An Assessment of the Relationship between the Total Prehospital Naloxone Dose Administered and EMS Transport in West Virginia

Introduction: Little is known about the relationship between prehospital naloxone dose and the decision to transport a suspected opioid overdose patient. West Virginia has the highest per capita drug overdose death rate in the nation at 34 per 100,000 residents versus the national average of 13 per 100,000. Because West Virginia is disproportionality impacted by the opioid epidemic, it is an important state in which to study naloxone administration.

Objective: To assess the relationship between the total dose of prehospital naloxone administered and EMS transport of suspected opioid patients to an emergency department in West Virginia. We hypothesized that higher dose of naloxone administered may be a proxy for more severe overdose and would be associated with higher rates of EMS transport.

Methods: This was a retrospective observational study of all 9-1-1 calls where one or more doses of prehospital naloxone were administered in West Virginia from January 1, 2016 to December 31, 2017. At the time of the study, West Virginia was collecting EMS data in the NEMSIS version 2 standard. The outcome of interest was derived from the Patient Disposition element (E20_10). While NEMSIS offered many response options for this element, only 4 were recorded in West Virginia during the study period (treated, transported by EMS; treated, transferred care; treated and released; patient refused care). Treated, transported by EMS was combined with treated, transferred care and treated and released was combined with patient refused care to form the dichotomous outcome variable indicating if the patient was transported (yes/no). During the study period, the medication given element (E18_03) collected free text responses. Multiple spellings and obvious misspellings of naloxone and Narcan were normalized to identify patients who were administered prehospital naloxone. The total dose of naloxone administered was captured in the Medication Dosage (E18_05) element and the Medication Dosage Units element (E18_06). To facilitate the analysis, only doses recorded in milligrams were included. Further evaluation of the linearity the total dose variable revealed that it was inappropriate to place it in a logistic regression model in a continuous form. West Virginia state protocols indicate that the initial dose of naloxone should be 0.4 milligrams titrated to 2 milligrams based on respiratory status. With this in mind, total dose was categorized as $\leq$0.4 milligrams (referent), 0.5 to 1.9 milligrams, and $\geq$2 milligrams. Wilcoxson Rank Sum and Chi-square tests were performed, where appropriate. Univariate odds ratios and 95% Confidence Intervals were calculated.

Results: There were 613,011 total 9-1-1 call and 9,279 (1.5%) where the patient received prehospital naloxone in West Virginia during the study period. Of those, 7,626 (82.2%) were transported and 1,653 (17.8%) were not transported. There were 530 (5.4%) cases that were excluded because the Medication Dosage Unit was recorded in units other than milligrams and 319 (3.4%) cases that were excluded due to missing Medication Dosage data or doses that were >25 milligrams leaving 8,430 (90.9%) cases available for analysis. Total naloxone doses ranged from 0.02 milligrams to 24 milligrams. The average total dose of prehospital naloxone was 1.6 milligrams (standard deviation 0.8) with a median of 2 milligrams (interquartile range 1-2). When comparing those who were transported to those who were not transported, the total naloxone dose was similar. Those who were transported had a total dose that ranged from 0.02 to 24 milligrams. The average total dose for those who were transported was 1.5 milligrams (standard deviation 0.8) with a median of 2 (interquartile range 1-2). Those who were not transported had a total dose that ranged from 0.08 to 12 milligrams. The average total dose for those who were not transported was 1.6 milligrams (standard deviation 0.7) with a median of 2 (interquartile range 1-2). This difference was not statistically significant (p=0.53). When categorized, there were 1,634

(19.4%) cases where the total naloxone dose was ≤0.4 milligrams. There were 1,079 (12.8%) cases where the total naloxone dose was 0.5 to 1.9 milligrams, and 5,717 (67.8%) cases where the total dose of naloxone was ≥2 milligrams. The relationship between total dose and transport remained statistically insignificant when evaluating total dose as a categorical variable (≤0.4 milligrams: referent; 0.5 to 1.9 milligrams: Odds Ratio = 1.22, 95% Confidence Interval = 0.99 to 1.49, $p>0.05$, ≥2 milligrams: Odds Ratio = 1.02, 95% Confidence Interval = 0.89 to 1.17, $p=0.75$).

Conclusion: The assessment of the relationship between total prehospital dose of naloxone and patient transport in West Virginia did not reveal a significant relationship. Total dose of prehospital naloxone was similar among those who were transported and those who were not transported. Limitations of this study included the univariate assessment of dose. It is likely that there are other important variables that are related to EMS transport including route of administration. This study was also not able to assess naloxone administered by bystanders or other first responders. Results from this study suggest that when evaluating factors related to transport of suspected opioid overdose patients, variables other than total naloxone dose should be studied. Future study should seek to identify relevant predictors of the need for transport for suspected opioid overdose patients.