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ORIGINAL CONTRIBUTIONS

POLICE OFFICERS CAN SAFELY AND EFFECTIVELY ADMINISTER INTRANASAL NALOXONE

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ABSTRACT

Introduction: Opioid overdose rates continue to rise at an alarming rate. One method used to combat this epidemic is the administration of naloxone by law enforcement. Many cities have implemented police naloxone administration programs, but there is a minimal amount of research examining this policy. The following study examines data over 18 months, after implementation of a police naloxone program in an urban setting. We describe the most common indications and outcomes of naloxone administration as well as examine the incidence of arrest, immediate detention, or voluntary transport to the hospital. In doing so, this study seeks to describe the clinical factors surrounding police use of naloxone, and the effects of police administration. **Methods:** All police officer administrations were queried from April 2014 through September 2015 ($n = 126$). For each incident we collected the indication, response, and disposition of the patient that was recorded on a "sick-injured civilian" report that officers were required to complete after administration of naloxone. All of the relevant information was abstracted from this report into an electronic data collection form that was then input into SPSS for analysis. **Results:** The most common indication for administration was unconscious/unresponsive ($n = 117$; 92.9%) followed by slowed breathing ($n = 72$; 57.1%), appeared blue ($n = 63$; 50.0%) and not breathing ($n = 41$; 32.5%). After administration of naloxone the majority of patients regained consciousness ($n = 82$; 65.1%) followed by began to breath ($n = 71$; 56.3%). However, in 17.5% ($n = 22$) of the cases "Nothing" happened when naloxone was administered. The majority of patients were transported voluntarily to the hospital ($n = 122$; 96.8%). Lastly, there was only one report where the patient became combative. **Conclusion:** Our study shows that police officers trained in naloxone administration can correctly recognize symptoms of opioid overdose, and can appropriately administer naloxone without significant adverse effects or outcomes. Furthermore, the administration of police naloxone does not result in a significant incidence of combativeness or need for scene escalations such as immediate detention. Further research is needed to investigate the impact of police naloxone; specifically, comparing outcomes of police delivery to EMS alone, as well as the impact on rural opioid overdoses. **Key words:** naloxone; police; overdose

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INTRODUCTION

Among persons aged 25 to 64 years old in the United States, unintentional drug overdose is now the leading cause of death with prescription and illicit opioids as the most common cause of these fatal overdsoses.[1] Many of these deaths could have been prevented by the timely administration of naloxone, an opioid antagonist that reverses respiratory depression that occurs during an opioid overdose. For more than 40 years, the public health response in the United States has been to distribute naloxone to emergency medical personnel; however, in an effort to combat growing rates of opioid overdose, recent policies and interventions have focused on distributing naloxone to laypersons and law enforcement who might witness or be first on scene of an overdose.[2–5] Specifically, police officers are often the first responder at the scene of an opioid overdose and the moments before emergency medical personnel arrive may be critical to reversing a potentially fatal overdose. Therefore, equipping police officers with naloxone and training them to detect the signs of an opioid overdose could help to reduce rates of fatal overdose.

The administration of intranasal naloxone has been shown to be safe and effective for opioid overdoses,[6,7]

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Indication for administration:	*Response to administration:*
[ ] Individual not breathing	[ ] Began breathing
[ ] Individual with slowed/abnormal breathing	[ ] Regained consciousness
[ ] Individual appeared blue	[ ] Vomiting
[ ] Individual unconscious/unresponsive	[ ] Became Combative
	[ ] Nothing

Note: Responses are not mutually exclusive

FIGURE 1. The required indications and responses the officers had to document following administration of naloxone.

and those cities that have equipped law enforcement with naloxone have shown that police officers are receptive to trainings on how to recognize and intervene during an overdose.[3,4,8–10] This makes police naloxone administration an important part of the public safety response to the current opioid epidemic. This practice has received support from national law enforcement partners as well as the Office of National Drug Control Policy, which strongly recommends that naloxone belongs "in the patrol cars of every law enforcement professional across the nation."[11] However, while many cities across the country utilize police naloxone programs, few have investigated the impact of these programs, and there is no literature that describes the clinical indications prompting police naloxone administration, nor the outcomes from its administration. In the present study, we use data from police incident and emergency medical services (EMS) reports to investigate the situational and clinical factors surrounding police officer naloxone use. We detail the implementation of the training program, describe the characteristics of overdose victims, and examine outcomes of naloxone administration. This study seeks to describe the clinical factors surrounding police use of naloxone, and the effects of police administration.

METHODS

Study Setting

The following study took place in a large urban police agency with over 400,000 responses per year. All officers received a 30-minute training on the recognition of the signs and symptoms of an opioid overdose as well as how to assemble and deploy naloxone using a Mucosal Atomization Device (MAD).This training took approximately 18 months and trained over 900 officers. Once the training was conducted in all districts, it was incorporated into the police training academy to capture new hires.

Naloxone Training Program

The goal of the training focused on three major topics. First, the training emphasized the growing opioid epidemic, stressing the importance of police officer response to this time-sensitive emergency. Next, officers were trained on the signs and symptoms of opioid overdoses and the importance of rapid recognition. Finally, they were educated and had to demonstrate hands on assembly and administration of the naloxone rescue kit. Each kit contained a mucosal atomizer device, prefilled 2-mL vial of naloxone (1 mg/mL) and a Luer-lock syringe. Officers were instructed to administer 1 mL per nostril, for a total dose of 2 mg per administration. All of the trainings included a presentation with photos and videos, as well as medical training manikins to demonstrate the use of intranasal naloxone. Throughout the training, educators highlighted the safety profile of naloxone as well as prepared the officers on what to expect when overdose victims are reversed. The training culminated with review of the necessary procedures officers would follow post naloxone administration (see IN.gov[12,13] for additional information on the policies and content of the training). The program required that any persons that had intranasal naloxone administered by law enforcement were to be transported to an emergency department. If a patient refused transport, law enforcement was instructed that the patient was to be taken under an involuntary detention.

Data Collection Procedures

To determine the impact of officer naloxone training, we analyzed (1) the number of times naloxone was administered by police, (2) the indications for naloxone administration, (3) basic demographics of the subject, and (4) response to naloxone as determined by the officer. To examine these questions, we gathered data from all reported uses of naloxone by officers from April 23, 2014 through September 2015. This data was extracted from standard police run reports, which also contained an additional naloxone administration data form. The standard police report contained general information collected by the police department (officers, offenders, and victims present at the scene, as well as the criminal outcome of the incident), while the naloxone administration data form captured information about the use of naloxone, such as the indicating factors for administering naloxone, victim's reaction to naloxone, time of EMS arrival at the scene, and whether the victim was voluntarily transported to a hospital.

Figure 1 shows the required indications and responses the officers had to document following administration of naloxone. These selections were not mutually exclusive, therefore officers could choose any combination of indications as well as responses. Our query of the incident reports resulted in a sample of 126 unique incidents over the 18-month study period. For each of the incidents where an officer administered naloxone, we attempted to collect follow-up EMS data. This data was obtained from the electronic medical record used by the transporting EMS service. For those EMS agencies that we did not have access to the electronic record, we requested the run reports from the services' medical directors.

A trained researcher abstracted all of the relevant information into an electronic data collection form and a second researcher checked every tenth case for consistency. These data were then input into SPSS (Statistical Package for the Social Science) version 21© for analysis. Many of the data points were already in categorical form; however, as discussed below, some of the narrative was coded to look for specific statements or themes. When possible we used the narrative to complete the form as there were some attributes that could not be determined; this missing data is described in the following section. All data collection procedures were reviewed and approved by the Indiana University IRB.

RESULTS

Police Reports

We identified 126 uses of naloxone by officers in the 18-months following training. Figure 2 displays police naloxone use by season and year for which complete data were available (the program started in late April, therefore spring 2014 is not included). There was slight reduction in use during winter 2014 that is consistent with seasonal overdose rates seen in previous studies.[14] However, Figure 2 shows that the number of police naloxone uses more than doubled between summer 2014 and summer 2015, with 16 and 34 uses respectively. Examination of time of day and frequency of police naloxone use showed more overdoses occurred between noon and 11 PM (77.8%) than from midnight to 11 AM (22.2%). The most common time was from 8 PM to 9 PM ($n = 19$; 15.1%). In fact, 57.9% of all the overdoses occurred from 3 PM to 9 PM. Finally, in terms of the distribution of naloxone use among officers, we found that among the 126 uses, there were 89 different officers who had administered naloxone: 51% of these officers administered naloxone once, 13% twice, 5% three times, and 2% five times.

Table 1 shows the characteristics of the overdose victims to whom police administered naloxone. The victim ages ranged from 20 to 57, with an average age of

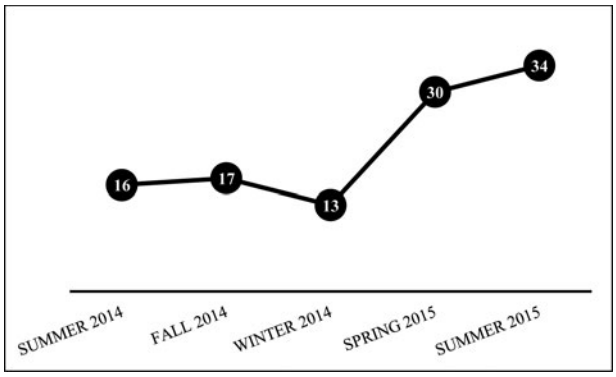

FIGURE 2. Officer use of naloxone.

32.8. Most of the overdose victims were White ($n = 117$; 92.9%) and over half were male ($n = 75$; 59.5%). In all of the naloxone incidents examined in this study, police arrived on the scene prior to EMS. Additionally, our data demonstrated that the overwhelming majority of victims voluntarily went to the hospital following naloxone administration (96.8%). The overall incidence of need for immediate detention was quite low (3.2%) as was the incidence of death (2.4%). In addition to clinical outcomes, our study examined the frequency of arrest of individuals receiving naloxone from police (see Table 1). Interestingly, the majority (82.5%) of overdose victims were not arrested. Of the remaining who were arrested, the decisions to arrest were the result of the overdose victim having one or more outstanding warrants, or the officers noted drug paraphernalia.

TABLE 1. Overdose victim characteristics and outcomes ($N = 126$)

Variable	Mean (SD)	
Age	32.8	(8.79)
Sex	*N*	%
Female	51	40.5
Male	75	59.5
Race		
Black	5	4.0
White	117	92.9
Asian	1	0.8
Unknown	3	2.3
Time to EMS Arrival after Law Enforcement		
Less than 1 minute	20	15.9
1–3 minutes	60	47.6
3–5 minutes	33	26.2
More than 5 minutes	13	10.3
Transported		
Voluntarily Transported	122	96.8
Immediate Detention	4	3.2
Arrested		
Yes	22	17.5
No	104	82.5
Fatal Overdose prior to EMS transport		
Yes	3	2.4
No	123	97.6

TABLE 2. Indications of overdose and responses to Naloxone ($N = 126$)

Overdose Indicators	N	%
Individual not breathing	41	32.5
Individual with slowed/abnormal breathing	72	57.1
Individual appeared blue	63	50.0
Individual unconscious/unresponsive	117	92.9
Response to Naloxone		
Began breathing	71	56.3
Regained consciousness	82	65.1
Vomiting	6	4.8
Became Combative	1	0.8
Nothing	22	17.5

Note. Indicators and responses are not mutually exclusive.

TABLE 3. EMS follow-up data on overdose incidents ($N = 98$)

Variable	Mean (SD)	
Prior EMS Involvement	2.0	(3.2)
Prior Overdose	0.6	(1.1)
Prior EMS Involvement	*N*	%
0	35	35.7
1	24	24.5
2	18	18.4
3 or more	21	21.4
Prior Overdose		
0	66	67.3
1	17	17.3
2	9	9.2
3 or more	6	6.1
Location		
Home/Residence	61	62.2
Street/Highway	14	14.3
Public Building	11	11.2
Commercial	12	12.2
Additional Naloxone by EMS		
Yes	54	55.1
No	44	44.9

As shown in Table 2, the most common indicator for administration was unconscious/unresponsive ($n = 117$; 92.9%), followed by slowed breathing ($n = 72$; 57.1%), appeared blue ($n = 63$; 50.0%), and not breathing ($n = 41$; 32.5%). Table 2 shows the most common response was the overdose victim regaining consciousness ($n = 82$; 65.1%), followed by beginning to breath ($n = 71$; 56.3%). Among the successful resuscitations, there were 6 instances where the victim vomited following naloxone (4.8%), and 1 instance of being combative (0.8%). When looking at those that "Began breathing" and/or "Regained consciousness," we found that in 82.5% ($n = 104$) of the police naloxone administration incidents, the overdose victim was successfully resuscitated at the scene. Table 2 also shows that in 17.5% ($n = 22$) of the cases "Nothing" happened when naloxone was administered intranasal. EMS data was analyzed to further examine what happened in these situations.

EMS Incident Reports

Of the 126 police uses of naloxone, we were able to collect additional EMS follow-up data on 98 (77.8%) cases. The remaining 28 (22.2%) cases were transported by EMS agencies of which the authors did not have access to the reports. Among the 98 individuals, there were 194 total prior EMS incidents of which 59 were a prior overdose. As shown in Table 3, the overdose victims had an average of 2.0 ($SD = 3.2$) prior encounters with EMS (range 0 to 21), and an average of 0.6 ($SD = 1.4$) prior drug overdoses that had been reversed by EMS (range 0 to 7). To describe these distributions further they are also presented categorically in Table 3; almost two-thirds of the subsample ($n = 63$; 64.3%) had a previous emergency that required EMS, and over one-third ($n = 32$; 32.7%) had a prior overdose when the EMS records were searched as far back as July of 2009. Moreover, among those with a prior overdose ($n = 32$), there were 132 prior EMS incidents of which 44.7% ($n = 59$) were an overdose. EMS data on this subsample also provided details about the type of location where the overdose occurred. Table 3 shows that 62.2% ($n = 61$) of overdoses where police used naloxone occurred in home or residence, followed by street/highway ($n = 14$; 13.4%), commercial properties ($n = 12$; 12.2%), and public buildings ($n = 11$; 11.2%). We were also able to capture data on the number of instances where EMS gave an additional dose of naloxone once they arrived at the scene, and found that this occurred in 55.1% ($n = 54$) of the cases.

Finally, we attempted to use the EMS data to further examine those 22 instances in which police used naloxone and reported that "Nothing" occurred. We were able to capture EMS data on 18 of these cases; of these, 3 were the fatalities noted above, 3 were not opioid related overdoses, and in each of the remaining 12 cases EMS administered an additional dose of naloxone and the patient became responsive.

DISCUSSION

As the use and abuse of opioid substances continues to grow, now becoming the leading cause of accidental death in the United States, public health officials have been forced to look to alternative ways, such as police naloxone programs, to combat this deadly epidemic. The rapid response of police, combined with increased exposure to overdose cases, has made this a good compliment to the typical EMS response. While there are many police naloxone programs across the United States, this study is the first to look at specific components of police naloxone delivery by law enforcement officers. Our findings suggest that this intervention was successful in several ways; specifically, police adoption, correct identification of opioid over-

dose patients, and the correct administration of naloxone to reverse the effects of an opioid overdose. While previous studies have demonstrated police are receptive to naloxone training, this is the first to show the effectiveness of this training on officer actions.[8]

Our analysis provides potential insight into the typical features surrounding an overdose victim with whom police officers intervene. For example, follow-up EMS data revealed that police officers were most often called to a residential home, nearly three-quarters of the overdose victims had prior EMS involvement, and approximately one-third had a prior overdose. Based on police reports, those who overdosed were cooperative, and were voluntarily transmitted to the hospital. There was only one instance where an officer stated an overdose victim became combative when naloxone was administered; yet even this person was resuscitated, voluntarily transported to the hospital, and was not arrested. The slower absorption and onset of action of intranasal naloxone contributes to the lower rates of combativeness than those reported with intravenous usage; this lower rate of combativeness with intranasal delivery compared with intravenous has also been documented in previous studies.[7,15]

In terms of implementation, we found that police were effective in recognizing the signs of overdose and using naloxone. In the majority of cases where police used naloxone, the overdose victim went from unresponsive to regained consciousness. And though not all patients regained consciousness, there was improvement in either their mental status or breathing in the majority of cases. We did not find previous studies looking at law enforcement naloxone administration and responses, however previous prehospital studies have shown that intranasal naloxone is anywhere between 72% to 74% effective in reversing opioid overdoses.[6,16] The requirement for a subsequent dose by EMS in 55.1% of the cases is likely due to the fact that, despite improving respiratory status, the peak action of the intranasal naloxone had not been reached with the short EMS arrival time after law enforcement. As naloxone will only improve mental status or respirations in an opioid overdose, the 82.5% positive response rate to officer administration of naloxone found in this study supports the idea that officers were able to appropriately recognize opioid overdose the majority of the time.

Looking at the EMS data on the cases that did not respond to intranasal naloxone, we were able to see that most overdose victims responded to subsequent EMS intravenous doses. These responses to intravenous doses are likely due to short response times by EMS; that is, EMS arriving prior to onset or peak action of the intranasal naloxone, which has been shown to be close to 8 minutes.[6] It is also possible that in the cases of police nonresponders, the dose was too small or it was not administered correctly. Furthermore, there were only three fatal overdoses, and only three instances where police administered the naloxone and it was determined that the victim was *not* experiencing an opioid overdose. The EMS follow-up data found that in nearly half of the cases the police naloxone was sufficient to revive the patient. That is, they did not require an additional dose of naloxone by EMS.

Data from this retrospective case series demonstrates a successful implementation of a law enforcement naloxone program. As more police agencies around the United States become equipped with naloxone, more research needs to be done to look at the clinical impact of police naloxone delivery. Prior studies have looked at the overall death rates in their counties pre and post police naloxone programs[9]; however, we found no prior studies that look at the individual response to administration in a police intranasal naloxone program. Future studies looking at the outcomes of patients that receive intranasal naloxone prior to EMS arrival, compared with those that receive it on EMS arrival, should be done to assess whether early administration of intranasal naloxone improves health outcomes. We would expect that among rural EMS agencies, with longer response times, the impact on outcome could be much greater. In our case series, the majority of EMS arrived within 5 minutes of police, with only 10.2% ($n = 13$) arriving after 5 minutes. A potential barrier for the use of police administered naloxone in overdose cases is the concern persons have of being arrested. Higher arrest rates when police administer naloxone could lead to downstream effects of delayed bystander calling 9-1-1 or reluctance to call when needed. Therefore, it is important not only to understand and address when and why police arrest the patient, but also building such concerns into future trainings.

Limitations

The primary goal of this study was to assess the impact of implementing training for police officers to detect and intervene during an opioid overdose. The study is limited in that it presents descriptive analyses that are based on retrospective administrative data from one city. As the cases were limited to those where police administered naloxone, there is a substantial potential for inclusion bias towards true opioid overdoses. This inclusion bias is likely part of the reason that we found a very high rate of successful resuscitations. Further research looking at all opioid overdoses that police responded to and were on scene prior to EMS arrival would give a more clear idea of the times that police failed to recognize the overdose and intervene appropriately. Moreover, the police reports have minimal narrative included and most of the information on naloxone use was contained in dropdown tabs. This

allowed officers to have uniform descriptors of the indications and responses to administration of naloxone, but fails to provide a deeper understanding of the overdose scene, the response of bystanders and patients, or the attitudes of officers. In terms of data collected for this study, despite having access to the majority of the EMS data, we did not have access to 28 of the reports. Finally, though the response to naloxone strongly suggests that the patient's altered mental status or respiratory depression was due to an opioid overdose, there was no confirmation from either urine toxicology or emergency department documentation. Though this may strengthen the likely diagnosis of opioid overdose, obtaining urine toxicology screens is not common practice in the emergency department as it is solely a qualitative and not quantitative test. Despite these limitations we feel that this study addresses many of the concerns to establishing a police naloxone program, as well as provides further evidence that officers can be trained to correctly determine an opioid overdose, and that they can use naloxone correctly to reverse potentially fatal overdoses.

CONCLUSION

Our study shows that police officers trained in naloxone administration can correctly recognize symptoms of opioid overdose, and can appropriately administer naloxone without significant adverse effects or outcomes. Furthermore, the administration of police naloxone does not result in a significant incidence of combativeness or need for scene escalations such as immediate detention. Further research is needed to investigate the impact of police naloxone. Specifically, comparing outcomes of police delivery to EMS alone, as well as the impact on rural opioid overdoses.

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