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Abstract

This study aimed to determine how comfortable rural and urban Emergency Medical Services (EMS) providers are with treating drug overdoses in the field, adjusting for various factors. This qualitative and quantitative cross-sectional survey included 90 respondents from urban and rural demographics and found no evidence ($p = .126$) that the likelihood of being extremely comfortable with administering naloxone differed for urban and rural EMS workers when accounting for certification level, years of experience, and amount of training. We also found no evidence ($p = .859$) of a difference between rural and urban EMS workers administering secondary doses of naloxone. The study demonstrated that although rural EMS providers have an increased transit time to get an overdose patient to the hospital and were less likely to have an advanced provider available to them at the response scene, rural providers feel equally comfortable with treating an opioid overdose with naloxone as do their urban counterparts when certification level, years of experience, and number of hours of training are considered.

BACKGROUND

Previous research has shown that America's rural counties have greater age-adjusted rates of drug overdoses and deaths than their urban counterparts.^{1,2} Patients utilizing emergency services with a chief diagnosis of suspected opioid overdose outpaced the growth of all Emergency Medical Services (EMS) and Emergency Department encounters from 1997 to 2002.³ One contributing factor to this discrepancy may be that personnel dealing with rural substance abuse treatment may be less prepared for the epidemic than their urban counterparts.^{4,5} In 2015, rural areas had an opioid overdose rate that was 45% higher than in urban areas, and the rate of naloxone administration in rural areas was 23% higher than in urban areas.⁶ Studies have also found that the odds of naloxone administration were significantly higher among Emergency Medical Technician (EMT) Intermediates than EMT Basics, suggesting that levels of EMT training may play a role in rural naloxone treatment.^{6,7}

The amount of time it takes from the 911 call being placed until the ambulance arrives at the hospital with the patient ("call time") is another important measure of differences in EMS responses in rural and urban areas. The average call time for rural communities was 80.16 minutes, compared with 62.38 minutes in urban communities in the same year.⁸ With a serum, the half-life of naloxone is approximately 64 minutes, making rural transports particularly problematic because they may require subsequent dosing for an opioid overdose.⁹

There are currently four levels of EMT certification status. The Emergency First Responder training certification requires a 50.5-hour training course.¹⁰ The EMT Basic course requires a minimum of 159 hours of training.¹⁰ The EMT Intermediate certification requires 160 hours of training, including proficiency with starting an intravenous line.¹⁰ Lastly, EMT Paramedics have the highest level of training, with more than 452 hours required.¹⁰ Statistically, rural areas are less likely to have higher-level EMS personnel, provide less oversight, and have less

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access to skill maintenance such as medical direction and training services.¹¹ Nationwide, rural areas were more likely to be staffed only by volunteers (53% for isolated small rural areas; 14% for urban areas).⁸ EMT training differences indicate that more highly certified prehospital providers work in urban areas than in rural areas.⁸ EMTs' confidence in their skills related to treating opiate overdoses is also important. Kilwein et al¹² assessed paramedics' confidence in their skills for dealing with opiate overdose and found that 94% of paramedics are somewhat or very confident in their ability to recognize an opioid overdose, treat it successfully, and provide follow-up care. Conversely, slightly more than 50% of EMT Basic providers felt the same.

Rural community EMS providers may encounter the complex situation of having more naloxone-treatable opioid overdose cases alongside extended call times that will potentially require additional naloxone administrations. In addition, there is an increasing prevalence of stronger opioid agonists such as carfentanil, which is reportedly nearly 100 times more powerful than fentanyl, requiring larger doses of naloxone.¹³

Overall, the increased prevalence of opioid drugs such as carfentanil and other synthetic opioids that have a much higher potency than oxycodone or fentanyl; the extended call times that rural providers face; and the predominance of EMT Basic-certified EMS providers mean that rural EMS providers will likely face a higher frequency of needing to administer additional doses of naloxone but feel less comfortable with treatment, leading to more opioid deaths.¹⁴

METHODS

A cross-sectional study from three locations within Indiana was conducted from January 2021 through April 2021. This study compared two rural EMS districts and one urban district; one district had 79% of the population designated as "rural" per the 2010 U.S. Census, the other was designated as 49.8% rural, and the final had only 23.8% of its population classified as rural.¹⁵ There were 90 surveys given to EMS providers (47 for providers from rural tracts and 43 from urban areas). Participants were asked a total of 19 questions about certification level, number of

years of experience, and personal involvement with overdose treatment and naloxone administration. Furthermore, participants were questioned on personal knowledge of overdose-related deaths, number of education hours they received, and continued education they receive as trends evolve regarding overdoses and treatment.

Demographics of the study's participants are summarized in Table 1; categorical variables were summarized using counts and relative frequencies, and quantitative variables were summarized using the sample mean and standard deviation. Few participants in our survey did not express some comfort with administering naloxone; therefore, we focused on the likelihood of a provider being "extremely comfortable" with administering naloxone (compared with all other comfort levels). A logistic regression model was used to compare this likelihood for rural and urban providers while accounting for their level of certification, number of hours training with naloxone, and the number of years of experience. There was only one Emergency Medical Responder (EMR) in our sample; therefore, for modeling purposes, the EMR and EMT Basic certifications were grouped, meaning that our models adjusted for whether the respondent had an EMT Paramedic certification.

Table 2 summarizes urban and rural providers' experience with naloxone. A Poisson regression model was used to compare the average number of patients that rural and urban EMS providers treated with naloxone per year of experience, adjusting for level of certification and number of hours of training with naloxone administration. Finally, a binomial regression model was used to compare how likely rural and urban EMS providers were to treat patients with a second dose of naloxone; this model also adjusted for level of certification and number of hours of training with naloxone administration. This model does not consider the comfort level as a predictor because we felt its effect would be captured primarily by the EMS providers' training hours and levels of certification.

RESULTS

Our results indicate that fewer rural EMS workers (17%) than urban EMS workers (58.1%) had an

advanced provider available within 15 minutes of responding to a drug overdose. For the purposes of this questionnaire, advanced providers were designated as any provider at the level of nurse practitioner, physician assistant, or physician. This finding may help shape the view of what resources our rural EMS providers have available to them compared with urban EMS providers.

This study found no evidence ($p = .126$) that the likelihood of being extremely comfortable with administering naloxone differed between urban and rural EMS workers when accounting for certification level, years of experience, or amount of training (Figure 1). Furthermore, EMT Paramedics were more likely (odds ratio [OR]: 8.25; 95% CI for OR: [1.85, 61.89]) to state they were extremely comfortable with naloxone administration compared to those with Basic-level EMS certifications (Table 3). This effect was present even when accounting for hours of training and years of experience. We also found no evidence ($p = .859$) of a difference between rural and urban EMS workers administering secondary doses of naloxone.

Similar percentages of rural EMS workers (27.7%) and urban EMS workers (27.9%) reported having lost a patient to a drug overdose. Firsthand experience with negative outcomes of opioid overdoses, such as death and disability, was reported by more than 1 in 4 of the respondents in this study and even higher percentages in other studies.

DISCUSSION

The current study demonstrates that 86% of EMS providers in urban areas and 76.6% in rural areas stated they were “extremely comfortable” with naloxone administration. This finding differs from prior research by Kilwein et al,¹² which found that only 53.7% of all EMT Basic providers were comfortable with naloxone administration. At the time that study was conducted in Wyoming, EMT Basic providers were not allowed to administer naloxone. Kilwein et al¹² did not compare rural and urban providers’ comfort levels with regard to administering naloxone. The finding of no difference in likelihood of a second dose administered by rural versus urban EMS providers is unexpected. Rural providers’ increased transit time from scene to

hospital had no significant impact on the likelihood of a second dose of naloxone being needed. Because of this context and the advent of stronger opiates such as carfentanil and other synthetic opioids, our hypothesis was that these EMS providers would administer subsequent doses of naloxone en route to the hospital; however, the current study did not support this theory after accounting for EMT certification levels.

Our study also found that paramedics were more likely to state that they were extremely comfortable with naloxone administration compared with those who had Basic-level EMT certifications, which is consistent with previous studies. Interestingly, this study had a higher percentage of survey respondents who were paramedics than what is accounted for in literature reviews as discussed previously.^{8,11,12} This could be due to the national requirement for Advanced Life Support–certified ambulances that are used by many ambulance services staffed with one paramedic-level provider and one Basic-EMT provider per shift, thereby increasing the exposure of paramedic-level respondents to the survey.

In addition, this study found that fewer rural EMS providers had an advanced provider (nurse practitioner, physician assistant, or physician) available within 15 minutes of responding to a drug overdose at the response scene than did urban EMS providers, although this finding had little impact on the responses concerning rural EMS providers’ level of comfort. Rural EMS providers felt as comfortable as their urban counterparts when it came to treating overdoses. The finding that rural EMS providers were extremely comfortable with administering naloxone was unexpected when considering the increasing opioid epidemic facing rural counties, along with the prevalence of more potent synthetic opioids and longer transit times, as discussed earlier. This finding accounts for variables that address the level of comfort with overdose treatment, including certification level, years of experience, and amount of training. These findings of insignificant difference between rural and urban areas demonstrate an association that providers feel equally prepared to treat an opioid overdose despite differences in exposure to overdoses, number of training hours, response times, and other variables. Rural EMS

providers are thought to be working under more austere conditions but feel just as comfortable as their urban counterparts with treating opioid overdose patients, potentially due to field experience and on-the-job training that results in comfort, or perhaps demonstrating a similar level of training across all dynamics that adequately instructs providers on naloxone administration. This finding provides insight into prehospital care and monitoring effectiveness of treatments for all populations and locations across the United States.

Finally, this study found no association between experience treating opioid overdoses and the location of an EMS provider. This was unusual, as rural areas experience a higher incidence of opioid-related overdoses at a population level.² Among both our urban and rural EMS providers, 25% had experienced contact with an opioid-related death. Given our finding that 1 in 4 of the providers in this study experienced an opioid-related death, as well as the current state of the opioid epidemic facing our rural communities, a focus on mental health and wellness has become an important aspect of health care and provider well-being.¹⁶

LIMITATIONS

This study was cross-sectional and therefore had several limitations. First, because of our limited study locations, it is difficult to generalize our results to other populations. Including other sites with a larger incidence of opioid-related deaths (of which Indiana ranked 16th in 2020, with 17.5 deaths per 100,000 residents)¹⁷ could substantially vary the exposure EMS providers have to opioid overdose patients who require a second naloxone dose and therefore would increase the study's external validity. Second, this study was aimed at increasing personal experience and response data related to EMS opioid overdose treatment; as such, it is susceptible to personal and recall biases from participants. As a limitation, objective data on the number of overdoses treated by each EMS provider (including experience level and the time period in which overdoses occurred) could provide specificity to the timeline and validity to our data; however, to the current investigators' knowledge, there is no such data collection. Additionally, due to the cross-sectional nature of this

study, results cannot be interpreted as causal, only as associations between data.

CONCLUSION

This study demonstrated that although rural EMS providers have an increased transit time to get an overdose patient to the hospital and are less likely to have an advanced provider available to them at the response scene, they feel similarly comfortable as their urban counterparts with treating an opioid overdose with naloxone when certification level, years of experience, and number of hours of training are considered. Interestingly, this study found that rural EMS providers were not more likely to provide a second dose of naloxone, despite the differences between rural and urban areas in opioid use prevalence (as demonstrated on a national basis) and extended call times.

Table 1. Study Demographics (N = 90)

Demographics	No. (%) of respondents in demographic	
	Urban (n = 43)	Rural (n = 47)
Male	17 (39.5)	30 (63.8)
Female	26 (60.5)	17 (36.2)
White (Caucasian)	37 (86)	47 (100)
Black (African American)	4 (9.3)	0 (0)
Hispanic (Latino)	1 (2.3)	0 (0)
Asian or Pacific Islander	1 (2.3)	0 (0)
EMR-First Responder	1 (2.3)	1 (2.1)
EMT-Basic	27 (62.8)	23 (48.9)
EMT-Paramedic	15 (34.9)	23 (48.9)
Age	29.91 (6.99)	34.21 (14.28)
Years of experience	5.95 (4.25)	10.23 (10.69)

Categorical variables are summarized using counts and relative frequencies, and quantitative variables are summarized using the sample mean and standard deviation.

Table 2. Summary of Experience With Naloxone for Rural and Urban EMS Workers (N = 90)

	Sample mean (standard deviation)	
	Urban (n = 43)	Rural (n = 47)
Hours of training received administering naloxone	4.50 (5.98)	3.31 (2.85)
Number of overdoses treated	14.49 (24.00)	18.40 (28.35)
Number of patients for whom naloxone was administered	8.86 (13.48)	12.23 (19.40)
Number of patients for whom a second dose of naloxone was administered	2.25 (6.30)	2.51 (2.86)

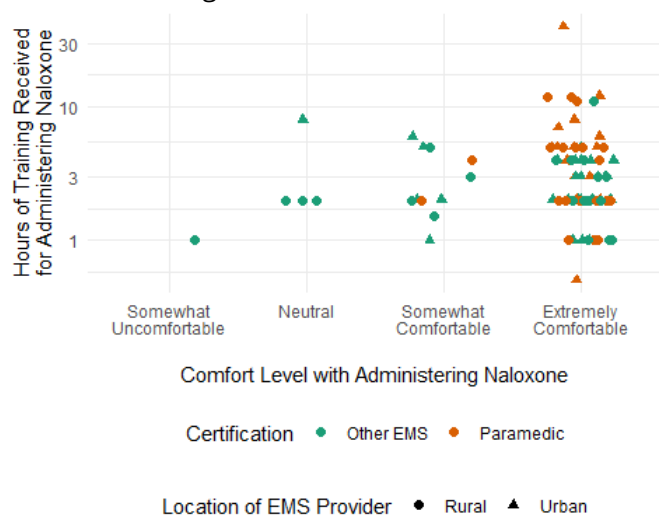
Quantitative variables are summarized using the sample mean and standard deviation.

Table 3. Summary of Characteristics of Providers Who Are “Extremely Comfortable” Administering vs. Those Who Are Not

	No. (%) of respondents	
	Not extremely comfortable (n = 17)	Extremely comfortable (n = 73)
Urban provider	6 (35.3)	37 (50.7)
Rural provider	11 (64.7)	36 (49.3)
EMT-Paramedic	2 (11.8)	36 (49.3)
EMT-Basic or EMR-First Responder	15 (88.2)	37 (50.7)

Categorical predictors are summarized using the count and relative frequency.

Figure 1. Relationship Between EMS Workers’ Comfort in Administering Naloxone and Number of Hours of Training Received



The one EMS worker who had not received training for administering naloxone was excluded.

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