Canada_Hosp1_COVID_Data_At_Admission Exploratory Analysis

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I. INTRODUCTION

This dataset can be found on Kaggle, under the UNCOVER COVID-19 Challenge dataset (https://www.kaggle.com/roche-data-science-coalition/uncover/tasks). The UNCOVER COVID-19 Challenge dataset consists of many different datasets from a wide variety of sources. Under the Canada_Hosp1_COVID_InpatientData.xlsx file (containing data about patients at a Canadian hospital), there is a sheet named Data-at-admission (the patients' data recorded upon admission), which we separated out and saved as Canada_Hosp1_COVID_Data_At_Admission.csv. We chose this dataset due to its high number of variables (54 columns) and decent mix of categorical and continuous variables.

II. DATA SET DESCRIPTION

After cleaning, this dataset contains 508 samples with 40 columns with various data types. A complete listing is shown in Table 1. Before cleaning, the dataset contained 508 samples with 55 columns with various data types. We decided that any column with less than 40 non-null values were to be discarded immediately, leading to us dropping columns *ethnicity_other, received_covid_vaccine, covid_vaccine, pao2, pao2_fio2, ph, high_senstivity_cardiac_troponin, esr, ferritin,* and *hs_crp. id* was dropped as it was (for our purposes) simply an alternate index. *ethnicity* was dropped as its data was apparently scrubbed, consisting entirely of "[]". *aptt_aptr* was dropped as it consisted entirely of numbers but used the string data type, had only 288 non-null values, and did not seem useful after some research as to what it meant. *meds* was dropped due to having too many unique values to be of use, along with *comorb_other.*

Table 1: Data Types and Missing Data

Variable Name	Data Type	Missing Data (%)
reason	nominal/object	0%
age	ratio/int64	0%
sex	nominal/object	0%
height	ratio/float64	46.46%
weight	ratio/float64	29.53%
comorb	nominal/object	25.39%
smoke_hist	nominal/object	41.73%
year_quit	interval/float64	91.54%
er_2_weeks	nominal/object	0%

Variable Name	Data Type	Missing Data (%)
admission_disposition	nominal/object	0%
systolic_bp	ratio/int64	0%
diastolic_bp	ratio/int64	0%
heart_rate	ratio/int64	0%
respiratory_rate	ratio/int64	0%
oxygen_sat	ratio/int64	0%
temp	interval/float64	0%
motor	nominal/object	.39%
verbal	nominal/object	.39%
eye	nominal/object	.39%
intubated	nominal/object	0%
wbc	ratio/float64	.39%
rbc	ratio/float64	.39%
hemoglobin	ratio/float64	.39%
hematocrit	ratio/float64	.39%
mcv	ratio/float64	.39%
mch	ratio/float64	.39%
mchc	ratio/float64	.39%
rdw	ratio/float64	.39%
platelet_count	ratio/float64	.39%
pt	ratio/float64	37.99%
alt	ratio/float64	20.67%
ast	ratio/float64	20.67%
serum_creatinine	ratio/float64	.39%
sodium	ratio/float64	.39%
potassium	ratio/float64	.39%
total_serum_bilirubin	ratio/float64	20.67%
lactate	ratio/float64	28.74%
inr	ratio/float64	37.99%
d_dimer	ratio/float64	50.39%
crp	ratio/float64	72.05%

III. DATA SET SUMMARY STATISTICS

This section consists of tables representing various statistical summaries of the dataset. Table 2 shows the basic statistics (count, mean, standard deviation, etc.) of each continuous variable. Tables 3A-J are summaries of the categorical variables, each table showing each value and its frequency/proportion for a given categorical variable. Tables 4A-E are correlation matrices, split up due to the large number of continuous variables in the dataset. Figure 0 is the heatmap of thee correlation matrix, a single visual representation of the data within Tables 4A-E.

Table 2: Summary Statistics for Canada_Hosp1_COVID_Data_At_Admission

Variable Name	Count	Mean	STDev	Min	25th	50th	75th	Max
age	508	66	16.4	19	55.8	66	78	100
height	272	166.9	11	125	159	167	175	198
weight	358	80.3	21.8	27.7	65.8	76.7	89.8	199.6
year_quit	43	1999.7	15.4	1971	1990	2000	2013.5	2021
systolic_bp	508	129.4	22.1	85	115	127	143	227
diastolic_bp	508	76	12.9	22	68	75	83	145
heart_rate	508	97.4	17.5	41	86	98	109	161
respiratory_rate	508	24.9	7.2	12	20	24	28	59
oxygen_sat	508	93.1	6.1	47	92	94	96	100
temp	508	37.8	.96	35.5	37	37.7	38.5	40.5
wbc	506	8	3.7	2	5.5	7.4	9.7	33.4
rbc	506	4.6	.72	2.78	4.2	4.6	5	8.2
hemoglobin	506	129.9	18	74	119	131	142	180
hematocrit	506	.395	.05	.23	.36	.397	.43	.55
mcv	506	86	7.4	56.7	83	86.5	90.3	112.2
mch	506	28.3	2.8	17.3	27	28.7	30	38.2
mchc	506	328.6	13.5	272	319	330	338	382
rdw	506	14	1.9	10.3	12.8	13.6	14.6	24.8
platelet_count	506	230.9	98	19	163	214	276	671
pt	315	14.6	5.4	11.7	13	13.5	14.4	72.6
alt	403	51.2	51	6	25	38	59	586
ast	403	61.4	78.5	11	33	47	68	1307
serum_creatinine	506	114.8	92	30	76	95	121	1179
sodium	506	135.3	5.2	112	133	135	138	161
potassium	506	3.89	.53	2.1	3.5	3.9	4.2	6.3
total_serum_bilirubin	403	10.6	5.7	3	7	9	12	40
lactate	362	2.33	1.25	.6	1.6	2	2.7	13.8
inr	315	1.16	.68	.9	1	1	1.1	8.9
d_dimer	252	1346.4	898.4	269	694	1030	1764	4001
crp	142	109.1	74.9	3	53	93.2	158.8	371

Table 3.A: Proportions for 'reason' (n=508)

Category	Freq.	Proportion
Acute respiratory distress syndrome	2	0.4%
COVID-19	220	43.3%
Coronavirus infection	2	0.4%
Cough	2	.4%
Febrile respiratory illness	7	1.4%
Fever	22	4.3%
Hypoxemia	22	4.3%
Myalgia	1	0.2%
Pneumonia	136	26.8%
Pneumonia due to COVID-19	41	8.1%
Probable COVID-19	8	1.6%
Respiratory failure	7	1.4%
Respiratory tract infection	1	0.2%
Shortness of breath	34	6.7%
Shortness of breath with exposure to COVID-19	1	0.2%
Tachypnea	1	0.2%
Viral pneumonia	1	0.2%

Table 3.B: Proportions for 'sex' (n=508)

Category	Frequency	Proportion (%)
Female	212	41.7%
Male	296	58.3%

Table 3.C: Proportions for 'smoke_hist' (n=296)

Category	Frequency	Proportion (%)
Ex-smoker	66	22.3%
Non-smoker	218	73.6%
Smoker	12	4.1%

Table 3.D: Proportions for 'er_2_weeks' (n=508)

Category	Frequency	Proportion (%)
No	43	8.5%
Yes	465	91.5%

Table 3.E: Proportions for 'admission_disposition' (n=508)

Category	Frequency	Proportion (%)
ICU	43	8.5%
WARD	465	91.5%

Table 3.F: Proportions for 'comorb' (n=379)

Category	Freq.	Prop.
Asthma	17	4.5%
Asthma, Chronic cardiac disease	19	5.0%
Asthma, Chronic cardiac disease, Chronic pulmonary disease	1	0.3%
Asthma, Chronic cardiac disease, Chronic pulmonary disease, Diabetes	3	0.8%
Asthma, Chronic cardiac disease, Diabetes	12	3.2%
Asthma, Chronic pulmonary disease	1	0.3%
Asthma, Diabetes	1	0.3%
Chronic cardiac disease	152	40.1%
Chronic cardiac disease, Chronic pulmonary disease	9	2.4%
Chronic cardiac disease, Chronic pulmonary disease, Diabetes	7	1.8%
Chronic cardiac disease, Diabetes	125	33.0%
Chronic pulmonary disease	5	1.3%
Chronic pulmonary disease, Diabetes	2	0.5%
Diabetes	25	6.6%

Table 3.G: Proportions for 'motor' (n=506)

Category	Frequency	Proportion (%)
1	2	0.4%
2	1	0.2%
3	2	0.4%
4	2	0.4%
5	20	4.0%
6	479	94.7%

Table 3.H: Proportions for 'verbal' (n=506)

Category	Frequency	Proportion (%)
1	9	1.8%
2	10	2.0%
3	2	0.4%
4	47	9.3%
5	438	86.6%

Table 3.I: Proportions for 'eye' (n=506)

Category	Frequency	Proportion (%)
1	3	0.6%
2	3	0.6%
3	13	2.6%
4	487	96.2%

Table 3.J: Proportions for 'intubated' (n=508)

Category	Frequency	Proportion (%)
No	493	97.0%
Yes	15	3.0%

Table 4: Correlation Table/Tables

Table 4A	age	height	weight	year_quit	systolic_bp	diastolic_bp
age	1.00	-0.27	-0.38	-0.34	0.07	-0.17
height	-0.27	1.00	0.47	-0.02	0.02	0.10
weight	-0.38	0.47	1.00	-0.10	-0.01	0.08
year_quit	-0.34	-0.02	-0.10	1.00	0.08	0.24
systolic_bp	0.07	0.02	-0.01	0.08	1.00	0.57
diastolic_bp	-0.17	0.10	0.08	0.24	0.57	1.00
heart_rate	-0.35	0.14	0.10	0.17	0.13	0.29
respiratory_rate	-0.15	0.01	0.08	0.16	0.11	0.12
oxygen_sat	-0.03	0.01	-0.09	-0.38	0.02	0.10
temp	-0.02	0.05	0.05	0.00	0.09	0.01
wbc	0.02	-0.07	0.00	-0.03	0.04	0.02
rbc	-0.29	0.31	0.22	0.23	0.02	0.19
hemoglobin	-0.18	0.32	0.16	0.25	-0.04	0.15
hematocrit	-0.16	0.31	0.20	0.17	-0.05	0.16
mcv	0.29	-0.04	-0.08	-0.20	-0.09	-0.10
mch	0.20	0.01	-0.10	-0.01	-0.07	-0.09
mchc	-0.09	0.11	-0.09	0.21	0.03	0.00
rdw	0.12	-0.09	0.08	-0.11	0.00	0.01
platelet_count	-0.12	-0.10	0.04	-0.33	-0.01	0.03
pt	0.12	0.20	0.03	-0.18	-0.02	-0.03
alt	-0.16	0.12	0.00	-0.01	0.00	0.04

Table 4A	age	height	weight	year_quit	systolic_bp	diastolic_bp
ast	-0.01	0.10	-0.03	0.05	0.00	-0.01
serum_creatinine	0.16	0.04	-0.01	-0.05	0.02	-0.04
sodium	0.17	0.00	-0.06	-0.15	-0.11	-0.01
potassium	0.19	0.14	0.00	0.02	0.03	0.04
total_serum_bilirubin	0.13	0.20	0.05	0.10	0.01	0.03
lactate	0.12	0.12	0.04	0.22	0.04	0.05
inr	0.11	0.20	0.02	-0.17	-0.01	-0.02
d_dimer	0.31	-0.16	-0.22	-0.68	-0.03	-0.04
crp	-0.10	0.10	0.27	-0.49	-0.01	-0.16

Table 4B	heart_rate	respiratory_rate	oxygen_sat	temp	wbc	rbc
age	-0.35	-0.15	-0.03	-0.02	0.02	-0.29
height	0.14	0.01	0.01	0.05	-0.07	0.31
weight	0.10	0.08	-0.09	0.05	0.00	0.22
year_quit	0.17	0.16	-0.38	0.00	-0.03	0.23
systolic_bp	0.13	0.11	0.02	0.09	0.04	0.02
diastolic_bp	0.29	0.12	0.10	0.01	0.02	0.19
heart_rate	1.00	0.28	-0.11	0.21	0.17	0.22
respiratory_rate	0.28	1.00	-0.29	0.12	0.24	0.09
oxygen_sat	-0.11	-0.29	1.00	0.03	-0.14	-0.03
temp	0.21	0.12	0.03	1.00	-0.01	-0.01
wbc	0.17	0.24	-0.14	-0.01	1.00	-0.03
rbc	0.22	0.09	-0.03	-0.01	-0.03	1.00
hemoglobin	0.16	0.02	-0.05	-0.04	-0.01	0.73
hematocrit	0.16	0.02	-0.03	-0.05	-0.02	0.80
mcv	-0.16	-0.14	0.03	-0.05	0.01	-0.53
mch	-0.12	-0.12	0.00	-0.03	0.03	-0.47
mchc	0.03	0.00	-0.06	0.03	0.05	-0.07
rdw	0.04	0.05	-0.06	0.09	0.08	0.08
platelet_count	0.10	0.09	-0.05	-0.16	0.36	-0.02
pt	-0.05	0.00	-0.06	-0.07	-0.02	-0.13
alt	0.10	0.10	-0.01	-0.01	0.06	0.06
ast	0.02	0.07	-0.08	-0.05	0.02	0.00
serum_creatinine	-0.11	-0.05	0.04	0.04	0.03	-0.14

Table 4B	heart_rate	respiratory_rate	oxygen_sat	temp	wbc	rbc
sodium	-0.01	-0.02	0.07	-0.05	0.02	0.00
potassium	-0.11	-0.07	0.07	-0.11	-0.01	-0.08
total_serum_bilirubin	-0.01	0.13	-0.11	-0.08	0.18	0.09
lactate	0.15	0.24	-0.31	-0.16	0.25	0.16
inr	-0.05	0.01	-0.04	-0.08	-0.03	-0.13
d_dimer	0.05	0.16	-0.11	-0.02	0.17	-0.27
crp	0.06	0.40	-0.29	-0.09	0.44	-0.03

Table 4C	hemoglobin	hematocrit	mcv	mch	mchc	rdw
age	-0.18	-0.16	0.29	0.20	-0.09	0.12
height	0.32	0.31	-0.04	0.01	0.11	-0.09
weight	0.16	0.20	-0.08	-0.10	-0.09	0.08
year_quit	0.25	0.17	-0.20	-0.01	0.21	-0.11
systolic_bp	-0.04	-0.05	-0.09	-0.07	0.03	0.00
diastolic_bp	0.15	0.16	-0.10	-0.09	0.00	0.01
heart_rate	0.16	0.16	-0.16	-0.12	0.03	0.04
respiratory_rate	0.02	0.02	-0.14	-0.12	0.00	0.05
oxygen_sat	-0.05	-0.03	0.03	0.00	-0.06	-0.06
temp	-0.04	-0.05	-0.05	-0.03	0.03	0.09
wbc	-0.01	-0.02	0.01	0.03	0.05	0.08
rbc	0.73	0.80	-0.53	-0.47	-0.07	0.08
hemoglobin	1.00	0.96	0.12	0.25	0.37	-0.34

Table 4C	hemoglobin	hematocrit	mcv	mch	mchc	rdw
hematocrit	0.96	1.00	0.07	0.09	0.09	-0.18
mcv	0.12	0.07	1.00	0.92	0.21	-0.37
mch	0.25	0.09	0.92	1.00	0.57	-0.54
mchc	0.37	0.09	0.21	0.57	1.00	-0.60
rdw	-0.34	-0.18	-0.37	-0.54	-0.60	1.00
platelet_count	-0.17	-0.15	-0.18	-0.19	-0.10	0.09
pt	-0.17	-0.14	0.02	-0.04	-0.15	0.16
alt	0.08	0.05	-0.04	0.01	0.11	-0.08
ast	0.02	0.01	0.00	0.02	0.04	-0.01
serum_creatinine	-0.11	-0.08	0.14	0.06	-0.14	0.15
sodium	0.04	0.16	0.24	0.05	-0.38	0.19
potassium	-0.08	-0.02	0.12	0.01	-0.21	0.05
total_serum_bilirubin	0.20	0.17	0.09	0.13	0.13	-0.05
lactate	0.17	0.20	-0.01	-0.02	-0.04	0.13
inr	-0.16	-0.13	0.02	-0.04	-0.15	0.15
d_dimer	-0.22	-0.23	0.14	0.11	0.00	0.08
crp	-0.12	-0.11	-0.11	-0.10	-0.02	0.11

Table 4D	platelet_count	pt	alt	ast	serum_creatinine	sodium
age	-0.12	0.12	-0.16	-0.01	0.16	0.17
height	-0.10	0.20	0.12	0.10	0.04	0.00
weight	0.04	0.03	0.00	-0.03	-0.01	-0.06
year_quit	-0.33	-0.18	-0.01	0.05	-0.05	-0.15
systolic_bp	-0.01	-0.02	0.00	0.00	0.02	-0.11
diastolic_bp	0.03	-0.03	0.04	-0.01	-0.04	-0.01
heart_rate	0.10	-0.05	0.10	0.02	-0.11	-0.01
respiratory_rate	0.09	0.00	0.10	0.07	-0.05	-0.02
oxygen_sat	-0.05	-0.06	-0.01	-0.08	0.04	0.07
temp	-0.16	-0.07	-0.01	-0.05	0.04	-0.05
wbc	0.36	-0.02	0.06	0.02	0.03	0.02
rbc	-0.02	-0.13	0.06	0.00	-0.14	0.00
hemoglobin	-0.17	-0.17	0.08	0.02	-0.11	0.04
hematocrit	-0.15	-0.14	0.05	0.01	-0.08	0.16
mcv	-0.18	0.02	-0.04	0.00	0.14	0.24
mch	-0.19	-0.04	0.01	0.02	0.06	0.05
mchc	-0.10	-0.15	0.11	0.04	-0.14	-0.38

Table 4D	platelet_count	pt	alt	ast	serum_creatinine	sodium
rdw	0.09	0.16	-0.08	-0.01	0.15	0.19
platelet_count	1.00	-0.04	0.03	-0.07	-0.11	0.01
pt	-0.04	1.00	0.49	0.72	0.04	-0.02
alt	0.03	0.49	1.00	0.80	-0.05	-0.07
ast	-0.07	0.72	0.80	1.00	0.03	-0.12
serum_creatinine	-0.11	0.04	-0.05	0.03	1.00	0.05
sodium	0.01	-0.02	-0.07	-0.12	0.05	1.00
potassium	-0.08	0.24	0.03	0.16	0.27	0.01
total_serum_bilirubin	-0.11	0.16	0.14	0.18	0.03	-0.01
lactate	0.03	0.53	0.35	0.49	0.04	-0.01
inr	-0.04	1.00	0.52	0.75	0.03	-0.04
d_dimer	0.17	0.06	0.05	0.08	0.15	0.01
crp	0.21	0.11	0.10	0.16	0.02	-0.07

Table 4E	potassium	total_serum_bilirubin	lactate	inr	d_dimer	crp
age	0.19	0.13	0.12	0.11	0.31	-0.10
height	0.14	0.20	0.12	0.20	-0.16	0.10
weight	0.00	0.05	0.04	0.02	-0.22	0.27
year_quit	0.02	0.10	0.22	-0.17	-0.68	-0.49
systolic_bp	0.03	0.01	0.04	-0.01	-0.03	-0.01
diastolic_bp	0.04	0.03	0.05	-0.02	-0.04	-0.16
heart_rate	-0.11	-0.01	0.15	-0.05	0.05	0.06
respiratory_rate	-0.07	0.13	0.24	0.01	0.16	0.40
oxygen_sat	0.07	-0.11	-0.31	-0.04	-0.11	-0.29
temp	-0.11	-0.08	-0.16	-0.08	-0.02	-0.09
wbc	-0.01	0.18	0.25	-0.03	0.17	0.44
rbc	-0.08	0.09	0.16	-0.13	-0.27	-0.03
hemoglobin	-0.08	0.20	0.17	-0.16	-0.22	-0.12
hematocrit	-0.02	0.17	0.20	-0.13	-0.23	-0.11
mcv	0.12	0.09	-0.01	0.02	0.14	-0.11
mch	0.01	0.13	-0.02	-0.04	0.11	-0.10
mchc	-0.21	0.13	-0.04	-0.15	0.00	-0.02
rdw	0.05	-0.05	0.13	0.15	0.08	0.11

| Table 4E	potassium	total_serum_bilirubin	lactate	inr	d_dimer	crp
platelet_count	-0.08	-0.11	0.03	-0.04	0.17	0.21
pt	0.24	0.16	0.53	1.00	0.06	0.11
alt	0.03	0.14	0.35	0.52	0.05	0.10
ast	0.16	0.18	0.49	0.75	0.08	0.16
serum_creatinine	0.27	0.03	0.04	0.03	0.15	0.02
sodium	0.01	-0.01	-0.01	-0.04	0.01	-0.07
potassium	1.00	0.00	0.13	0.24	0.05	-0.02
total_serum_bilirubin	0.00	1.00	0.16	0.15	0.23	0.11
lactate	0.13	0.16	1.00	0.55	0.15	0.33
inr	0.24	0.15	0.55	1.00	0.06	0.09
d_dimer	0.05	0.23	0.15	0.06	1.00	0.37
crp	-0.02	0.11	0.33	0.09	0.37	1.00
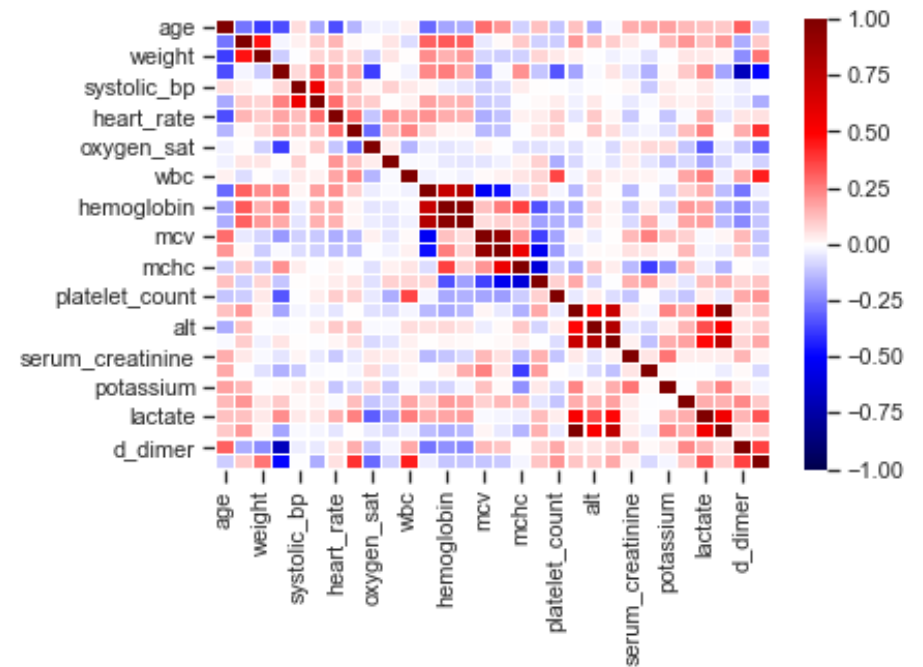
Figure 0: Heatmap of the correlation matrix.

To the right is Figure 0, a heatmap representing the correlation matrix of the data. Note that the labels skip every other row/column of the data, but the values are still present (i.e., the first column/row is labeled age, the third column/row is labeled weight, and the second column/row is unlabeled but represents height.)

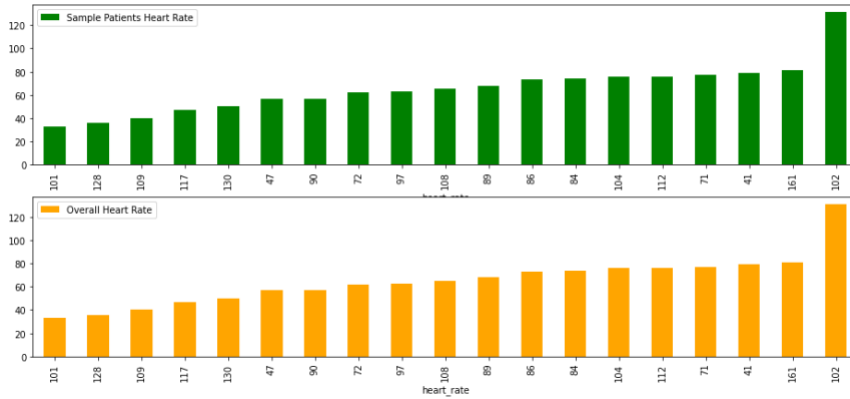# IV. DATA SET GRAPHICAL EXPLORATION

Distributions

Figure 1: Comparison of (a)Sample Patients Hearts/(b)Overall Heart Rates by age (multiple plots)

With this initial comparison we were able to see a significant difference in heart rate of those with a heart rate of 102 in comparison to a sudden spike of an irregular heartbeat of those with a heart rate of 161 across both (a) Sample Patients and (b) Overall Patients.
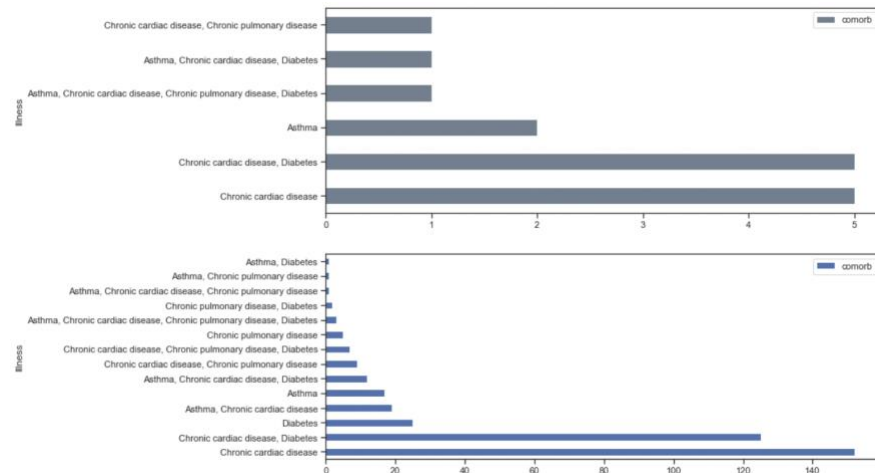
Bar Charts

Figure 2: Comparison of Known Illness from (a)Sample Patients and (b)Overall Patients (multiple plots)

From the Known Illnesses we could be able to see how those with certain health issues may overlap with their chances of potential having Afib if experiencing an irregular heartbeat.
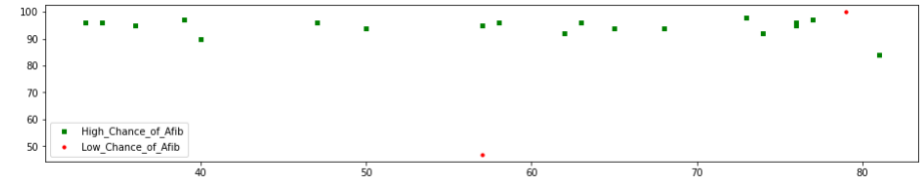
Scatter Plots

Figure 3: High Chance of Afib against low chance of Afib in Sample Patients (single plot)

Within our sample of patients, we were able to determine 18 out of the 20 may have a (green plots) high chance based off of their initial heart rate from each of their own individual admission reports.
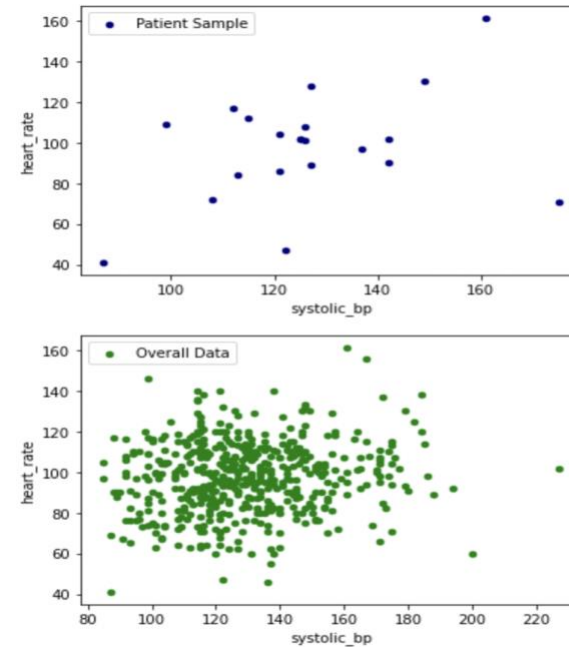

Figure 4: (a)Patient Sample vs (b) Overall Data of Heart Rate vs. Systolic BP (multiple plots)

With background knowledge of how higher systolic blood pressure on a regular basis having is a long-term predictors of incident Afib. We found that our (a)sample

patients had a lower and stable systolic blood pressure in comparison to (b) the overall patients.
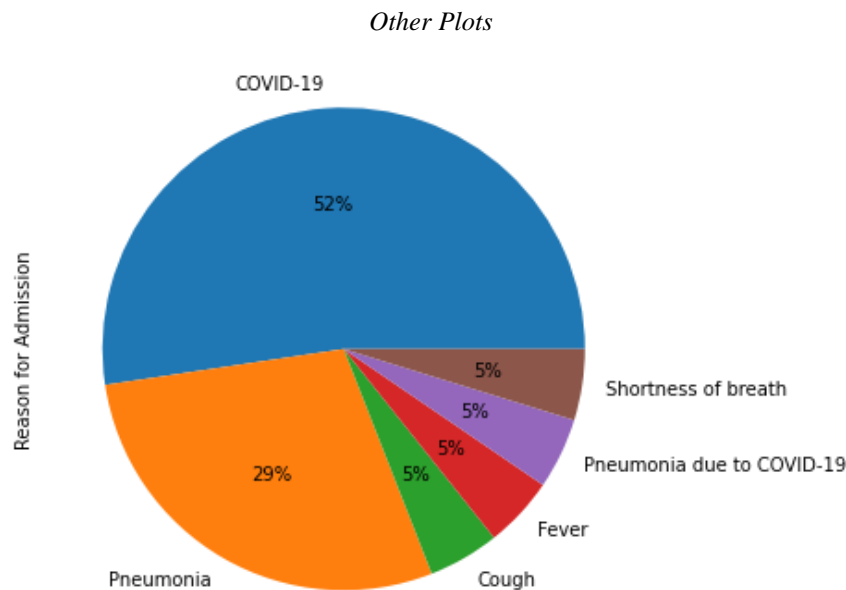
Other Plots

Figure 5: Sample reason for admission (single plot)
When reviewing the reasoning for admission for our Sample Patients we noticed a lot of patients we're admitted for covid-19, which could explain the high heart rates but lower systolic bp for some of them. However, the 34% of patients admitted for pneumonia(solely), and shortness of breath still have a high chance of having Afib.
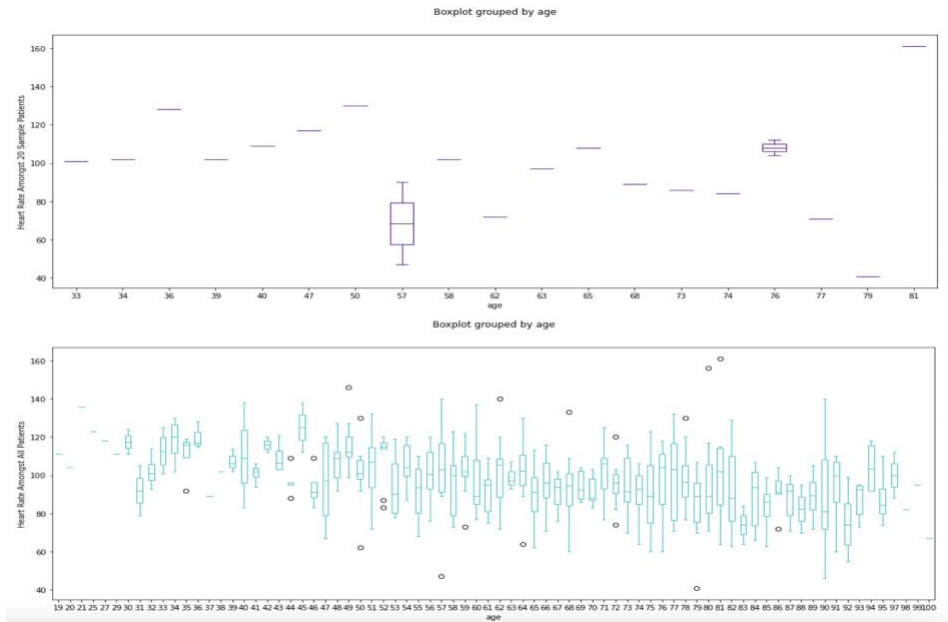

Figure 6: Another visual of the (a)Heart Rate of Sample Patients against (b)The Heart Rates of All Patients (multiple plots)

However, with this boxplot it was specified down enough to help us then check the rows with the highest and lowest heart rates and compare the data of those two admitted patients. It's just more complex and allowed for us to pinpoint certain age groups to look through.

V. SUMMARY OF FINDINGS

After fully digesting the information in front of us and considering all possible factors that we possible could to our current ability. Naat and I were able to organize the information from the admissions reports and use the correlations first to see what all may interact and if it does in what way. To then looking through comparisons and finding an interesting use for age as when we first looked at. That variable didn't have much interaction or change within the dataset. Then finding some overlapping variables. To come to a possibility of predicting possible Afib within not just our general dataset. But also, through a created dataset of example patients to size down our work and leave out possible room for error in our predictions. The idea of starting from simply cleaning a dataset to processing the information to create predictions with real-life information was very helpful when applying our learnings into this project. Especially, with the information in our data set being something used in everyday life some people it also created a since of making sure it's comprehendible and visually appealing for those who would like to use and or reference it.