Detecting Drug Diversion

Students: Jing Lyu, Jake Sumner, Juliana Zhang
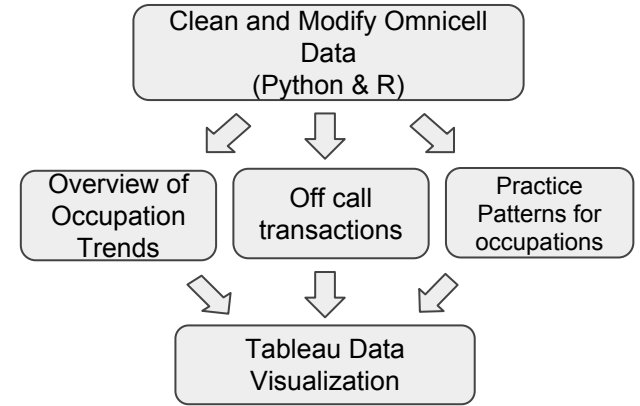Mentors: Willem van den Boom, Rebecca Schroeder, M.D.

Objective

Create visualizations to aid in the detection of drug diversion for Certified Registered Nurse Anesthetists (CRNAs), Fellows, and Residents in the Duke Medical Center. Detection would help both the HCP recover from their condition and prevent patients from being under the care of a diverting HCP.

Clean and Modify Omnicell Data (Python & R)

Overview of Occupation Trends

Off call transactions

Practice Patterns for occupations

Tableau Data Visualization

Drug Diversion

- a health care provider (HCP) transfers drugs intended for an individual's medical use for illicit purposes often limiting mental capacities

Omnicell Data

- ~300,000 transactions obtained by the Duke Medical Center Pharmacy
- Only CRNAs, Residents, and Fellows
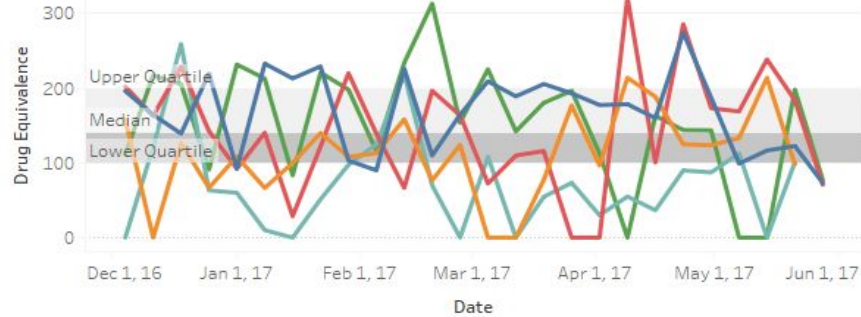- Includes drug type and amount and time of transaction

Above: An Omnicell device. These automated drug dispensing machines gathered recorded all of the data for the project.

Visualizations

- This dashboard shows the changes in total drug usage over time per CRNA in the Ambulatory Surgery Center (ASC), and any occupation and practice can be chosen
- Analysis can be done on any group of controlled substances (such as opioids or benzodiazepines), and can be specified for a drug such as the opioid fentanyl
- This visualization uses the filters on the right side of the charts to also select for specific time periods, and to choose to look at the time in the different granularities of month, week, and day
- Clicking on a user in the line chart automatically updates the bar chart information for that user

Drug Equivalence over Time for CRNAs in ASC (click on User for closer look)

Segmented Bar Graph of Drug Equivalence Over Time

Date Granularity Field
12/1/2016 to 7/31/20..

Date Granularity
Week

DOI Type
Multiple values

Drug Name
All

Occupation
CRNA

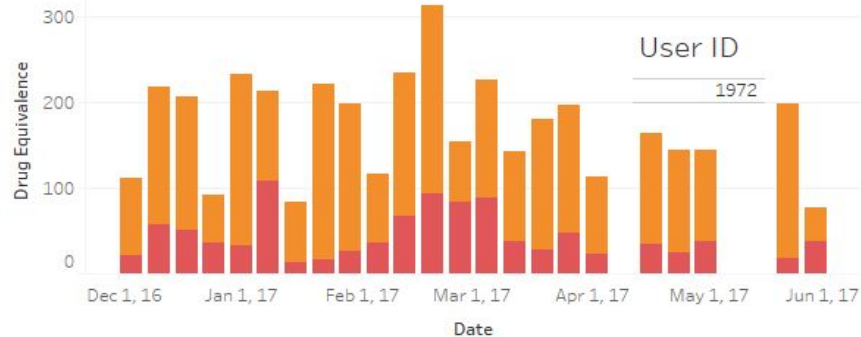Practice Assignment G..
ASC

Drug Name
fentaNYL
hydroMORphone

Location
Duke OR

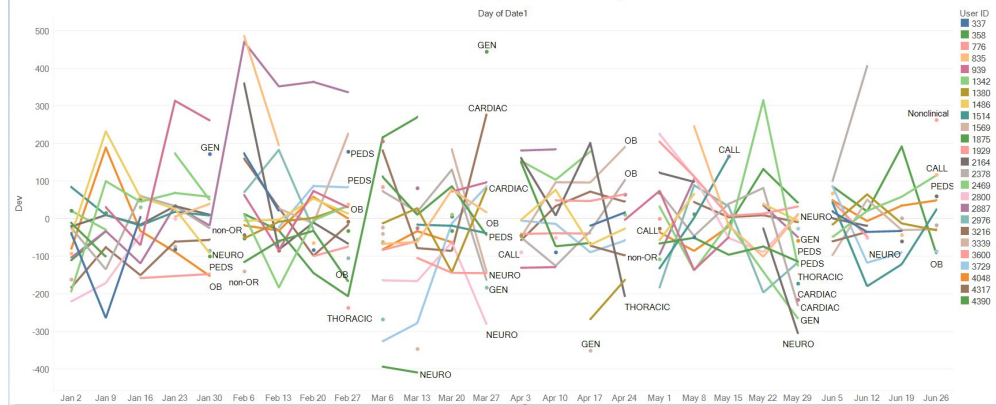User ID
113
595
1167
1953
1972

Interactive Dashboards

- Difficult to observe abnormal drug usage for residents as they move between different practices weekly
- Top dashboard corrects for each resident's changing practice. It shows the deviations from assignment practice patterns (calculated as the moving average of a median per practice) per user as residents move weekly
- Bottom dashboard: last 6 months of off call transactions for CRNAs with off call transaction counts by week per user and comparisons of multiple users in a practice and single user data
- Off-Call transactions: diverters may withdraw controlled substances when not on shift - available for fellows, CRNAs and Residents
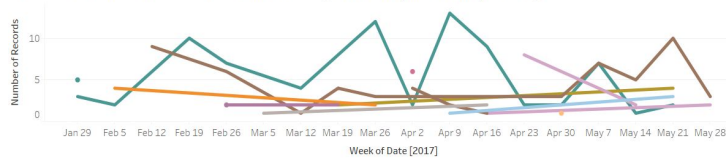
Future Work

- Include non-controlled substances to ensure HCPs are prescribing proper amounts to avoid waste
- Set up automatic flagging algorithm for suspicious behavior to save time on analysis

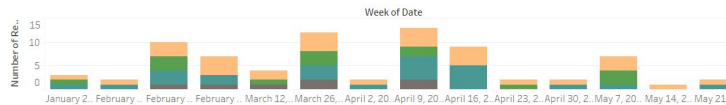OPIOID: Deviation from Practice Pattern of All Residents (Last 6 months)

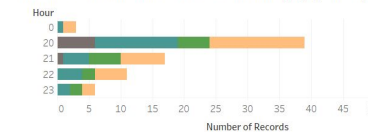Dashboard of CRNAs (Last 6 months)

Duke OR: Frequency of Off Call Transaction (8 pm-6 am) in CRNAs(Weekly)

Off Call Transactions of Different Drugs(By Week)

Off Call Transactions of Different Drugs(By Hour)

Pie Chart of Off Call Transaction Locations

Off Call Transactions

Contact: jl709@duke.edu, jas197@duke.edu, jvz2@duke.edu, wv8@duke.edu, schro016@duke.edu