Our results suggest that this difference is not systematic—at least using transport time for the measure of quality.

that actually use the services (or at least from the groups that insure them) and less likely to require payments from local taxpayers, which would suggest an increase in social welfare. Of course, this statement comes with a number of significant caveats, and one needs to recognize that the more aggressive behavior by for-profit ambulance companies may involve an increase in political costs.

VII. Conclusions

This paper represents an early effort at trying to provide information for local governments that are trying to decide on the best way to structure EMS in their area. Our results suggest that if the measure of quality is time to the hospital, ambulances that are part of fire departments seem to provide the highest quality of service, although the difference is smaller in urban areas and likely results from ambulances being collocated with fire trucks, which may not be the most efficient option. Other than this difference, we find very little difference in quality among other ownership structures. Based on our admittedly crude measures of cost differences, we do not see much difference in the costs of operating an ambulance service across ownership types. Finally, our discussion of other factors to consider when thinking about the most efficient form of ambulance services tends to slightly favor private-sector ambulances, but this advantage remains highly speculative. In the end, like many early efforts to explore an important question, the main result from this study is to highlight important issues that need to be addressed before we can reach a definitive conclusion.

However, one conclusion we are comfortable drawing is that increasing the availability of more complete data on this industry is important. Medicare alone reimbursed $5.2 billion in 2012 for ambulance services (GAO, 2012). Mears et al. (2012) report that in 2011, over 13,000 emergency services employed over 826,000 people to provide transport to patients, which represents a significant expenditure of taxpayer dollars. Therefore, it seems worth expending additional resources to obtain data on patient outcomes and other measures of quality of services, as well as to collect more complete data on costs, so that policymakers can make more informed decisions on the best way to provide ambulance services in a community.

References

Avsec, R. (2016, July 7). Product News: EMS Funding: 6 Alternative Sources. *EMS1.com News.* Retrieved from www.ems1.com.

Bailey, M. (2017, November 20). Ambulance trips can leave you with surprising—and very expensive—bills. *The Washington Post*.

Blackwell, T. H., Kline, J. A., Willis, J. J., & Hicks, G. M. (2009). Lack of association between prehospital response times and patient outcomes. *Prehospital Emergency Care, 13*(4), 444–450. doi:10.1080/10903120902935363.

Blanchard, I. E., Doig, C. J., Hagel, B. E., Anton, A. R., Zygun, D. A., Kortbeek, J. B., . . . Innes, G. D. (2012). Emergency medical services response time and mortality in an urban setting. *Prehospital Emergency Care, 16*(1), 142–151.

Chiang, A. J., David, G., & Housman, M. G. (2006). The determinants of urban emergency medical services privatization. *Critical Planning, 13*.

Courtemanche, C., Friedson, A., Koller, A.P. & Rees, D. I. (2018).The affordable care act and ambulance response times. *NBER Working Paper, No. 23722*.

Déziel, J. (2017). Effects of emergency medical services agency ownership status on patient transport. *Prehospital Emergency Care, 21*(6), 729–733. doi:10.1080/10903127.2017.1335817.

Duggan, M. G. (2000). Hospital ownership and public medical spending. *The Quarterly Journal of Economics, 115*(4), 1343–1373.

Estep, B. (2017a, April 12). Crippled by coal's decline, county's leaders deadlock on fee to fix revenue drop. *Lexington Herald Leader*.

Estep, B. (2017b, October 25). This Kentucky county failed to collect almost $2 million for ambulance runs. *Lexington Herald Leader*.

Federal Interagency Committee on Emergency Medical Services. (2012). *2011 National EMS Assessment*. Retrieved from Washington, DC: www.ems.gov.

Freeman, V., Patterson, D., & Slifkin, R. (2008). Issues in staffing emergency medical services: A national survey of local rural and urban EMS directors. *North Carolina Rural Health Research and Policy Analysis Center, Final Report No. 93*.

Gunderson, M. (2015). *Emergency Medical Services: Clinical Practice and Systems Oversight, Second Edition* (D. Cone, J. H. Brice, T. R. Delbridge, & J. B. Myers Eds. Vol. 2: Medical Oversight of EMS): John Wiley & Sons, Inc.

Holian, M. J. (2009). Outsourcing in US cities, ambulances and elderly voters. *Public Choice, 141*(3–4), 421.

Hsia, R. Y., Dai, M., Wei, R., Sabbagh, S., & Mann, N. C. (2017). Geographic discordance between patient residence and incident location in emergency medical services responses. *Annals of emergency medicine, 69*(1), 44–51. e43.

Institute of Medicine of National Academies. (2007). *Emergency Medical Services: At the Crossroads*. Washington, DC: The National Academies Press.

Ivory, D., Potress, B., & Bennett, K. (2016, June 25). When you dial 911 and Wall Street answers. *The New York Times*.

Jena, A. B., Mann, N. C., Wedlund, L. N., & Olenski, A. (2017). Delays in emergency care and mortality during major US marathons. *New England Journal of Medicine, 376*(15), 1441–1450. doi:10.1056/NEJMsa1614073.

Lambert, T. E., Min, H., & Srinivasan, A. K. (2009). Benchmarking and measuring the comparative efficiency of emergency medical services in major US cities. *Benchmarking: An International Journal, 16*(4), 543–561.

McCallion, T. (2011). NASEMSO Survey provides snapshot of EMS Industry. *Journal of Emergency Medical Services*. Retrieved from jems.com: https://www.jems.com/articles/2011/11/nasemso-surveyprovides-snapshot-ems-ind.html.

Mears, G., Armstrong, B., Fernandez, A. R., Mann, N. C., McGinnis, K., Mears, C. R., . . . Shofer, F. S. (2012). *2011 National EMS Assessment*. Retrieved from http://www.nasemso.org/documents/NASEMSO_2011_EMS_Industry_Snapshot-Final.pdf.

National Emergency Medical Services Advisory Council. (2012). EMS system performance-based funding and reimbursement model. *NEMSAC Advisory*. Retrieved from https://www.ems.gov/nemsac/FinanceCommitteeAdvisoryPerformance-BasedReimbursement-May2012.pdf.

National Fire Protection Association. (2016). *NFPA 1710, Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Fire Departments*. Retrieved from https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=1710.

National Highway Traffic Safety Administration. (2007). National EMS scope of practice model. *DOT HS, 810*, 657.

NEMSIS. (2016). *National EMS Database NEMSIS Research Data Set v. 2.2.1, 2015 User Manual*. Retrieved from: https://nemsis.org/media/reportingTools/documents/NEMSISRDS2212015UserManual_000.pdf.

Newgard, C. D., Schmicker, R. H., Hedges, J. R., Trickett, J. P., Davis, D. P., Bulger, E. M., . . . Gubler, K. D. (2010). Emergency medical services intervals and survival in trauma: assessment of the "golden hour" in a North American prospective cohort. *Annals of Emergency Medicine, 55*(3), 235–246. e234.

Nichol, G., Detsky, A. S., Stiell, I. G., O'Rourke, K., Wells, G., & Laupacis, A. (1996). Effectiveness of emergency medical services for victims of out-of-hospital cardiac arrest: A metaanalysis. *Annals of Emergency Medicine, 27*(6), 700–710.

Ott, J. S., and Hasanen, M. M. (1995). Emergency medical services: Yet another developing crisis in rural America. *State & Local Government Review*, 159–168.

Pons, P. T., Haukoos, J. S., Bludworth, W., Cribley, T., Pons, K. A., & Markovchick, V. J. (2005). Paramedic response time: Does it affect patient survival? *Academic Emergency Medicine, 12*(7), 594–600.

US Centers for Medicare and Medicaid Services (CMS). (2016). *Medicare Benefit Policy Manual, Chapter 10 - Ambulance Services*. Retrieved from https://www.cms.gov/Regulations-and-Guidance/Guidance/Manuals/downloads/bp102c10.pdf.

US Centers for Medicare and Medicaid Services (CMS). (2018). *Medicare Claims Processing Manual, Chapter 15 - Ambulance*. Retrieved from https://www.cms.gov/Regulations-and-Guidance/Guidance/Manuals/Internet-Only-Manuals-IOMs-Items/CMS018912.html.

US Department of Agriculture (USDA). (2013). *Urban Influence Codes*. Retrieved from: https://www.ers.usda.gov/data-products/urban-influence-codes.aspx.

US Department of Agriculture Economic Research Service (USDA ERS). (2013). Urban Influence Codes. Retrieved from https://data.nal.usda.gov/dataset/urban-influence-codes.

US Department of Health and Human Services (HHS). (2015). *Report to Congress Evaluations of Hospitals' Ambulance Data on Medicare Cost Reports and Feasibility of Obtaining Cost Data from All Ambulance Providers and Suppliers*. Retrieved from Washington, DC: www.cms.gov/Medicare/Medicare-Fee-for-Service-Payment/AmbulanceFeeSchedule/Downloads/Report-To-Congress-September-2015.pdf.

US General Accounting Office (GAO). (2000). *Rural Ambulances: Medicare Fee Schedule Payments Could Be Better Targeted*. (GAO/HEHS-00-115). Washington, DC.

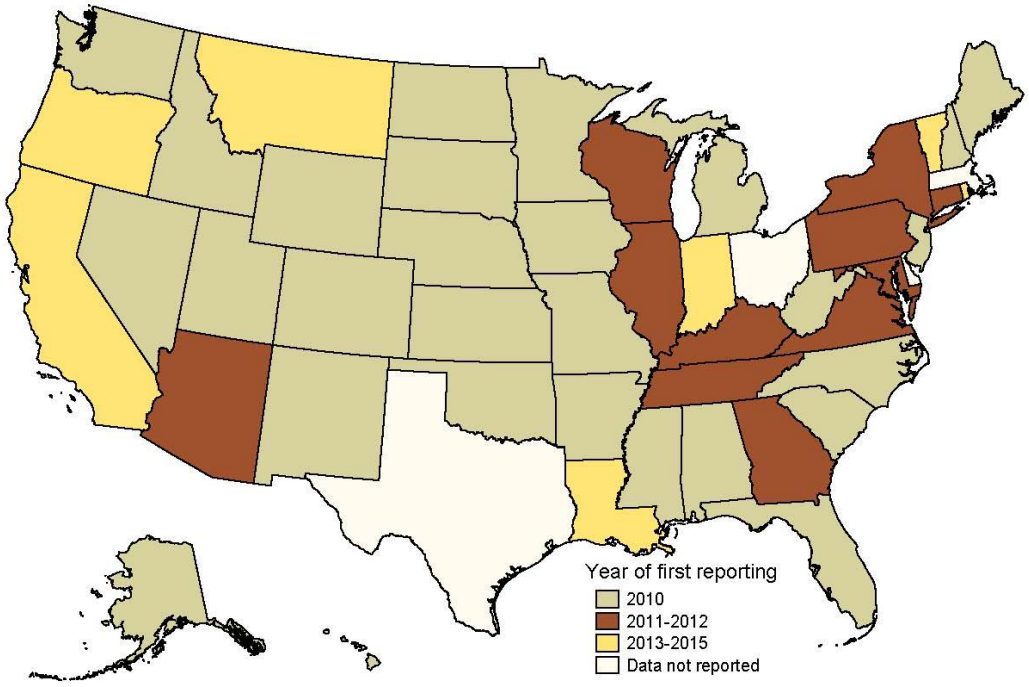
US General Accounting Office (GAO). (2003). *Ambulance Services: Medicare Payments Can Be Better Targeted to Trips in Less Densely Populated Rural Areas*. Washington, DC.

US Government Accountability Office (GAO). (2007). *Ambulance Providers: Costs and Expected Medicare Margins Vary Greatly*. (GAO-07-383). Washington, DC.

US Government Accountability Office (GAO). (2012). *Ambulance Providers: Costs and Medicare Margins Varied Widely; Transports of Beneficiaries Have Increased*. (GAO-13-6). Washington, DC.

Wilde, E. T. (2013). Do emergency medical system response times matter for health outcomes? *Health Economics, 22*(7), 790–806. doi:10.1002/hec.2851.

Figure 1: Years States Started Reporting to NEMSIS



Note: Data collected from various PowerPoint presentations made by NEMSIS staff.

Table 1: Percent of Ambulance Trips by Organizational Type

Organizational Type	Percent of all trips
Fire Department	28.3
Government	21.2
Private, Nonhospital	20.8
Community, Nonprofit	17.2
Hospital	12.5

Source: NEMSIS data for 2010–15.
Note: These are all 911 calls for Medicare patients 65 years and older with transport to a hospital. Sample size is 21,057,075.

Table 2: Percent of EMS Agencies by Organizational Type

Organizational Type	Percent of all agencies
Fire Department	41.4
Private, Nonhospital	25.3
Government	21.1
Other EMS Agency	6.3
Hospital	5.8

Source: Federal Interagency Committee on Emergency Medical Services (2012).
Note: Data are missing for CA, IL, VA, and WA.

Table 3: Definitions of Staff Medical Status

Staff Medical Status	Description
First Responder or Emergency Medical Responder (EMR)	"The Emergency Medical Responder's scope of practice includes simple skills focused on lifesaving interventions for critical patients. Typically, the Emergency Medical Responder renders on-scene emergency care while awaiting additional EMS response and may serve as part of the transporting crew, but not as the primary care giver."
EMT-Basic	EMT-Basic "have the basic knowledge and skills necessary to stabilize and safely transport patients ranging from non-emergency and routine medical transports to life threatening emergencies."
EMT-Intermediate	EMT-Intermediate "perform interventions with the basic and advanced equipment typically found on an ambulance. The Advanced EMT is an important link for administering ALS care from the scene to the emergency health care system."
EMT-Paramedic	EMT-Paramedic "is an allied health professional whose primary focus is to provide advanced emergency medical care for critical and emergent patients. This individual possesses the complex knowledge and skills necessary to provide patient care and transportation."

Source: National Highway Traffic Safety Administration (2007).

Table 4: Definition of CMS Service Levels

Service Level	Definition
Basic Life Support	"BLS is transportation by ground ambulance vehicle and the provision of medically necessary supplies and services including BLS ambulance services as defined by the state. The ambulance vehicle must be staffed by at least two people who meet the requirements of the state and local laws where the services are being furnished, and at least one of the staff members must be certified at a minimum as an emergency medical technician-basic (EMT-Basic) by the state or local authority where the services are being furnished and be legally authorized to operate all lifesaving and life-sustaining equipment on board the vehicle. These laws may vary from state to state or within a state."
Basic Life Support Emergency	"When medically necessary, the provision of BLS services, as specified above, in the context of an emergency response (defined as a BLS or ALS1 level of service that has been provided in immediate response to a 911 call or the equivalent. An immediate response is one in which the ambulance provider/supplier begins as quickly as possible to take the steps necessary to respond to the call.)"
Advanced Life Support Level 1	"Advanced life support, level 1 (ALS1) is the transportation by ground ambulance vehicle and the provision of medically necessary supplies and services including the provision of an ALS assessment by ALS personnel or at least one ALS intervention**.** An ALS intervention is a procedure that is in accordance with state and local laws, required to be done by an emergency medical technician-intermediate (EMT-Intermediate) or EMT-Paramedic."
Advanced Life Support Level 1 Emergency	"When medically necessary, the provision of ALS1 services, as specified above, in the context of an emergency response (defined as a BLS or ALS1 level of service that has been provided in immediate response to a 911 call or the equivalent. An immediate response is one in which the ambulance provider/supplier begins as quickly as possible to take the steps necessary to respond to the call.)"
Advanced Life Support Level 2	"ALS2 is the transportation by ground ambulance vehicle and the provision of medically necessary supplies and services including (1) at least three separate administrations of one or more medications by intravenous (IV) push/bolus or by continuous infusion (excluding crystalloid fluids) or (2) ground ambulance transport, medically necessary supplies and services, and the provision of at least one of the ALS2 procedures listed below: Manual defibrillation/cardioversion, endotracheal intubation, central venous line, cardiac pacing, chest decompression, surgical airway, or intraosseous line."

Source: US Centers for Medicare and Medicaid Services (2018).

Table 5: Summary Statistics for Variables Used in the Analysis

Variable	Mean	Standard Deviation
Dependent variables:		
Ln *Total Response Time*	3.63	0.372
Ln *Time to Scene*	1.97	0.608
Ln *Scene Time*	2.74	0.471
Ln *Transport Time*	2.44	0.739
Total Response Time	40.5	15.7
Time to Scene	8.6	5.8
Scene Time	17.2	7.8
Transport Time	14.7	10.6
Independent variables:		
Patient characteristics		
Gender (%)		
Male	0.40	0.490
Female	0.60	0.490
Age (65 to 105 years)	79.29	8.681
Agency characteristics		
Ownership type (%)		
Community, Nonprofit	0.16	0.368
Fire Department	0.27	0.445
Government	0.21	0.409
Hospital	0.14	0.351
Private, Nonhospital	0.21	0.408
Staff medical status (%)		
EMT-Basic	0.09	0.284
EMT-Intermediate	0.01	0.113
EMT-Paramedic	0.85	0.359
Nurse	0.04	0.192
Physician	0.01	0.107
First Responder	0.00	0.038
Staff composition (%)		
Mixed	0.21	0.406
Nonvolunteer	0.76	0.427
Volunteer	0.03	0.173
CMS Service Level (%)		
BLS	0.06	0.240
BLS Emergency	0.23	0.418
ALS Level 1	0.21	0.405
ALS Level 1 Emergency	0.47	0.499
ALS Level 2	0.03	0.173

Table 5 - Continued

Variable	Mean	Standard Deviation
Census Division (%)		
East South Central	0.03	0.156
Mountain	0.03	0.177
Pacific	0.05	0.220
West North Central	0.06	0.234
South Atlantic	0.41	0.492
West South Central	0.04	0.194
Middle Atlantic	0.24	0.430
East North Central	0.10	0.300
New England	0.04	0.193
Urban (%)		
Rural/Wilderness	0.11	0.316
Urban/Suburban	0.89	0.316

Note: Sample size is 11,635,714.

Table 6: Regression Results

Dependent Variables	Ln *Total Response Time* (1)	Ln *Time to Scene* (2)	Ln *Scene Time* (3)	Ln *Transport Time* (4)
Ownership ("Community Nonprofit" is the omitted category)				
Fire Department	–0.20***	–0.30***	–0.05	–0.27***
	(0.043)	(0.089)	(0.027)	(0.073)
Government	0.05**	–0.02	0.01	0.13***
	(0.014)	(0.013)	(0.035)	(0.033)
Hospital	–0.08*	–0.06	–0.02	–0.14
	(0.040)	(0.058)	(0.020)	(0.087)
Private Nonhospital	–0.05	–0.02	–0.04	–0.08
	(0.051)	(0.070)	(0.040)	(0.088)
Ownership X Urban				
Community Nonprofit X Urban	–0.00	–0.10***	0.05**	0.09***
	(0.017)	(0.029)	(0.020)	(0.020)
Fire Department X Urban	0.02	0.02	0.02	0.11
	(0.064)	(0.079)	(0.020)	(0.116)
Government X Urban	–0.10***	–0.09**	–0.01	–0.11**
	(0.012)	(0.028)	(0.016)	(0.042)
Hospital X Urban	0.05	–0.02	0.13**	0.06
	(0.026)	(0.036)	(0.040)	(0.091)
Private Nonhospital X Urban	0.02	–0.01	0.08**	0.05
	(0.035)	(0.030)	(0.030)	(0.087)
CMS Service Level ("BLS" is the omitted category)				
BLS Emergency	–0.02	–0.06*	0.02	–0.00
	(0.018)	(0.028)	(0.027)	(0.009)
ALS Level 1	0.10***	–0.04	0.19***	0.13***
	(0.022)	(0.028)	(0.025)	(0.018)
ALS Level 1 Emergency	0.08***	–0.06**	0.17***	0.11***
	(0.016)	(0.021)	(0.043)	(0.020)
ALS Level 2	0.12**	–0.08**	0.25**	0.10**
	(0.042)	(0.027)	(0.090)	(0.031)
Staff Medical Status ("EMT-Basic" is the omitted category)				
EMT-Intermediate	0.12*	0.16	0.08	0.07
	(0.057)	(0.101)	(0.052)	(0.098)
EMT-Paramedic	0.05	0.08	0.07**	0.04
	(0.057)	(0.076)	(0.029)	(0.091)
Nurse	0.01	0.09	–0.03	0.04
	(0.049)	(0.096)	(0.031)	(0.095)
Physician	0.06	0.18*	0.10***	–0.03
	(0.054)	(0.081)	(0.019)	(0.087)
First Responder	–0.36***	–0.53***	0.05	–0.92***
	(0.073)	(0.103)	(0.046)	(0.110)

Table 6 - Continued

Staff Composition ("Mixed" is the omitted category)				
Nonvolunteer	–0.04**	–0.02	0.01	–0.12***
	(0.011)	(0.023)	(0.019)	(0.027)
Volunteer	0.15***	0.24***	0.07**	0.21***
	(0.023)	(0.039)	(0.027)	(0.033)
Female	–0.01*	–0.02***	0.02***	–0.02***
	(0.002)	(0.002)	(0.003)	(0.003)
Patient Age	–0.00	–0.00	0.00***	–0.00***
	(0.001)	(0.001)	(0.000)	(0.001)
Constant	3.66***	2.26***	2.15***	2.86***
	(0.087)	(0.092)	(0.055)	(0.129)
Year Effects	Yes	Yes	Yes	Yes
Census Division Effects	Yes	Yes	Yes	Yes
R-squared	0.059	0.040	0.044	0.040
Observations	11,635,714	11,635,714	11,635,714	11,635,714

Note: Heteroskedasticity-robust standard errors are in parentheses. These are corrected for clustering within Census division. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

Table 7: Percent of Ambulance Calls by Ambulance Service Characteristics and Ownership Type

	Community Nonprofit	Fire Department	Government	Hospital	Private Nonhospital
Staff Medical Status					
EMT-Basic	25.0	6.8	5.7	5.7	4.3
EMT-Intermediate	2.4	1.0	1.1	0.6	1.5
EMT-Paramedic	67.6	87.7	89.9	85.0	88.8
Nurse	4.1	2.7	0.7	8.4	5.1
Physician	0.0	1.9	2.5	0.3	0.3
First Responder	0.8	0.0	0.0	0.0	0.0
Staff Composition					
Mixed	44.3	28.8	13.6	6.5	9.8
Nonvolunteer	43.9	68.2	85.3	93.3	89.7
Volunteer	11.8	3.0	1.1	0.1	0.6
CMS Service Level					
BLS	5.5	9.5	5.1	2.4	5.9
BLS, Emergency	34.9	17.8	21.9	30.4	14.9
ALS, Level 1	5.2	32.7	15.2	4.6	33.7
ALS, Level 1 Emergency	52.9	37.1	54.8	60.0	40.8
ALS, Level 2	1.6	2.9	3.1	2.8	4.7