# Using MIMIC/eICU I/O and Medication

## Workshop

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# Agenda

- Clinical insights
  - What are I/O and medications? Why do we use them?
- Explanation of the tables (attributes)
- Tutorial using MIMIC/eICU tables
  - Summing up fluid input, output
  - Identifying duration of hemodialysis
  - Identifying whether patient had antibiotics during hospitalization
  - …

# What are I/O and Medications?

- I/O
  - Input / Intake
    - Oral intake
    - IV intake (IV fluids and IV medications)
    - Saline flush (and analogues) and KVO
  - Output
    - Urine, stool
    - Drains (surgical drains, etc.)
    - Insensible losses
- Medication
  - Home medications
  - Hospital medications

# Why Do We Use I/O and Medications?

- Fluid balance
  - Congestive heart failure
  - Liver disease
  - Kidney failure
- Hemodynamics
  - Expected urine output vs measured urine output (renal perfusion)
  - Improving cardiac output (heart function)
- Treatment for various disease states
  - Extensive burns
  - Sepsis
  - Rhabdomyolysis (from a busy morning at SoulCycle)
  - Recurrent hypoglycemia
  - Toxic ingestions

# What Can We Do with These Data?

1. What characteristics predict patients who successfully receives the **30 mL/kg IV fluid bolus** as mandated by the *Surviving Sepsis* campaign, in severe sepsis?
2. **How quickly** do they receive it?
3. What clinical and lab biomarkers predict an **increase in output recorded in surgical drains** after cardiac bypass?
4. How much IV fluid is **too much IV fluid** in end-stage renal disease?
5. Which medications are associated with **the development of ICU delirium**?
6. Which characteristics predict the choice of **the first-line inotropic medication** given to patients in cardiogenic shock?
7. Is **normal saline associated with acute kidney injury**?

# I/O in MIMIC-III

- `inputevents_cv`
  - https://mimic.physionet.org/mimictables/inputevents_cv/
  - Input information from the old system (CareVue, 2001-2008)
- `inputeevents_mv`
  - https://mimic.physionet.org/mimictables/inputevents_mv/
  - Input information from the new system (MetaVision, 2008-2012)
  - #457 Starttime bigger than endtime
- `outputevents`
  - https://mimic.physionet.org/mimictables/outputevents/
  - Output information, e.g. urine output
  - `CHARTTIME` (event time) vs `STORETIME` (input/validate time)
- `chartevents`
  - https://mimic.physionet.org/mimictables/chartevents/
  - Some special input/output events will be here, e.g. hemodialysis

# I/O in eICU-CRD

- `intakeOutput`
  - https://eicu-crd.mit.edu/eicutables/intakeoutput/
  - Unified table for input/output information
  - `intakeOutputOffset` vs `intakeOutputEntryOffset`

# Medication in MIMIC-III

- `prescriptions`
  - https://mimic.physionet.org/mimictables/prescriptions/
  - All prescribed medication
  - NDC code? https://github.com/MIT-LCP/mimic-code/issues/132
- `inputevents_cv`
  - https://mimic.physionet.org/mimictables/inputevents_cv/
  - Input information from the old system (CareVue, 2001-2008), e.g. vasopressors, insulin
- `inputeevents_mv`
  - https://mimic.physionet.org/mimictables/inputevents_mv/
  - Input information from the new system (MetaVision, 2008-2012), e.g. vasopressors, insulin
  - #457 Starttime bigger than endtime
- `noteevents`
  - Require NLP

# Medication in eICU-CRD

- `admissiondrug` (extremely infrequently used)
- `allergy`
- `medication`
  - https://eicu-crd.mit.edu/eicutables/medication/
  - `drugstartoffset` vs `drugorderoffset`
- `infusionDrug`
  - https://eicu-crd.mit.edu/eicutables/infusiondrug/
  - e.g. dopamine, epinephrine, …
  - `volumeoffluid` vs `drugamount`
    - amount of drug in the bag vs volume of the bag
- `treatment`
  - Allow users to document, in a structured format

# Some Tips

- Find the scripts on GitHub repo first
  - `https://github.com/MIT-LCP/mimic-code`
  - `https://github.com/MIT-LCP/eicu-code`
- Search the **Issues**
- Ask if there are people also working on the similar query using Slack
- Syntax difference between PostgreSQL and BigQuery
- Get `itemid` from existing SQL query
- If you built MIMIC locally
  - https://github.com/MIT-LCP/mimic-code/tree/master/concepts
  - **git clone → make-concepts.sql**

# Prerequisite

- Google account
  - To access GCP and BigQuery
- RStudio server access OR R/RStudio
  - `http://35.231.235.240:8787`

# Tutorial - Fluid / Medication Data Manipulation

- Modified from LCP GitHub repositories
  - `https://github.com/MIT-LCP/mimic-code`
  - `https://github.com/MIT-LCP/eicu-code`
- `https://github.com/criticaldatacourse/hst953-2018-workshops/tree/master/1012-inout`
  - **Clone or download**
  - **Upload Rmd to RStudio server**
- What's inside the tutorial?
  - How to connect to BigQuery in R and python
  - Extracting input/output/medication information from MIMIC/eICU demo datasets
  - 9 SQL examples (in `sql` folder)