

The background is a light blue gradient with a complex pattern of overlapping hexagons in various shades of blue, teal, and red. These hexagons are interconnected by a network of thin, light blue lines, creating a sense of a digital or molecular structure. Some hexagons are solid, while others are outlines, and some are slightly offset, giving a 3D effect.

Fifth Eye Technical Assignment

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Executive Summary

- While the **data used was statistically small**, there was evidence of relationships between drug intake and changes in vitals
 - **Sodium Chloride** is paired with both continuous drugs and might be necessary for drug effectiveness or preventing undesired side effects
 - **Midazolam** is associated with **easing of vitals** and restful states
 - **Norepinephrine** is associated with **higher blood pressure**, and to a lesser degree, lower Heart Rate
- Aside from small data problem, it is **difficult to ascertain these relationships** since drugs **may induce** or instead **counteracting** the observed vital changes. More background research is required.

Time Spent

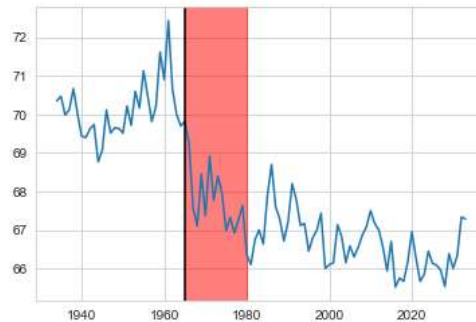
- Reading MIMIC definitions, grasping data, light web search – 1 hour
- Initial strategizing – 15 minutes
- Coding – 5 hours
- Presentation – 1.5 hours

Data Cleaning & Engineering

- No NA's needed replacement
- Dropped "Rewritten" Status Description since [MIMIC notes](#) this drug was not actually admitted and only present for auditing purposes
- Dropped records of drug intakes that were outside of the time series of the patient vitals
- Merged the two dataframes using an outer join, resulting in matching vitals to drug intakes

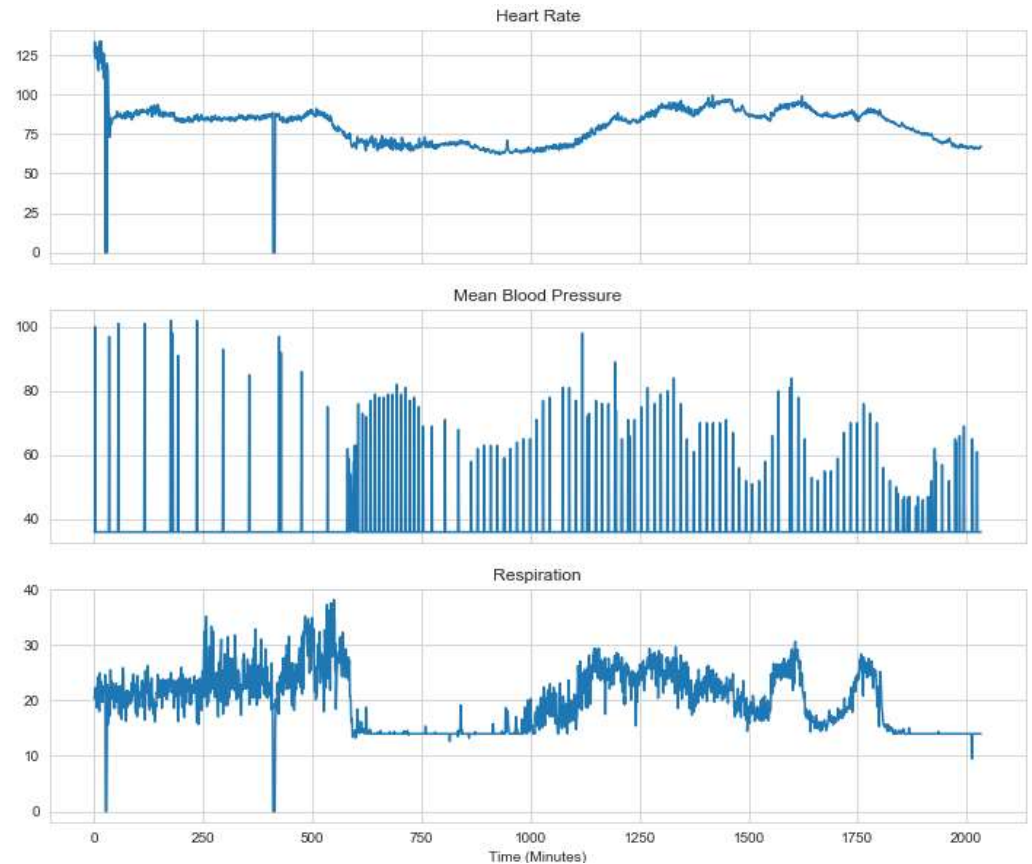
Time	HR	Time	Drug	Time	HR	Drug
Minute 1	90	Minute 3	NaCL	Minute 1	90	N/A
Minute 2	95	Minute 4	NaCL	Minute 2	95	N/A
Minute 3	90			Minute 3	90	NaCL
Minute 4	88			Minute 4	88	NaCL
Minute 5	87			Minute 5	87	N/A

- Created new variables to measure *change* in average vitals over the subsequent 5, 10, and 15 minute windows



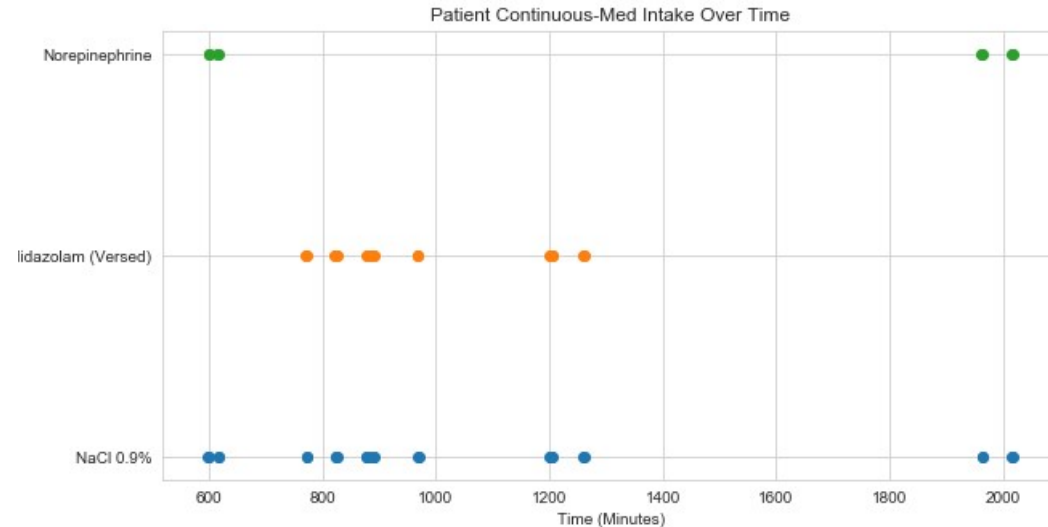
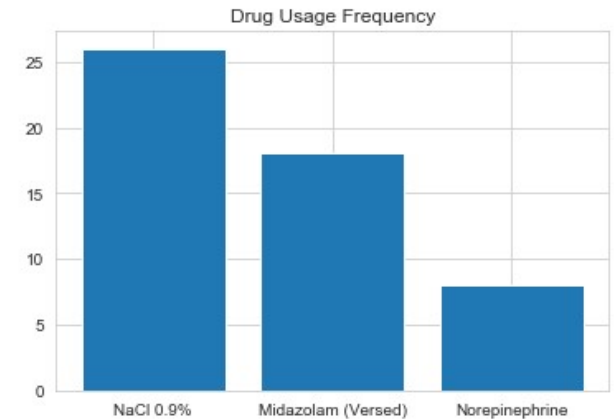
Basic Vital Charts – First Impressions

- Heart Rate
 - Mostly lies within a [normal](#) range (60-100 bpm)
 - Outliers of “zero” are likely lapses in recording, due to brief duration and quick return to normalcy
- Blood Pressure
 - Exhibits high volatility
 - Blood pressure tends to be higher when respiration flat-lines
- Respiration
 - Shares outliers moments with Heart Rate
 - Gradual drop-to-flat line could be restful states



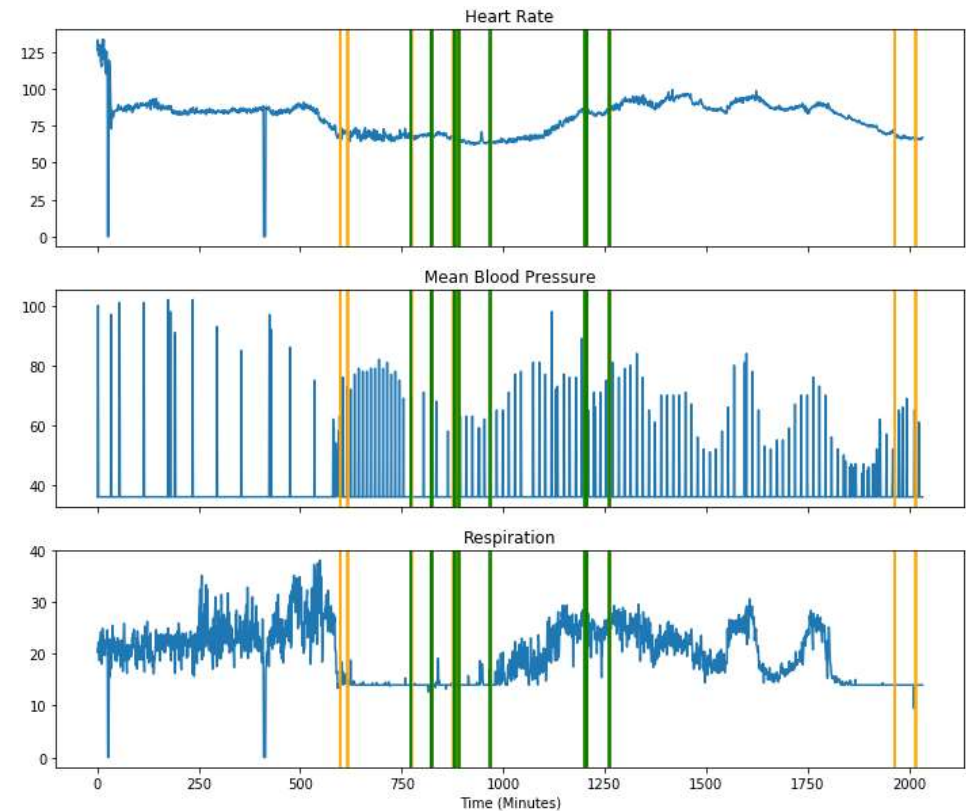
Drug data – First Impressions

- All of the Continuous Med sample groups had too low a count to make any strong statistical inferences – take the summary with a grain of salt!
- NaCl is always paired with other drugs – therefore we won't conduct independent analysis on it



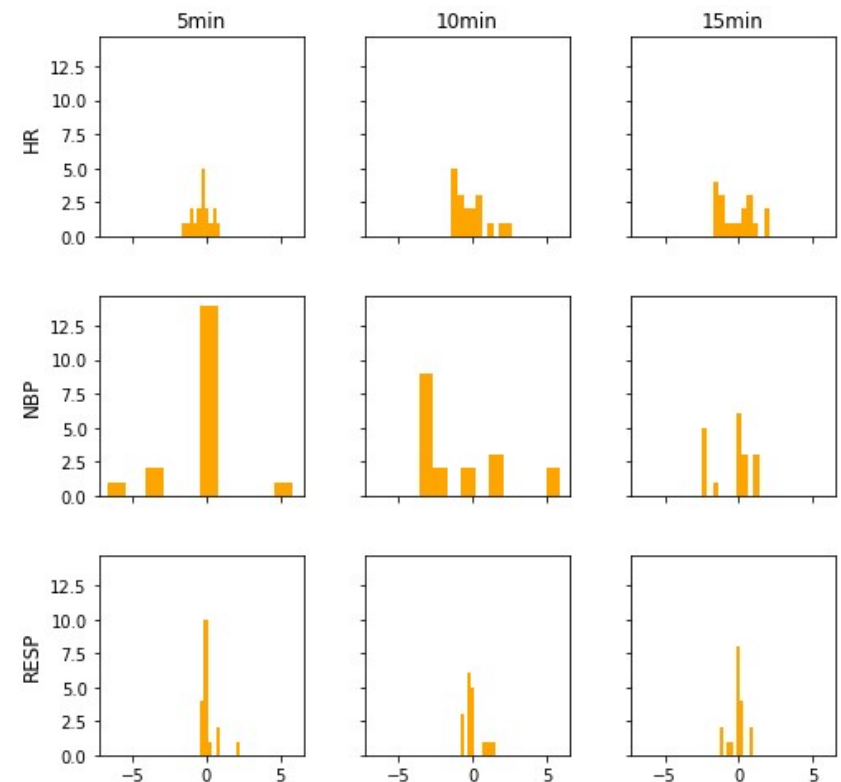
Drug data – First Impressions (cont'd)

- Overlaying Basic Vitals with Drug Data we can get an idea of the relationships...
 - Midazolam appears to loosely be associated with stabilizing Heart Rate, Increased Blood Pressure, and constant Respiratory rate
 - Norepinephrine effects are inconclusive in this view
- Take it with a grain of salt: Small sample sizes, dense graph



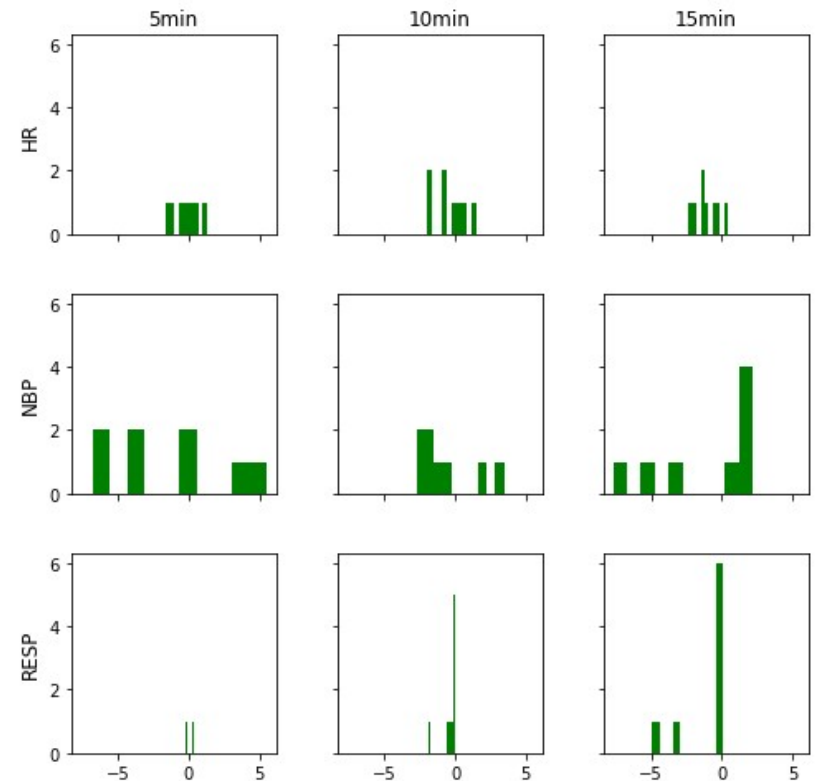
Vitals Effects - Midazolam

- Heart Rate and Blood Pressure seem to begin change from normal to having positive-skew over time
 - Density is mostly below zero, indicating an **easing**
- Respiration is opposite, going from positive-skew to normal
 - Higher density below zero also indicates **easing**
- In general, the data shows it to **ease vital signs, but start to reverse by ~15 minutes**



Vitals Effects - Norepinephrine

- Distribution changes apparent
 - Heart Rate and Blood Pressure seem to stabilize from a uniform to normal distribution
 - Blood Pressure & Respiratory change to negative-skewed
- The data shows this drug **reducing heart rate and respiration, but raising blood pressure**

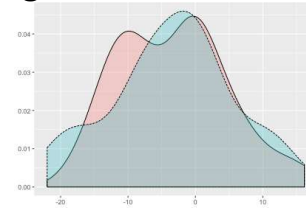


Questions

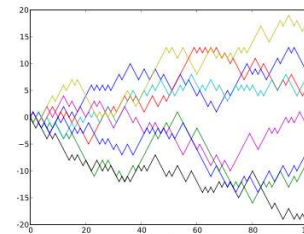
- What was the background of the patient?
 - Fundamental understanding helps better frame analytical approach
- Were vital signs typical to begin with?
 - Was this an ER visit?
 - Times of activity (ex: sleep, awake, urgent care)
- What are the expected effects of drugs?
 - How long do the drugs generally need to take affect? (Should we change our time windows?)
 - Did the patient's vitals react in line with expectations? (just right, too weak, too strong?)

Further work

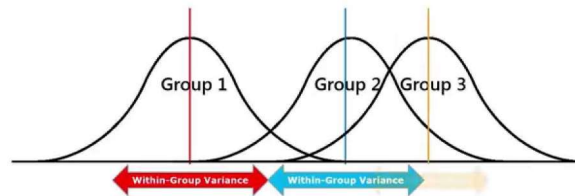
- **Collect more data** to make a stronger statistical case to drugs' effects
- **Compare distributions** from control to test (i.e. Kolmogorov-Smirnov test)



- **Try additional perspectives** – consolidate trajectories of entire time window



- Analyze **interaction affects** via ANOVA



Results: How'd we do?

- ✓ NaCL was indeed used to facilitate drug intake
- ✓ Midazolam was indeed meant to promote easing of vitals
- ✓ Norepinephrine was indeed meant to increase blood pressure, **but was supposed to promote higher Heart Rate**

Sodium Chloride IV Infusion is **used** for treatment of fluid loss and to restore **sodium chloride** balance. It is **used** in the treatment of patients who are unable to take fluids and nutrients by mouth. **It is also used for dilution of other medicines before injection into the body**

Sodium Chloride Intravenous Infusion BP - NPS MedicineWise
<https://www.nps.org.au/medicine-finder/sodium-chloride-intravenous-infusion-bp>

Midazolam (Injection Route)

Description and Brand Names	Drug information provided by: IBM Micromedex
Before Using	US Brand Name
Proper Use	Versed
Precautions	Canadian Brand Name
Side Effects	Midazolam
Products and services	Descriptions
The Mayo Clinic Diet	Midazolam injection is used to produce sleepiness or drowsiness and relieve anxiety before surgery or certain procedures . When midazolam is used before surgery, the patient will not remember some of the details about the procedure. Midazolam injection is also used as an anesthesia to produce loss of consciousness before and during surgery.

Norepinephrine

From Wikipedia, the free encyclopedia

This article is about the hormone and neurotransmitter. For the medication used in treating (medication).

Norepinephrine (NE), also called **noradrenaline (NA)** or **noradrenalin**, is an organic chemical in the catecholamine family that functions in the brain and body as a hormone and neurotransmitter. The name "noradrenaline", derived from Latin roots meaning "at/alongside the kidneys", is more commonly used in the United Kingdom; in the United States, "norepinephrine", derived from Greek roots having that same meaning, is usually preferred.^[1] "Norepinephrine" is also the **international nonproprietary name** given to the drug.^[2] Regardless of which name is used for the substance itself, parts of the body that produce or are affected by it are referred to as **noradrenergic**.

The general function of norepinephrine is to mobilize the brain and body for action. Norepinephrine release is lowest during sleep, rises during wakefulness, and reaches much higher levels during situations of stress or danger, in the so-called **fight-or-flight** response. In the brain, norepinephrine increases arousal and alertness, promotes vigilance, enhances formation and retrieval of memory, and focuses attention; it also **increases restlessness and anxiety**. In the rest of the body, norepinephrine **increases heart rate and blood pressure**, triggers the release of glucose from energy stores, increases blood flow to skeletal muscle, reduces blood flow to the gastrointestinal system, and inhibits voiding of the bladder and gastrointestinal motility.

Bonus Question – Summary Table

label	amount			rate			originalamount			originalrate		
	min	mean	max	min	mean	max	min	mean	max	min	mean	max
Acyclovir	1.0	1.0	1.0	NaN	NaN	NaN	1.0	1.0	1.0	1.0	1.0	1.0
Calcium Gluconate	2.0	2.0	2.0	NaN	NaN	NaN	2.0	2.0	2.0	0.0	0.0	0.0
Dextrose 5%	50.0	90.0	100.0	200.0	200.0	200.0	50.0	90.0	100.0	0.0	40.0	200.0
Dextrose 50%	25.0	33.3	50.0	NaN	NaN	NaN	25.0	33.3	50.0	25.0	33.3	50.0
Fosphenytoin	100.0	133.3	200.0	NaN	NaN	NaN	100.0	133.3	200.0	100.0	133.3	200.0
Heparin Sodium (Prophylaxis)	1.0	1.0	1.0	NaN	NaN	NaN	1.0	1.0	1.0	1.0	1.0	1.0
Insulin - Humalog	2.0	2.0	2.0	NaN	NaN	NaN	2.0	2.0	2.0	2.0	2.0	2.0
Keppra	750.0	833.3	1000.0	NaN	NaN	NaN	750.0	833.3	1000.0	750.0	833.3	1000.0
Labetalol	10.0	10.0	10.0	NaN	NaN	NaN	10.0	10.0	10.0	10.0	10.0	10.0
Lorazepam (Ativan)	1.0	1.0	1.0	NaN	NaN	NaN	1.0	1.0	1.0	1.0	1.0	1.0
Magnesium Sulfate	2.0	2.0	2.0	NaN	NaN	NaN	2.0	2.0	2.0	0.0	0.0	0.0
Midazolam (Versed)	0.4	3.3	30.9	1.0	2.3	5.0	0.5	45.1	100.0	0.5	1.6	5.0
NaCl 0.9%	0.4	329.2	1000.0	1.0	54.6	256.7	50.0	494.7	1000.0	1.0	229.6	1000.0
Norepinephrine	0.1	0.1	0.2	0.1	0.1	0.1	7.8	7.9	8.0	0.1	0.1	0.1
Piperacillin/Tazobactam (Zosyn)	1.0	1.0	1.0	NaN	NaN	NaN	1.0	1.0	1.0	1.0	1.0	1.0
Potassium Chloride	40.0	40.0	40.0	NaN	NaN	NaN	40.0	40.0	40.0	0.2	0.2	0.2