**Model development**

*Data Preparation*

The data was converted from a “long” format with every drug given a separate line within an incident/victim combination to a “wide” format where every drug had a separate column and every incident/victim combination had only one line. The resulting file had 8,369 incidents and 8,525 victims (Tables 1 and 2). Each victim occurred only once by Victim ID, although there may be issues with longitudinal tracking. There were 2,319 incidents with multiple victims, averaging 2.42 victims per such incident, with a range of 2-12.

Because of small cell counts, the only drugs examined specifically were HEROIN, FENTANYL and UNKNOWN. Similarly, Race was consolidated into White, Black, or Unknown/Other. The three lowest age brackets were combined into 19 or lower, and the three highest into 60 or older. If the Gender Desc field was “Female” then the victim was considered Female, otherwise not.

Survive had three levels – Y, N or U – so Died was Survive==”N” as opposed to “Y” or “U.

*Structure of Model*

To generate a tractable model, the ‘rms’ package in R was used to identify consistent features for a logistic regression model. The original model had the form:

***Died = f(Naxalone.Administered x [ HEROIN x (FENTANYL+UNKNOWN) + Female+Age.Range + Race +Ethnicity.Desc+Day)])***

which allowed for Naxalone to interact with all variables and included Ethnicity and Day.

The reduced model had the structure

***Died =f(Naxalone.Administered x [ HEROIN x FENTANYL + UNKNOWN + Age.Range)]) +Female +Race***

where Ethnicity and Day fell out and so did interaction between Naxalone and Race or UNKNOWN drug. Performance of this reduced model was good – AUC of 0.804, 0.799 after optimism correction. For the model predicting whether the patient lived, the AUC was 0.736, 0.730 after correction. Calibration curves also matched the ideal performance between 0 and 80% probability of death.

Using the ‘lmerTest’ package, the logistic regression model was adjusted by first adding a random intercept per county to allow for variations in death rate, then by further adding a random slope so that each county might have varying efficacy with Naxalone. Changes in AIC suggested that the random slope+intercept model was the best to use. The ICC for the model was 0.06, suggesting that the county-level effect only accounted for 6% of the outcome variation.

**Results**

*Table 1 Narcan*

Despite statistical significance, not much variation in demographics. Major differences are in Survival, use in Unknown Drugs. Very young less likely to get Narcan. See also Table 5

*Table 2 and 3 Drugs*

Patients with Fentanyl Only less likely to get Narcan, but also have worst survival. 57.4% of patients with neither Heroin nor Fentanyl are listed as Unknown Drug.

*Table 4 Statistical Significance in statistical model of death*

Based on pruned model as described in methods

*Table 5 Statistical Model for Narcan given*

No pruning since I assume demographic differences are of interest, even if non-significant. See also Table 1.

*Table 6 – Mortality and Narcan and Drugs*

Fentanyl seems to be deadly by itself

*Table 7 – Narcan administration*

Fentanyl not getting Narcan at same rate?

*Figure 1 – death*

Narcan has greater benefits for older victims

*Figure 2 – death rates across counties, without and with Narcan*

Narcan shrinks the bell curve

*Figure 3 – no relationship between Death Rates with and Without Narcan per county*

*Figure 4- administration rates follow bell curve*

*Figure 5 -*