

Identification of Clinical Indicators of Opioid Overdose using innovative EMS software analytics

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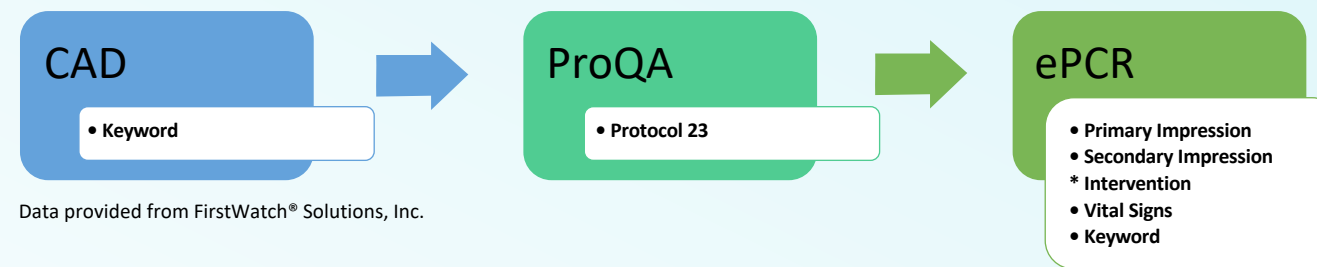
Introduction

In North America, we experience the highest rate of drug related mortality in the world. In the US, overdose is now the leading cause of death among adults under the age of 50. The opioid crisis is rapidly evolving due to changes in drug availability and the presence of adulterated fentanyl among other factors, leading to a critical need for innovative methods to identify overdoses for surveillance and intervention purposes.

Methods

We initially created a set of EMS agency specific opioid overdose filters using FirstWatch® software as part of a public health research study. Following that initial development, we built a generic set of identifiers. In the initial approach we used ZOLL Data Systems software for ePCR and TriTech Inform CAD to define 3 sets of identifiers: (T1) captured calls in which naloxone was administered and a positive clinical response was documented, (T2) included same criteria as T1 except there was no such positive response, and (T3) consisted of calls in which one or more drug-related keywords were present within the narrative of the ePCR. Because the initial analysis was conducted in the context of a single research study, we aimed to create a more generalizable set of identifiers of opioid overdose that would function across different EMS agencies and data sources. Within the FirstWatch® software we created a high OD1 and a low OD2 detailed set of clinical indicators based on the data

Diagram 1: Data sources and fields used to create clinical indicators of Opioid Overdose



sources and fields illustrated in Diagram 1. (OD1) included calls which had CAD and ePCR drug-related keyword in the comments and narrative, along with ProQA card 23, ePCR impression of opioid overdose, an intervention of Naloxone/Narcan, low respiratory rate (RR), low GSC score, and a documented improvement of RR and/or GSC score after intervention. (OD2) included a ProQA card of 23, an impression of Overdose, an intervention of Naloxone/Narcan, and a low GSC and RR.

Results

Table 1: Results of Validity Measures of the Clinical Indicators of Opioid Overdose

	Overdose Calls		Sensitivity	Specificity	PPV	NPV	*LR+	*LR-
	Yes	No	% (IC 95%)	% (IC 95%)	% (IC 95%)	% (IC 95%)	(IC 95%)	(IC 95%)
T1	Yes	76	48	99	71	99	2.53	0.002
	No	82	(.401-.561)	(.998-.999)	(.201-.380)	(.997-.998)	(1.829-3.508)	(.001-.002)
T2	Yes	7	4	99	6	93	0.07	0.004
	No	151	(.019-.092)	(.996-.997)	(.028-.134)	(.865-.971)	(.034-.143)	(.003-.004)
T3	Yes	75	47	39	0.3	99	0.003	0.005
	No	83	(.395-.555)	(.389-.399)	(.002-.004)	(.993-.995)	(.002-.004)	(.004-.006)
OD1	Yes	83	53	99	52	47	1.11	0.001
	No	75	(.444-.604)	(.997-.998)	(.444-.604)	(.395-.555)	(.887-1.380)	(.001-.002)
OD2	Yes	133	84	99	60	99	1.53	0.007
	No	25	(.773-.893)	(.997-.998)	(.536-.669)	(.998-.999)	(1.235-1.858)	(.0004-.001)

PPV: Positive Predictor Value, NPV: Negative Predictor Value, IC 95%: 95% Confidence Interval

* Likelihood Ratio weighed by prevalence

Methods (Continued)

To provide a better understanding of our indicators we calculated validity measures for all 5 identifiers of opioid overdose. To provide comparable data for this analysis, OD1 and OD2 were calculated within the same system (CAD, ProQA, ePCR) as the indicators calculated for T1, T2, and T3.

Conclusion

Specificity within our indicators was high, except on T3 (39%). The Sensitivity was highest in indicator OD2 (84%) and PPV and NPV were also highest in OD2 (60% & 99%) as well as in T1 (71% & 99%). Likelihood ratios had remarkable results in T1, OD1, and OD2. Within the context of a single clinical indicator of overdose, OD2 provides the most reliable features to correctly identify an EMS Opioid Overdose call.

Correctly identifying an opioid overdose can be a challenge. Its clinical features are non-specific and bystanders fear repercussions of disclosing the nature of the 911 call. Determining the correct number of opioid overdoses requires a tailored identification process. While we hypothesized that a more detailed and focused set of criteria would provide the most accurate approximation of Opioid Overdose calls, our data suggests that a more conservative approach while maintaining a multisource of EMS data is preferable.

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