Title: A Description of Naloxone Administration by Law Enforcement Officers in South Carolina

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Introduction: To combat the opioid overdose epidemic, in 2016, Law Enforcement Officers (LEO) in South Carolina began administering naloxone to patients prior to EMS arrival. Research into the success of initiatives allowing prehospital LEO administration of naloxone are scant. The South Carolina (SC) Department of Health and Environmental Control (SCDHEC), Bureau of EMS requires LEOs to complete a form, similar to a prehospital care report, anytime naloxone is administered.

Objective: To evaluate the success of the SC initiative allowing LEO administration of naloxone and to describe patients receiving LEO administered naloxone.

Methods: This retrospective observational study evaluated all patients who received LEO administered naloxone from June 11, 2016 to April 13, 2018. Study data were obtained from the Law Enforcement Officer Naloxone Reporting Portal (LEON) located within the EMS Performance Improvement Center at the University of North Carolina – Chapel Hill. Analysis included a description of the patient indicators that initiated LEO administration of naloxone, calculation of the proportion of successful reversals, the patient level of responsiveness following a reversal, and the amount of time it took for the naloxone to take effect following LEO administration of naloxone, and any other patient care related actions that were taken by the LEOs. Descriptive statistics were calculated to describe patient age and gender. The number of repeat patients was also calculated. Finally, where available, the type of opioid causing the overdose was described. Information regarding the type of opioid causing the overdose was obtained by follow-up investigations from the SCDHEC, Bureau of EMS.

Results: Since 2016, 243 patients received LEO administered naloxone. Of these, there were 24 (10.0%) patients that had received EMS administered naloxone within 12 months or less from the date of the LEO naloxone administration. There were 5 (2.0%) repeat patients who received LEO administered naloxone on separate dates during the study period. The majority of patients were male (67.9%). Patient age ranged from 14 to 65. The average age was 35.2 (standard deviation 11.2) and the median age was 33 (interquartile range 27-42). Slow breathing (68.7%) was the most commonly reported indicator for naloxone administration followed by pinpoint pupils (43.2%), blue lips (43.2%), no pulse (25.9%), slow pulse (14.8%), no breathing (10.3%), paraphernalia on scene (9.5%), and bystander report of overdose (9.1%). There were 201 (82.7%) of patients that had more than one indicator reported and 10 (4.1%) that did not have an indicator reported. The patients response to the first dose of naloxone was most often reported as “responsive but sedated” (48.6%) followed by “responsive and alert” (40.7%) and no response to naloxone (10.7%). There were 105 (43.2%) times when a second naloxone administration was required. Overall LEO administered naloxone led to successful reversal (96.3%) in total. When evaluating the time it took for naloxone to take effect, LEO reported it took less than one minute 20.6% of the time, 1 to 3 minutes 28.0% of the time, 3 to 5 minutes 33.3% of the time, and greater than 5 minutes 17.7% of the time. Following naloxone administration LEOs delivered the following additional patient care related actions: place the patient in the recovery position (28.8%), performed CPR (26.3%), performed a sternal rub (18.1%), and applied an AED (3.7%). Finally, the type of opioid causing the overdose was reported on 67 calls. Of those 67, this free text question returned the following information: Heroin (80.6%), Heroin and Meth (7.5%), Oxycodone (3.0%), Fentanyl (1.5%), Fentanyl and Roxy (1.5%), Heroin and Xanex (1.5%), Lortabs and ETOH (1.5%), Norco and Valium (1.5%), Roxyxodone (1.5%).

Conclusion: The South Carolina LEON program allowing law enforcement administration of naloxone was highly successful. Over 96% of calls where LEO administered naloxone resulted in a patient reversal.

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Surveillance of Occupational Fatalities, Injuries and Exposures among EMS Personnel Using State-Based NEMSIS Data

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INTRODUCTION: The full extent and nature of occupational injuries and exposures among EMS workers is not known because there is not adequate surveillance of this worker population. One potential source for national surveillance data is the National EMS Information System (NEMSIS). Currently, 49 US states and 3 territories routinely collect—often in near-real time—data on the geographic, demographic, clinical, responder (crew), and operational characteristics of all or nearly all responses made by transporting EMS units (ambulances) according to the NEMSIS standards promulgated by the National Highway Traffic Safety Administration (NHTSA). A number of data elements in the latest version of the NEMSIS standards (version 3) are designed to capture information relevant to the safety and health of EMS personnel, including the occurrence and nature of any fatalities, injuries or exposures to the responding crew members and their use of PPE, providing an opportunity for occupational health surveillance. However, states do not send data for these variables to be included in the NEMSIS national dataset. The use of EMS response data as a source for occupational health surveillance, therefore, must involve partnering with state EMS authorities. This opportunity is nevertheless appealing because it takes advantage of preexisting data that was designed to be collected and used to document occupational safety and health of EMS personnel but, until now, has not been utilized for that purpose. Although it is possible to do so, to date there has been no national effort to aggregate NEMSIS data from multiple states for occupational health surveillance of EMS personnel. The National Institute for Occupational Safety and Health (NIOSH) has therefore undertaken a three-year project that will demonstrate the feasibility of, and lay the procedural and methodological groundwork for, the use of state EMS response data for ongoing, national surveillance of occupational injury and exposure among EMS personnel by piloting the concept with two U.S. state partners.

OBJECTIVE: To describe the initial quantity, quality, and completeness of data submitted to NIOSH by state partners for the purpose of occupational health surveillance and to report initial injury and exposure rates based on those data.

METHODS: NIOSH partnered with two states, State A and State B, which collect all NEMSIS version 3 data elements relating to personal protective equipment (PPE) use by and occupational fatalities, injuries and exposures to EMS personnel: eOther.03, eOther.05, and eOther.06. NEMSIS version 3 captures data on the occurrence of 12 specific categories of three event types: fatality (3 categories), injury (2 categories), and exposure (6 infectious and 1 toxic categories), as well as an "Other" category. NIOSH developed methods and procedures to receive, aggregate and analyze NEMSIS data files shared by state partners on a quarterly basis. Data completeness and quality were evaluated in terms of the proportion of records with missing, "Not Recorded," or "Not Reporting" values for each occupational health-related data element. Incidence rates were calculated for fatalities, injuries and exposures as the number of events occurring per 10,000 EMS responses. Counts and rates for specific fatality, injury and exposure categories are not reported due to small cell sizes.

RESULTS: Both participating states initially submitted data covering the 1-year period November 1, 2016 to October 30, 2017.

State A submitted data for 363,832 EMS responses. PPE data were missing for 19.6% of responses. Data on the occurrence of occupational fatalities, injuries and exposures were missing for 0.7% of responses. Data on the

type of fatality, injury or exposure were missing for 20.3% of responses and 37.2% of all non-missing fatality, injury or exposure values (multiple values are possible for each response) were “Not Recorded” or “Not Reporting.” “None” is a valid, non-missing value for this variable when no crew member fatalities, injuries or exposures occurred on the response. A total of 2,157 fatality, injury, or exposure events were reported, involving 1,464 distinct EMS responses. Dividing by the 361,137 responses for which data on the occurrence of occupational fatalities, injuries, and exposures were available yields an overall rate of 59.7 events per 10,000 EMS responses. Of the incidents for which information of the type of event was available, twenty-three deaths were reported, resulting in an overall fatality rate of 0.63 deaths per 10,000 EMS responses. Two hundred sixty-one injuries were reported for an overall rate of 7.2 injuries per 10,000 responses. One hundred-five infectious or toxic exposures were reported for an overall rate of 2.9 exposures per 10,000 responses. The remaining incidents either did not have an event type recorded or were recorded as “Other.”

State B submitted data for 850,809 EMS responses. PPE data were missing for 80.2% of responses. Data on the occurrence of occupational fatalities, injuries, and exposures were missing for 43.0% of responses. Data on the type of fatality, injury, or exposure were missing for 50.7% of responses and 3.8% of all non-missing fatality, injury or exposure values were “Not Recorded” or “Not Reporting.” A total of 140 injury events were reported, involving 130 distinct EMS responses. Dividing by the 484,961 responses for which data on the occurrence of occupational fatalities, injuries and exposures was available yields an overall rate of 2.3 events per 10,000 EMS responses. No fatalities or exposure events were reported.

CONCLUSION: State-based EMS response data collected according to NEMSIS standards is a promising data source for timely occupational health surveillance of EMS personnel. Since the informatics infrastructure and data standards already exists, the use of NEMSIS data for surveillance could be rapidly and efficiently scaled up and potentially extended to nearly every state in the country if the methodology and procedures developed for this project prove feasible in the pilot states. However, the quality and completeness of the data initially submitted by states to NIOSH was poor, with unacceptably high proportions of missing and “Not Recorded” data values. Data quality and completeness is likely to improve over time as states continue to fully implement the NEMSIS version 3 standards and as EMS providers become more familiar with the collection of occupational health data elements. Nevertheless, sustained effort will be required on the part of state EMS authorities to improve data collection quality before the results of surveillance analyses can be considered reliable. Targeted educational interventions promoting the complete and correct recording and reporting of all NEMSIS data elements relating to fatalities, injuries, and exposures to and PPE use by EMS personnel were implemented by EMS authorities and academic partners in both pilot states in December 2017. Follow up promotional activities intended to reinforce the original messaging and to provide feedback on data quality trends to EMS providers are planned in both states in 2018 and 2019.

Demonstrating the feasibility of using state-based NEMSIS response data for occupational health surveillance of EMS personnel in the participating pilot states will ultimately lead to improved national surveillance by encouraging the more complete collection and broader use of this data, either as part of a national system operated at the federal level, by individual states themselves, or by both. When fully implemented, it will also contribute to prevention efforts by better quantifying and characterizing occupational injury and exposure among EMS personnel. For example, by identifying demographic, clinical, operational, and other risk factors for injury and exposure, trends can be identified and targeted interventions can be developed and implemented that will decrease illness, injuries, and fatalities in the EMS worker population. Furthermore, the findings from this project will help to inform and improve EMS safety policy and practice, including safer ambulance design, and proper infection control and PPE practices.

Mapping Opioid-Associated Resuscitative Emergencies for Targeted Intervention in Colorado

Introduction: Opioid overdoses and overdose related deaths continue to increase in the United States. This epidemic is often described using data from death records, however these data only tell part of the story. While death records provide key insights to the individuals who died as a result of their opioid use, these records fail to describe the larger picture of opioid overdoses across the nation. In 2015, Colorado began allowing pharmacies, harm reduction agencies, and law enforcement officers to access the life-saving drug naloxone, a drug that EMS agencies have been using to combat opioid-associated resuscitative emergencies for decades. Using EMS patient care reports to describe opioid overdose trends can help describe who is affected by this epidemic as well as identify where targeted interventions should occur.

Objective: To quantify and describe opioid-associated resuscitative emergencies in Colorado; specifically who is affected, and where these emergencies occur throughout the state.

Methods: Using a retrospective observational study design, EMS prehospital care reports from the Colorado data repository at the Colorado Department of Public Health and Environment were used to identify opioid-associated resuscitative emergencies from 2013-2017. An opioid-associated resuscitative emergency refers to 'any clinical condition that is known or thought to be associated with opioids where a patient is obtunded without obvious signs of life'[1]. Cases were defined as having naloxone administration as well as a 911 response to remove any potential provider induced overdoses. ESRI, Inc. ArcMap v10.4 and Pitney Bowes MapMarker v 30 software were used to geocode incident and patient addresses to appropriate counties and create heat maps. Descriptive statistics were calculated to assess demographics (age, race, sex and EMS call volume by county). Rates were calculated using the non-duplicative number of incidents with naloxone administration in each defined area and the total number of EMS incidents or total population in that area.

Results: During the study period, 16,290 patients were administered naloxone in Colorado, and this number has been steadily increasing over time. Opioid-associated resuscitative emergencies account for about 0.57% of all EMS incidents reported to the state from 2013-2017. When broken down by year, we see an increase from 2013 (0.55% of EMS incidents) to 2017 (0.65% of all EMS incidents). Males were more commonly associated with these incidents (58%), and the average age of all patients was 47 years. Of the 12,008 incidents where patient home state was recorded (74%), most of the patients were Colorado residents (98%). The state of Colorado is divided into 64 counties ranging in population from less than 700 (San Juan County) to almost 700,000 (Denver County). Counties were divided by level of burden of opioid-associated resuscitative emergencies based on the number of incidents where naloxone was administered during the study period. Five counties (Denver, El Paso, Jefferson, Pueblo, and Arapahoe) had more than 1,000 naloxone administrations, and were, therefore, identified as high burden areas. Four of the five high burden counties were also among the five highest populations in the state; however one county (Pueblo) had the fourth highest number of opioid related incidents (1393) with only approximately 30% of the population size of the other high burden areas[2]. Pueblo only had the seventh highest count of opioid or heroin related deaths during the study period (128), indicating the high use of naloxone may have an impact on opioid-related mortality in that area. Other factors such as EMS call volume, patient home address and death records were used to identify high EMS utilization areas (rate of incidents with naloxone administration per 100,000 EMS responses), high mortality areas (rate of opioid-related deaths per 100,000 residents) and high destination utilization areas (proportion of non-resident patients per all patients receiving naloxone) for targeted interventions.

Conclusions: EMS prehospital care report data may be used to help describe and locate the ever growing population of patients suffering from opioid overdoses. By utilizing advanced geocoding and mapping technologies, such as Geographic Information Systems (GIS), these data can reveal key locations for high use, high burden and high mortality. With the ability to identify this subset of population at risk, targeted interventions and more equipped EMS responses may be facilitated.

Citations:

[1] Drennan, I. R., ACP, BScHK,PhD(c), & Orkin, A. M., MD, MSc, MPH. (2016). Prehospital Naloxone Administration for Opioid-Related Emergencies. *Journal of Emergency Medical Services,41*(3). Retrieved April 1, 2018, from http://www.jems.com/articles/print/volume-41/issue-3/special-focus-resuscitation-recommendations/prehospital-naloxone-administration-for-opioid-related-emergencies.html

[2] United States Census Bureau / American FactFinder. "Annual Estimates of the Resident Population: April 1, 2010 to July 1, 2016". 2016 Population Estimates Program. Web. March 2017. http://factfinder2.census.gov.

Title: Describing Senior Fall Patients in North Carolina who Refuse Transport

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Introduction: Frequently EMS responds to calls for patients that had simple trips and falls. In the younger population these falls might not result in major problems. However, due to the risk factors of aging populations, falls could have serious consequences, even during seemingly minor events. Sometimes patients refuse transport following a seemingly minor fall, but there can be significant underlying health issues that cannot be identified without seeking evaluation at the hospital. Anecdotally, field providers believe that older patients who refuse transport following a fall often end up calling EMS for care and transport shortly after they refused care. Because the EMS patient population is aging, it is important to gain a better understanding of senior patients who refuse transport for traditionally simple injuries, yet find themselves utilizing 9-1-1 services again within 24 or one week.

Objective: To describe North Carolina (NC) prehospital patients that were 65 and older who called 9-1-1 for a fall, refuse transport, and call 9-1-1 again within 24 hours or one week in 2017.

Methods: This retrospective analysis included all 9-1-1 calls from 2017 in which transport was refused and a documented injury cause of "fall" or a documented fall height greater than zero feet was recorded on the Prehospital Care Report. EMS calls from the same patient that initially refused transport were also included. Study data were obtained from the NC EMS Data System located within the EMS Performance Improvement Center at the University of North Carolina – Chapel Hill. Patient demographics (age, gender, race, and ethnicity), the community size in which the call took place, the incident location, and the EMS provider's primary impression of the repeat call were evaluated. In 2017, NC EMS data was collected in the NEMSIS version 2.2.1 standard and, therefore, categorical data responses described were consistent with this version. Comparisons were made among those that had a repeat call within 24 hours and those that had a repeat call within one week. Chi-square tests and Fisher's Exact tests (where appropriate) were performed to assess statistical significance on categorical data. Assessments of continuous data utilized t-tests and/or Wilcoxon Rank Sum tests.

Results: In 2017, there were 57,032 9-1-1 calls for falls where the patient was at least 65 years old. Of these, 2,779 (4.9%) refused transport. There were 190 fall patients who called 9-1-1 within 24 hours following a refusal of transport and 282 who called 9-1-1 within one week. Of the patients who had a repeat call within 24 hours 47.9% (91) were male and 52.1% (99) were female. The average age was 80.2 years (± 8.2). When evaluating race, 7.7% (14) of patients were black or African American, 92.3% (167) were white, and there were no patients categorized as other. There were 0.6% (1) that were Hispanic. With respect to community size, 25.8% (47) of these incidents occurred in rural areas and 74.2% (135) in urban areas. Further, the majority of these calls were to a home or residence 78.6% (132) followed by a residential institution 8.3% (14), health care facility 7.1% (12), trade or service 3.6% (6), and "other" location 2.4% (4). Most of repeat calls within 24 hours had a provider's primary impression listed as traumatic injury (68.1%, n=62), 9.8% (9) altered mental status, behavioral or psychiatric disorder 3.3% (3), syncope or fainting 3.3% (3), diabetic symptoms 2.2% (2), stroke or CVA 2.2% (2), seizure 2.2% (2), respiratory distress 2.2% (2), poisoning or drug ingestion 2.2% (2), cardiac rhythm disturbance 1.1% (1), hypothermia 1.1% (1), hypovolemia or shock 1.1% (1), and chest pain or discomfort 1.1% (1). When evaluating senior fall patients who refused transport and had a repeat call to 9-1-1 within one week, 44.6% (125) were male and 55.4% (155) were female. The average age was 79.9 years (± 8.0). When evaluating race and ethnicity, 15.4% (40) of patients were black or African American, 83.4% (216) were white, and 1.2% (3) were categorized as other. There were 2.0% (5) that were Hispanic. Assessing

community size revealed that 29.0% (81) of these incidents occurred in rural areas and 71.0% (198) in urban areas. The majority of these calls were to a home or residence 77.5% (196) followed by a residential institution 11.1% (28), "other" location 5.9% (15), health care facility 4.4% (11), and trade or service 1.2% (3). Also, a majority of repeat calls had a provider's primary impression listed as traumatic injury (53.5%, n=46), 9.3% (8) syncope or fainting, 7.0% (6) respiratory distress, 7.0% (6) abdominal pain or problems, 5.8% (5) behavioral or psychiatric disorder, 3.5% (3) diabetic symptoms, 3.5% (3) altered level of consciousness, 2.3% (2) cardiac arrest, 2.3% (2) cardiac rhythm disturbance, 2.3% (2) chest pain or discomfort, 1.2% (1) allergic reaction, 1.2% (1) stroke or CVA, and 1.2% (1) hyperthermia. When comparing those that had a repeat call within 24 hours to those that had a repeat call within one week, statistically significant differences were noted with respect to race ($p=0.01$), incident location ($p<0.001$), and the provider's primary impression ($p<0.001$).

Conclusion: Approximately 5% of senior prehospital fall patients refuse transport and, of those, almost 20% end up utilizing 9-1-1 services again within 24 hours or one week. This study emphasizes the need for transport to a hospital following a fall for senior prehospital patients. This study also suggests that it would be prudent for EMS agencies to implement a screening tool to evaluate the appropriateness for refusal as well as develop a Community Paramedic program to follow-up with at risk patients. Future studies should seek to evaluate the outcomes of senior fall patients who refuse EMS transport.

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Title: An Investigation of Prehospital Scene Times in West Virginia

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Introduction

Trauma is the leading cause of death for persons under the age of 44 years old. Although there is not broad consensus on a specific standard for scene times which Emergency Medical Services (EMS) must meet for patients suffering from trauma, the majority of experts agree that minimizing scene time is better. This is especially true for patients who have suffered significant or life threatening trauma. It is important for the State Office of EMS and other trauma stakeholders to continuously analyze trauma scene times to establish a framework for support, inform education and training objectives, and address resource management to reduce trauma scene times and potentially decrease mortality.

Objective

To describe trauma scene times for general and significant life threatening trauma in West Virginia (WV).

Methods

This retrospective observational study examined the scene times for all 911 Emergency Medical Service (EMS) patients who experienced trauma in West Virginia in 2016. Data for this study was obtained from the WV EMS Data System located within the EMS Performance Improvement Center at the University of North Carolina – Chapel Hill. All EMS events in WV are documented with patient care reports which include elements recording scene times and descriptors of trauma. The study definition of significant trauma utilized available NEMSIS 2.2.1 elements that were consistent with the Centers for Disease Control and Prevention (CDC) Field Triage Guidelines for transport to a trauma center. Patients were categorized as significant trauma patients if they presented with any of the following: a Glasgow Coma Scale of less than 13, systolic blood pressure of less than 90 mmHg, adult respiratory rate of less than 10 or greater than 29 breaths per minute, flail chest segment, pregnancy greater than 20 weeks, burn as mechanism of injury, fall of greater than 10 feet for a patient under 16 years old, fall of greater than 20 feet for anyone over 16 years old, and vehicle injury indicator of death in same vehicle, ejection of patient, or at least 1 foot of intrusion into the drivers compartment. Trauma that was not identified as significant was classified as general. Descriptive statistics were calculated regarding the scene times for patients suffering from general and significant trauma, as well as for community size (rural and urban). Scene times involving the high acuity events requiring transport by air medical ambulance as well as where extrication was required were also examined. Because scene times are not normally distributed, Mann–Whitney U tests were performed to evaluate statistically significant differences between comparison groups.

Results

There were 86,835 EMS events documented as trauma in WV in 2016. Overall, scene times ranged from 0 minutes to 117.96 minutes. The median scene time for all trauma events in WV was 15.29 minutes (Interquartile Range 10.92 to 21.85) with an average of 17.16 minutes (standard deviation 11.04). The 90% fractile time was 30.58 minutes. There was a statistically significant difference when comparing scene times based on the community size where the call took place ($p<0.01$). Both rural and urban trauma calls had a median scene time of 15.29 minutes (Interquartile Range 10.92 to 21.84). Trauma call in urban areas average had an average of 17.08 minutes (standard deviation 10.49) and a 90% fractile time of 28.40 minutes. Trauma call in rural areas average 17.38 minutes (standard deviation 11.99) with a 90% fractile time of 30.58 minutes.

There were 9,933 calls identified as significant trauma. The median scene time for significant trauma calls was 20.16 minutes (Interquartile Range 10.92 to 24.03) with an average of 17.48 minutes (standard deviation 13.34). The 90% fractile time was 34.95 minutes. General trauma calls had an average of 16.75 minutes (standard deviation 10.64), a median of 15.29 minutes (Interquartile Range 10.92 to 21.85), and a 90% fractile of 28.40 minutes. There was a statistically significant difference found when comparing scene times for general trauma calls to significant trauma calls ($p<0.001$). There were 161 documented cases of trauma calls that required air medical transport. Trauma scene times for events requiring air medical transport had an average scene time of 25.44 minutes (standard deviation 12.72), median of 21.85 minutes (Interquartile Range 17.45 to 30.58), and a 90% fractile of 41.51 minutes. Trauma scene times for events that did not require air medical transport had an average of 17.14 minutes (standard deviation 11.03), a median of 15.29 minutes (Interquartile Range 10.92 to 21.85), and a 90% fractile of 30.58 minutes. There was a statistically significant difference noted when comparing scene times for trauma calls that utilized air medical ambulance when compared to trauma calls that were transported by ground ambulance ($p<0.001$). Finally, there were 72 calls where extrication was documented. Scene times when extrication was required had an average of 30.30 minutes (standard deviation 17.97), a median of 26.21 minutes (Interquartile Range 19.66 to 34.95), and a 90% fractile of 52.43 minutes. Scene times for trauma calls that did not require extrication had an average of 17.14 minutes (standard deviation 11.03), a median of 15.29 minutes (Interquartile Range 10.92 to 21.85), and a 90% fractile of 30.58 minutes. There was a statistically significant difference found when comparing calls that required extrication to those that did not require extrication ($p<0.01$).

Conclusion

Overall trauma scene times has a median scene time of 15 minutes and 17 seconds. Scene times for significant trauma calls were significantly longer than general trauma. Additionally, there was a statistically significant difference noted when comparing scene times when air medical transport was required to ground transport with air medical transport calls having longer scene times. Scene times for calls that required extrication were significantly longer than scene times when no extrication was required. Finally, although there was a statistically significant difference noted when comparing scene times in rural and urban areas, this difference does not appear to be clinically important. This study provides benchmarks for the WV Office of EMS and trauma stakeholders as it relates to trauma scene times. Future study should seek to evaluate interventions to reduce scene time and identify barriers to reducing scene time.

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Title: A Comparison of Volunteer and Paid EMS Professionals in West Virginia.

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Introduction: Volunteer personnel represent a significant portion of the EMS workforce. Volunteer EMS providers sometime struggle to obtain required continuing medical education and may not gain as much experience caring for patients as career EMS providers. Therefore it is unknown if volunteer providers administer the same level of care as paid EMS providers. There is little research comparing paid and volunteer EMS providers. This study focused on the comparisons of care provided to EMS patients based on EMS provider pay status (volunteer vs. paid).

Objective: To compare prehospital care provided to 9-1-1 EMS patients by volunteer and paid EMS professionals in West Virginia.

Methods: This retrospective observational study assessed all 9-1-1 calls and EMS provider data for West Virginia in 2016. This information was obtained via Prehospital Care Report (PCR) submissions that involved a paid or volunteer EMS provider listed as primary care provider. Specifically, this study did a comparative analysis of intubation and IV success rates as well as the number of attempts required for procedure success. This study also evaluated the number of times multiple sets of vital signs were documented. Comparisons were based on the EMS providers pay status (volunteer vs. paid) and, where relevant, stratified by certification level (Emergency Medical Technician, Advanced Care Technician, and Paramedic). EMS providers with a reported pay status of Part Time Paid and Part Time Unpaid Employee were removed from the analysis. Study data were obtained from the West Virginia State EMS Data System located within the EMS Performance Improvement Center at the University of North Carolina - Chapel Hill. A two-sample Wilcoxon rank-sum test was utilized to evaluate medications administered, IV attempts, and intubation attempts. Chi-squared and Fisher's exact tests, where appropriate, were used to analyze a statistically significant difference for the difference in IV and intubation success rates as well as the documentation of multiple sets of vital signs.

Results: There were 308,017 9-1-1 EMS calls in WV in 2016. There was a primary care provider listed on 178,171 calls (57.8%). Paid EMS providers were listed as the primary care provider on 94.3% (168,143) of these calls and volunteers were listed as primary care providers on 5.6% (10,028) of calls. Paid EMS providers attempted to place an IV 39,869 times with a success rate of 82.47%. Volunteer EMS providers attempted to place an IV 2,029 times with a success rate of 83.54%. When stratified by certification level, there was no statistically significant difference noted when comparing IV success rates between paid EMS providers and volunteer EMS providers ($p>0.05$). The average number of attempts to successfully place an IV for paid EMS providers was 1.14 attempts (standard deviation 0.79) with a median of 1 attempt. The average number of attempts to successfully place an IV for volunteer EMS providers was 1.13 attempts (standard deviation 0.39) with a median of 1 attempt. When stratified by certification level, there was no statistically significant difference noted when comparing IV success rates between paid EMS providers and volunteer EMS providers ($p>0.05$). There were 789 prehospital intubation attempts by paramedics in West Virginia. There were 749

intubation attempts by paid paramedics (94.93%) and 40 attempts by volunteers (5.07%). The overall intubation success rate was 72.75%. Paid paramedics had an intubation success rate of 73.16% and volunteer paramedics had an intubation success rate of 65.00% (p=0.259). There was no statistically significant difference noted when evaluating the number of attempts before a successful intubation (0.53). The average number intubation attempts for a successful intubation for paid EMS provider was 1.20 (standard deviation 0.50) with a median of 1 attempt. The average number intubation attempts for a successful intubation for volunteer EMS providers was 1.14 (standard deviation 0.41) with a median of 1 attempt. When evaluating the documentation of multiple sets of vital signs, paid EMS providers recorded no vital signs on 7.00% of the time. One set of vitals was recorded 23.84% of the time, and at least two sets of vitals were recorded 69.16% of the time. Volunteer EMS providers recorded no vital signs on 5.04% of the time. One set of vitals was recorded 10.95% of the time, and at least two sets of vitals were recorded 84.02% of the time. The difference in the recording of multiple vital signs between paid and volunteer EMS providers was statistically significant ($p<0.001$).

Conclusion: When evaluating IV success rates, intubation success rates, and the number of attempts required to successfully initiate these interventions, there was no statistically significant differences noted between paid and volunteer EMS providers. This result suggests that volunteers and paid EMS providers have similar levels of skill when performing common patient care procedures. Furthermore, volunteer EMS providers had a higher percentage of calls were at least two sets of vital signs were recorded. This study suggests that volunteer EMT, ACT, and Paramedics patient care performance is comparable to paid EMS providers. Further study should attempt to evaluate patient outcomes for those who were cared for by paid or volunteer providers.

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Frequent Use of Emergency Medical Services in Florida

Junwei Jiang, MPH; Karen Card, DrPH; Alan Mai, MPH; Steve McCoy, BAS; Josh Sturms, MS

Introduction: The Florida Emergency Medical Services Tracking and Reporting System (EMSTARS) indicated that there were approximate 2.7 million incidences in the year of 2016. While EMS is developed to provide emergency medical care for patients with serious illness or injury caused by an incident, EMS system abuses widespread in the U.S. Frequent use of emergency services is associated with high healthcare costs and may indicate challenges accessing, or poor outcomes of, healthcare. To enhance healthcare utilization, related health outcomes, and cost effectiveness, research is needed to understand frequent users of EMS and to support the development of targeted interventions to improve population health.

Objective: We investigated patient demographics and health factors related to frequent use of EMS services of Florida in 2016.

Method: We reviewed records from the Florida EMSTARS database in 2016. Social Security Number (SSN) (if available) and first name/last name (SOUNDEX recoded) were used to identified unique patients/individuals. For records that did not have a valid SSN, first name/last name, date of birth, gender, race and ethnicity were used to identified individuals. Frequent use was defined as six or more EMS incidents in the 1-year period. Analyses were performed to investigate differences in demographics and health problems of frequent EMS users compared to non-frequent users.

Result: There were approximate 2.34 million (9-1-1 calls) records in the 2016 EMS data system, of which about 1.8 million (study sample) had sufficient information to identify individuals. In the study sample, EMS users had a range of 1-271 incidents during the observation period. Even though, the frequent users (six or more incidents) only accounted for 1.75% of the total patients, they accounted for 11.51% of total EMS incidents (average count of incidents for frequent user is 9.65) in the study period. Frequent users, as compared to the non-frequent users, were somewhat more likely to be male (46.84% vs. 44.24%), white (63.07% vs. 57.01%) and between 46-65 years old (approximate 19% vs. 13%); all differences were significant.

Among the frequent users, the most reported condition (from primary impression) was “Other, Non-Traumatic Pain” (34% of all conditions); it was listed as a primary impression more than twice as often than among non-frequent users (15.97%). Frequent users compared to non-frequent users had significantly lower levels of trauma related incidents (9.54% vs. 23.75%), stroke (0.77% vs. 1.43%), and cardiac arrest (0.19% vs. 1.14%). Of health problems, frequent users indicated a higher level of behavioral problems compared to non-frequent users including “Behavioral/Psychiatric Disorder” (4.19% vs 3.78%) and “Alcohol Related Problems/DTs” (1.19% vs. 0.62%). Frequent users compared to non-frequent users also had higher levels of

select chronic conditions (such as diabetes: 2.90% vs. 1.99%, respectively and seizure: 3.73% vs. 2.82%, respectively).

Conclusion: This study revealed the demographic distributions and health conditions of the frequent users of EMS. These results suggest the need of public health effort to improve access and utilization of preventive services to improve population health outcomes and reduce emergency services costs. The study demonstrates the value of EMS patient data in identifying health services abuse, and provides guidance on intervention to enhance healthcare utilization, related health outcomes, and cost effectiveness.

Using Linked EMS and Trauma Registry Datasets to Assess Outcomes Associated with Motor Vehicle Crashes Among Children Under Three, Texas, 2016

Dylan McAfee, Meredith Jagger, Dan Dao

INTRODUCTION:

The new Texas Office of Injury Prevention combined the state's EMS and Trauma Registries with the Safe Riders Traffic Safety Program. A priority is child motor vehicle injury surveillance and prevention. By linking vehicle crash data from the Texas Department of Transportation (TXDOT) with Registry data, epidemiologists can assess the use of age-appropriate restraints and summarize crash-related health outcomes.

OBJECTIVE:

1. To demonstrate value of linked crash to EMS and crash to Trauma data for program planning

2. To describe health outcomes (EMS transport and trauma injury severity) of children under the age of three involved in a traffic crash.

3. To assess differences in health outcomes by type of restraint.

METHODS:

The initial analysis was limited to children under the age of three involved in a car crash in Texas in 2016. Crash data were probabilistically linked to EMS and Trauma Registry data, creating two datasets used here. Passive surveillance is used for the Registries; EMS and Trauma events are potentially underreported. Because National Highway Traffic Safety Administration guidelines suggest rear-facing seats until age two given a child's size, this type of seat was considered the standard for restraint for this demographic.

RESULTS:

In 2016, there were 35,600 children under the age of three involved in a crash reported to TXDOT by investigating police officers (2.4% of all persons in a crash). Of these, 16,694 (47%) were restrained in a forward- and 11,814 (33%) in a rear-facing child seat. Of the 853 children in a crash where EMS responded, 504 (59%) were transported. Three-hundred eighty-five (45%) were restrained in a forward- and 330 (39%) in a rear-facing child seat. Of the 204 children in a crash with a linked trauma record, 20 (10%) had a severe injury (an ISS >15). Eighty-three (41%) were

restrained in a forward- and 52 (26%) in a rear-facing child seat. There were no significant differences in EMS transports or traumatic injury severity between children under three in a child seat compared to other types of restraints, like a seatbelt; however, most crash records were not linked with a Registry event.

CONCLUSION:

Analysis with linked data can inform program planning. While significant results were not seen here, additional questions can be framed with input from partners and stakeholders. Research questions will be expanded to improve reporting and linking and analyzed additional demographics, sub-state geographies, and other outcomes.

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Bozena M. Morawski, A. Kassem, K. Carter, J. Cramer

Repeat Users of Emergency Medical Services — Idaho, 2013–2016

Background: Localities have saved up to $5,000/patient in annual healthcare costs by enrolling repeat emergency medical services (EMS) users in community paramedicine programs. We characterized EMS use in rural Idaho as a preliminary step in allocating medicosocial support resources.

Methods: Among 83 EMS agencies using Idaho's prehospital electronic record collection system, 8 rural agencies were selected by stratified sampling. LinkPlus software matched individuals by name and birthdate. Repeat users were persons with >1 ground ambulance response during January 2013–December 2016. Holm-Bonferroni-adjusted logistic regression compared demographic characteristics and EMS responders' primary clinical impression (primary impression) across repeat versus singleton users. Among frequent users (≥5 responses), we summarized within-patient primary impression similarity by Simpson's Diversity Index (diversity), a 0 (none) to 1 (infinite) observation heterogeneity and relative abundance metric. Linear regression estimated associations between diversity and demographic characteristics.

Results: Approximately 15% (738/4,906) of users initiated 36.3% (2,378/6,546) of EMS responses. Repeat users had a median of 2 (interquartile range [IQR]: 2–3; maximum 102) responses, 15.8 (IQR: 2.8–44.4) weeks apart. Repeat users were median 68 years (IQR: 44–80 years) of age and 51.2% female; whereas, median age of singleton users was 47 years (IQR: 23–67 years) (P <.001) and 44.0% were female (P <.001). Repeat users were more likely than singleton users to have responses associated with primary impressions of chronic obstructive pulmonary disease, patient assistance (e.g., falls), seizures, or weakness (P <.001 for each association). Among frequent users (n = 91), median primary impression diversity was .68 (IQR: .61–.79). Diversity was positively associated with increasing age ($\beta_{5\text{-year}}$ = .015; 95% confidence interval: .007–.023).

Conclusions: In rural Idaho, we identified patients who might benefit from preventive medicosocial support. EMS agencies statewide could characterize their response data to assess suitability of community paramedicine programs for their communities.

Word Count: 300/300; edited 300

Title: Evaluation of Prehospital Patient Care Performance among Advanced Life Support Providers in West Virginia.

Authors: Courtney Harrison, MS[1]; Michael Mills, DO, FACEP[2]; Melissa Raynes, MS[2]; Sean Kaye, BA, EMT-P[1]; Jenny Kagarise Wilson, BA, EMT-B[1]; Antonio R. Fernandez, PhD, NRP, FAHA[1]

Introduction: Advanced life support providers care for similar acuity patients, however there is a paucity of research comparing the performance of different advanced life support (ALS) certification levels. As outlined by the state office, an Advanced Care Technician (ACT) can provide Basic Life Support (BLS) along with some intermediate levels of Advanced Life Support. Paramedics can provide all forms of BLS and ALS.

Objective: The objective of this study was to compare documentation quality and patient care performance of certified Paramedics versus Advanced Care Technicians in West Virginia.

Methods: This retrospective observational study examined all 911 call data and EMS provider data for West Virginia in 2016. This study focused on the information that was obtained via Prehospital Care Report (PCR) submissions that involved a Paramedic or an ACT. Study data were obtained from the West Virginia State EMS Data System located within the EMS Performance Improvement Center at the University of North Carolina - Chapel Hill. Quality of documentation was analyzed using data quality scores. These scores were calculated based on the number of errors on a PCR. Every data error results in a one point increase in data quality scores, therefore lower data quality scores represent PCRs with fewer data entry errors. T-tests were used to evaluate statistically significant differences in data quality scores. Rapid Acute Physiology Scores (RAPS) is a validated severity scale used to measure patient physiologic status (Rhee, 1987). RAPS are reported on a scale of 0-16. A comparison of first and last RAPS can be used as a proxy for patient care performance. When comparing first RAPS to the final RAPS measure, equal scores represented calls where patients experienced no change in their physiologic status over the course of the EMS call. Lower final RAPS scores represented an improvement in their condition. An increase in RAPS scores represented patients who experienced a deterioration in their physiologic status during the EMS call. For the analysis, the change in RAPS was dichotomized as improved or no change vs. worsened. Chi-squared and Fisher's exact tests, where appropriate, were used to analyze a statistically significant difference for the change in RAPS. Analysis was stratified by call type (total calls, trauma calls, cardiac arrest, cardiac chest pain, ST Elevated Myocardial Infarction [STEMI], stroke).

Results: In 2016, there were 117,306 calls that involved an Advanced Care Technician or a Paramedic. Paramedics were the highest provider level on 112,790 (96.2%) of the calls, and ACTs were the highest for the remaining 4,516 (3.8%). There was no statistically significant difference between the overall data quality scores for Paramedics and ACTs (2.4 vs. 2.3, respectively; p-value = 0.195). This result was also reflected in the data quality scores for the documentation of trauma calls (2.4 vs. 2.4, respectively; p-value = 0.908), cardiac arrest calls (3.9 vs. 5.0, respectively; p-value = 0.357), cardiac chest pain calls (2.3 vs. 2.4, respectively; p-value = 0.605), STEMI calls (3.4 vs. 4.1, respectively; p-value = 0.704), and stroke calls (2.8 vs. 2.9, respectively; p-value = 0.630). A chi-squared analysis was performed to evaluate the change in patient physiologic status during the EMS call. There was no statistically significant difference in the overall change in RAPS between Paramedics and ACTs (p-value = 0.333). The analysis for overall performance for Paramedics showed that 96,859 (85.9%) of patients experienced an improvement or no change in their condition. Comparatively, 3,855 (85.4%) of ACT patients experienced an improvement or no change in their condition. This result was also reflected in the RAPS for trauma calls (85.6% vs. 85.3%, respectively; p-value = 0.830), cardiac arrest calls

(85.6% vs. 95.0%, respectively; p-value = 0.235), cardiac chest pain calls (85.8% vs. 84.3%, respectively; p-value = 0.354), STEMI calls (84.6% vs. 85.7%, respectively; p-value = 0.933), and stroke calls (85.4% vs. 88.7%, respectively; p-value = 0.153).

Conclusion: Overall, there was no statistically significant difference in the quality of documentation assessed by data quality scores or the patient care performance levels between Paramedics and ACTs when assessed using the change in RAPS.

REFERENCES

Rhee, Kenneth J., et al. "The Rapid Acute Physiology Score." *The American Journal of Emergency Medicine,* vol. 5, no. 4, 1987, pp 278-282.

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