Abstract

For this project, I will be analyzing how the frequency and severity of alcoholic hepatitis has changed from before the COVID-19 pandemic to now. In order to measure the severity of alcoholic hepatitis, we will be calculating a sample size of patients' Model for End-Stage Liver Disease (MELD) score. The greater the MELD score, the more likely the patient will be recommended for a liver transplant. In order to determine the overall frequency of alcoholic hepatitis, I will be comparing the number of patients diagnosed with alcoholic hepatitis from the University of Kansas Hospital, from two different timeframes: 2018-2019 for patients diagnosed before the COVID-19 Pandemic, and 2020-2021 for patients diagnosed during the COVID-19 Pandemic. While studying the change in frequency and severity I will be analyzing the patients in 4 different groups: gender, race, age, and Body Mass Index. The results of this study have shown that the number of cases of alcoholic hepatitis has increased from the two-year period before the pandemic compared to the two-year period during the pandemic. However, the difference in average MELD scores between the two sample sizes was not statistically significant.

How Has the Frequency and Severity of Alcoholic Hepatitis Changed From Before the COVID-19 Pandemic to Now?

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Acknowledgements

I would like to thank Mrs. Amy Clement, Ms. Rhonda Reist, Dr. Matt Richard, Ms. Mina Mazin Yahya Al-Hamadani, Dr. Winston Dunn, and the University of Kansas Department of Gastroenterology and Hepatology for helping me with this project.

Purpose and Hypothesis

The question that this research project will answer is: how has the frequency and severity of alcoholic hepatitis changed from before the COVID-19 pandemic to now? I hypothesize that cases of alcoholic hepatitis will be more frequent and more severe during the COVID-19 pandemic compared to before the COVID-19 pandemic. This is because people will tend to feel depressed and lonely when confined to their homes and will look to make themselves feel better.

Background Research

My brother once told me that no matter if people are happy or sad, they will always purchase and consume alcohol. For adults over the age of 21, alcohol consumption is a popular, yet unhealthy, option to care for their short-term mental health. Alcoholic hepatitis occurs when the liver is damaged by decades of heavy drinking. This causes the liver to become inflamed, scarred, and can even lead the liver to become fatty liver. Another name for severe scarring of the liver is cirrhosis. If not treated, alcoholic hepatitis can prompt complete liver failure. Overall, about 35% of long-term heavy drinkers are diagnosed with alcoholic hepatitis. During the COVID-19 pandemic, many people have experienced depression due to the mental hardship of being confined to their homes and away from family and friends. According to a survey conducted by *The Harris Poll and Alkermes*, 17% of adults over the age of 21 admitted to heavy drinking during the COVID-19 pandemic. For this project, I will be analyzing how the frequency and severity of alcoholic hepatitis has changed from before the COVID-19 pandemic to now. In order to measure the severity of alcoholic hepatitis, we will be calculating patients' Model for End-Stage Liver Disease (MELD) score. The MELD score is a number from 6 to 40 that estimates the patient's chances of survival within the next 3 months. The greater the MELD score, the more likely a patient will be recommended for a liver transplant. The MELD score is calculated using a

patient's lab results, specifically their serum creatinine, serum bilirubin, and the international normalized ratio (INR):

$$MELD = 3.78 \times \ln[\text{serum bilirubin (mg/dL)}] + 11.2 \times \ln[\text{INR}] + 9.57 \times \ln[\text{serum creatinine (mg/dL)}] + 6.43$$

If a patient shows signs of cirrhosis, then their serum sodium will be incorporated:

$$MELD\ Na = MELD - [\text{serum sodium (mmol/L)}] - (0.025 \times MELD \times (140 - [\text{serum sodium (mmol/L)}])) + 140$$

In order to determine the overall frequency of alcoholic hepatitis, I will be comparing the number of patients diagnosed with alcoholic hepatitis from the Universityof Kansas Hospital, from two different timeframes: 2018-2019 for patients diagnosed before the COVID-19 Pandemic, and 2020-2021 for patients diagnosed during the COVID-19 Pandemic. While studying the change in frequency and severity I will be analyzing the patients in 4 different groups: gender, race, age, and Body Mass Index (BMI). These groups have been selected because I believe they all influence if someone will be diagnosed with alcoholic hepatitis at some point in their life. The results of this study will hopefully help better indicate how heavy drinking affects one's liver and, unfortunately, how much people rely on alcohol to get them through depressing times.

Procedure

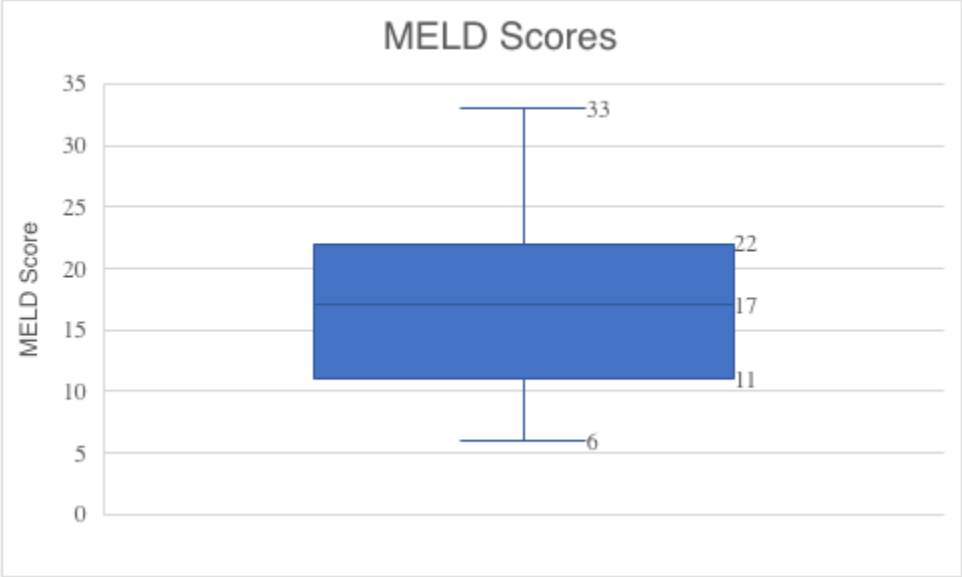
1. Gather list of all alcoholic hepatitis patients from KUMC EPIC database from 1/01/2018-12/31/2021
2. Divide list into two excel spreadsheets. One for patients from 2018 & 2019 and another for patients from 2020 & 2021.
3. Arrange the 1st column with all patient ID numbers.
4. Arrange the 1st row with patients data: serum creatinine, serum creatinine date, serum bilirubin, serum bilirubin date, INR, INR date, serum sodium, serum sodium date, age, gender, race, BMI, and signs of cirrhosis.
5. If a patient is missing any of the data from the previous step, or dates of serum creatinine, serum bilirubin, INR, and serum sodium are more than two weeks apart, remove them from the list.
6. Using the serum creatinine, serum bilirubin, and INR calculate the MELD score for all patients. If the patient shows signs for cirrhosis, take serum sodium into account and use the MELD Na formula to calculate the MELD score.
7. Sort all patients by MELD score. Duplicate spreadsheet 4 times to sort by age, gender, race, and BMI for both 2018 & 2019 and 2020 & 2021 timeframes.

8. Create bar graphs to track the number of cases of alcoholic hepatitis for age, gender, race, and BMI.
9. Create box-and-whisker plots for each subgroup (ex. 50-59, male, white, overweight) if they have at least 10 cases of alcoholic hepatitis.

Data Analysis

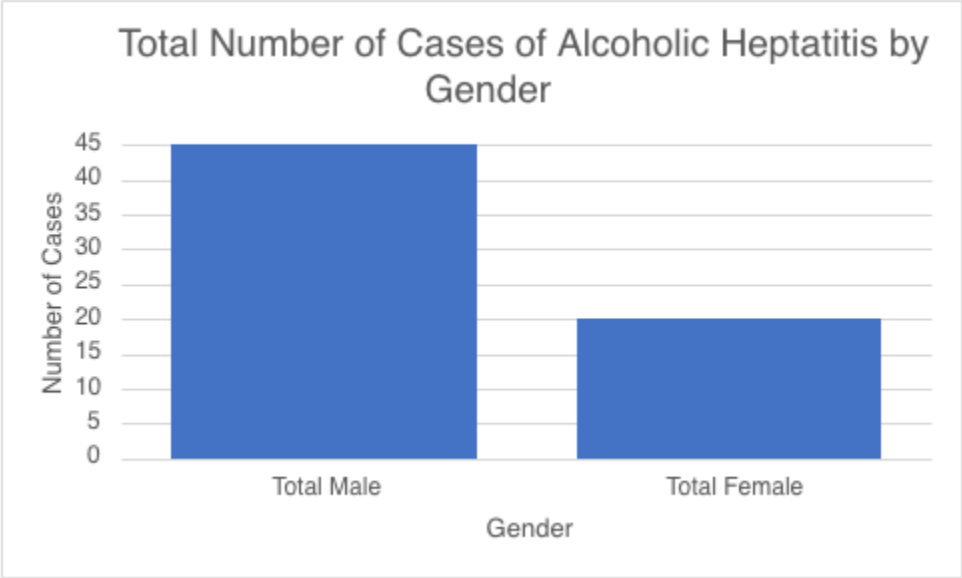
1/1/2018 - 12/31/2019 Results:

MELD Scores for 2018 & 2019

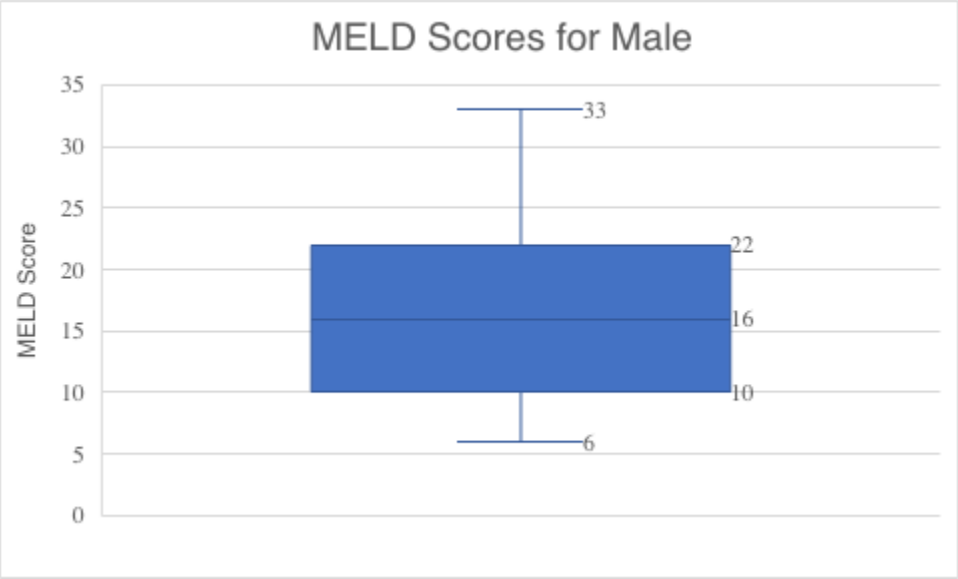


Average MELD Score: 17.23

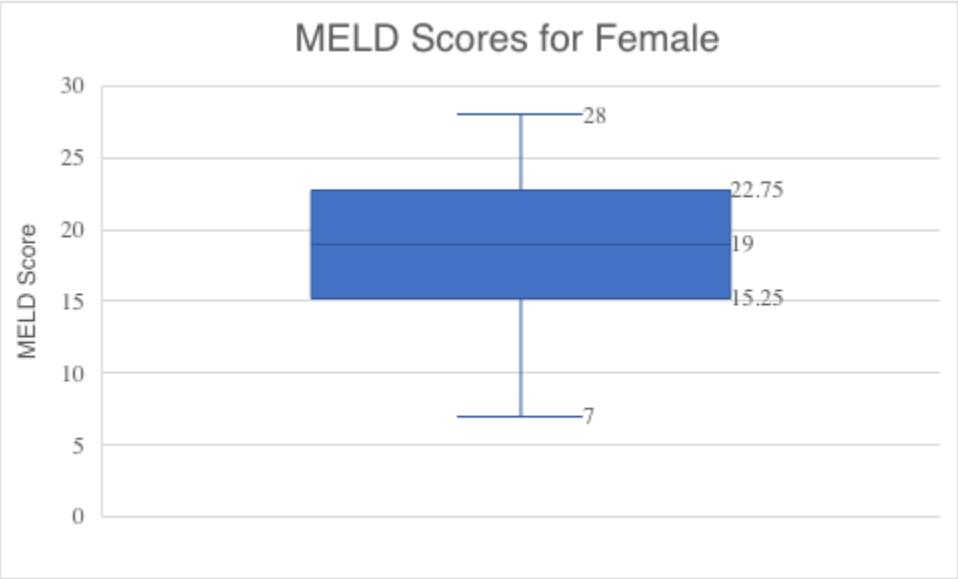
Total Number of Cases of Alcoholic Hepatitis by Gender for 2018 & 2019



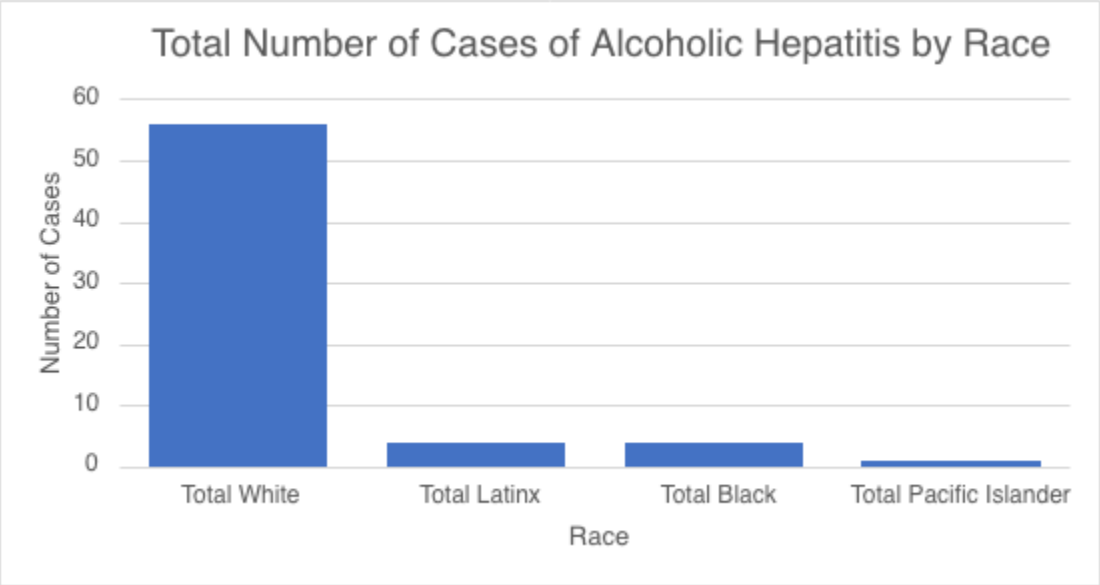
MELD Scores for Male for 2018 & 2019



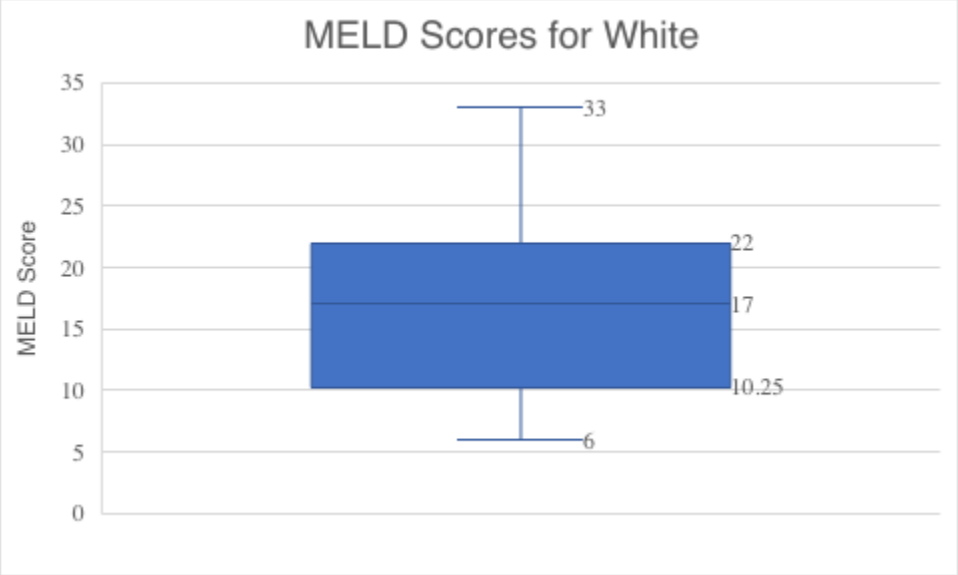
MELD Scores for Female for 2018 & 2019



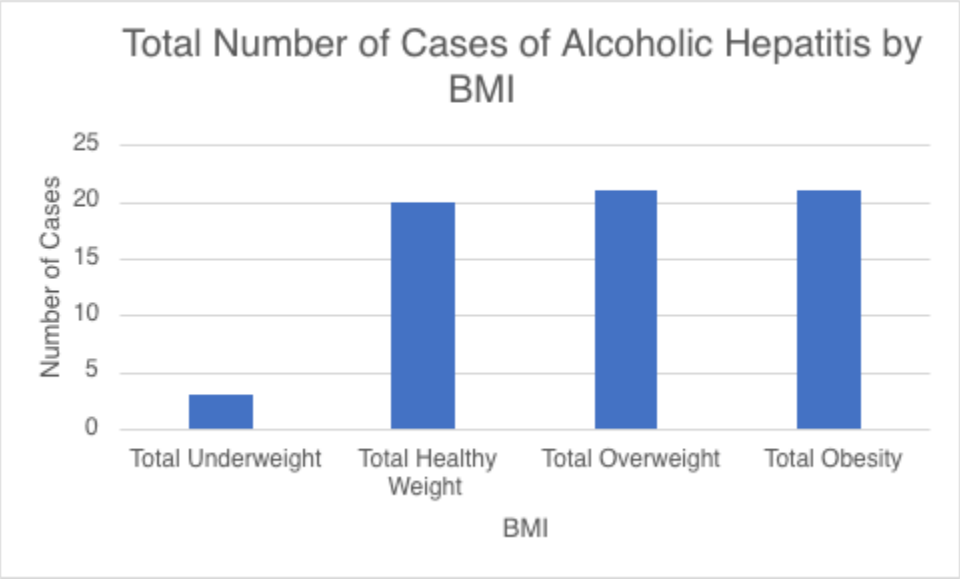
Total Number of Cases of Alcoholic Hepatitis by Race for 2018 & 2019



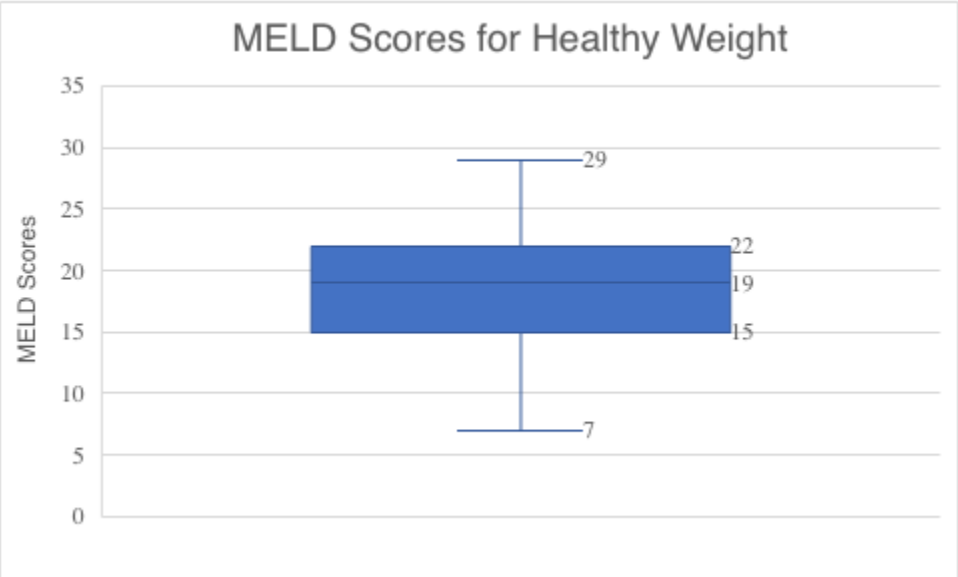
MELD Scores for White for 2018 & 2019



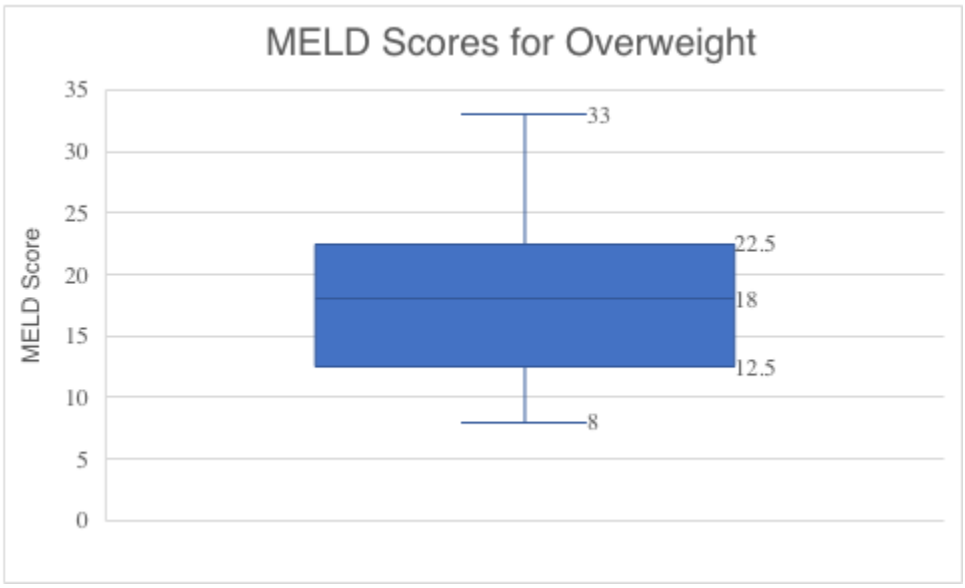
Total Number of Cases of Alcoholic Hepatitis by BMI 2018 & 2019



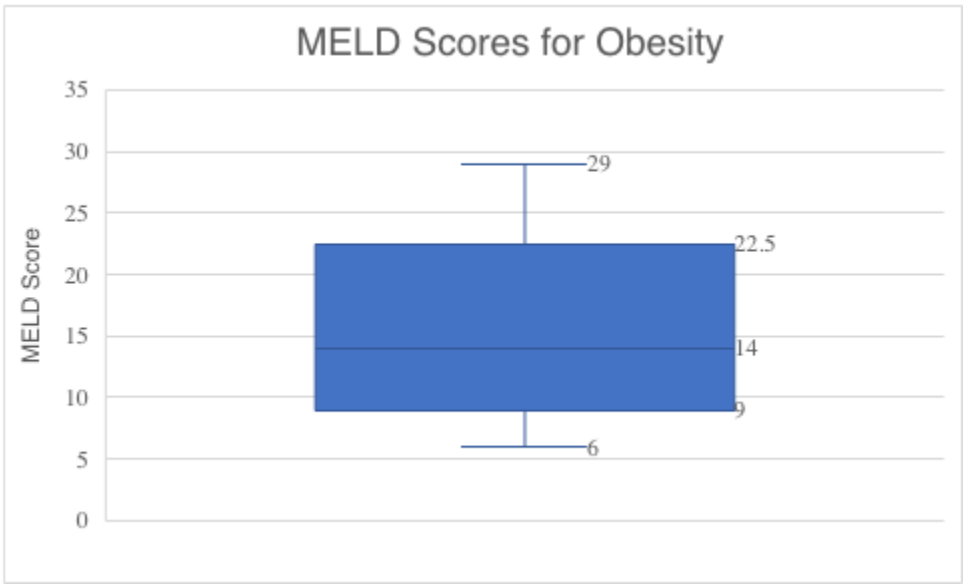
MELD Scores for Healthy Weight 2018 & 2019



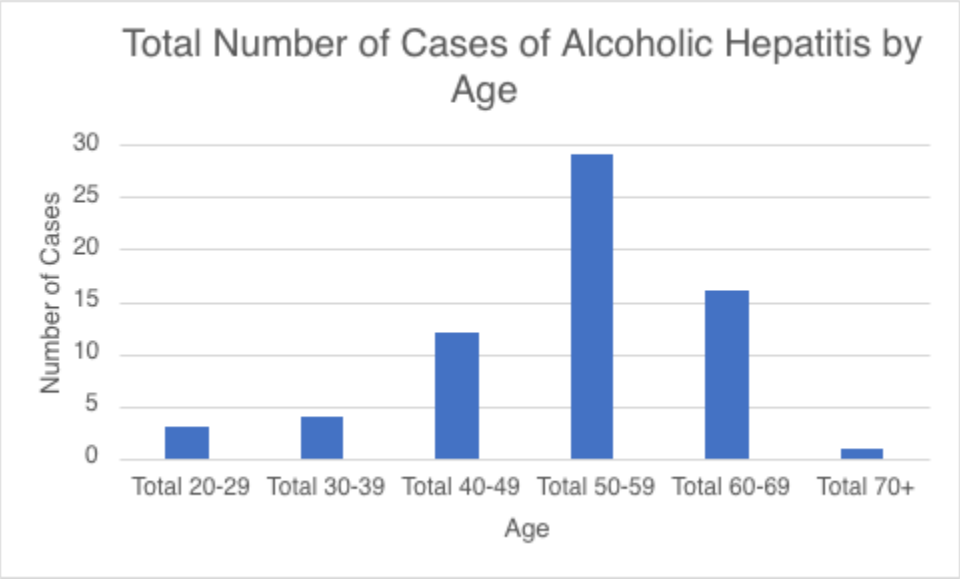
MELD Scores for Overweight 2018 & 2019



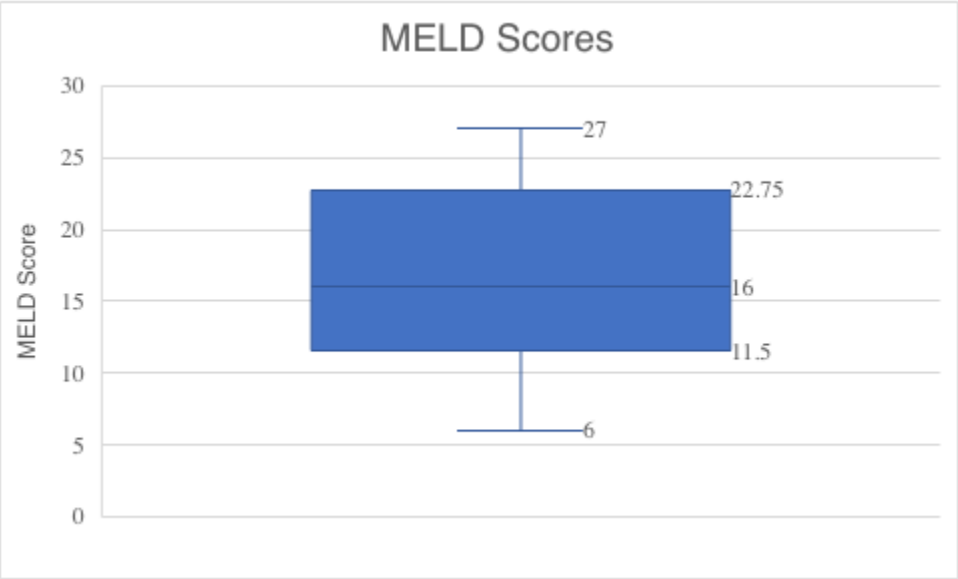
MELD Scores for Obesity 2018 & 2019



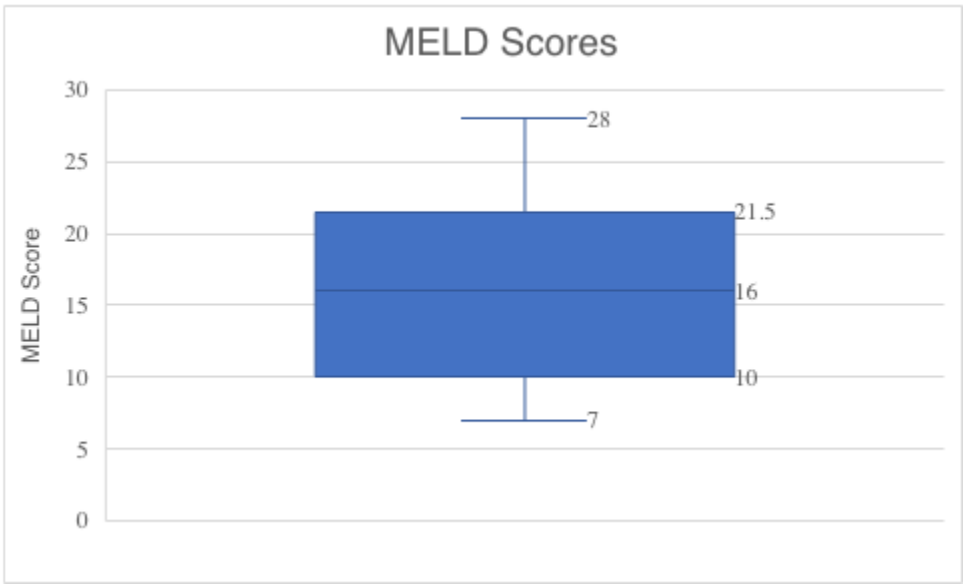
Total Number of Cases of Alcoholic Hepatitis by Age 2018 & 2019



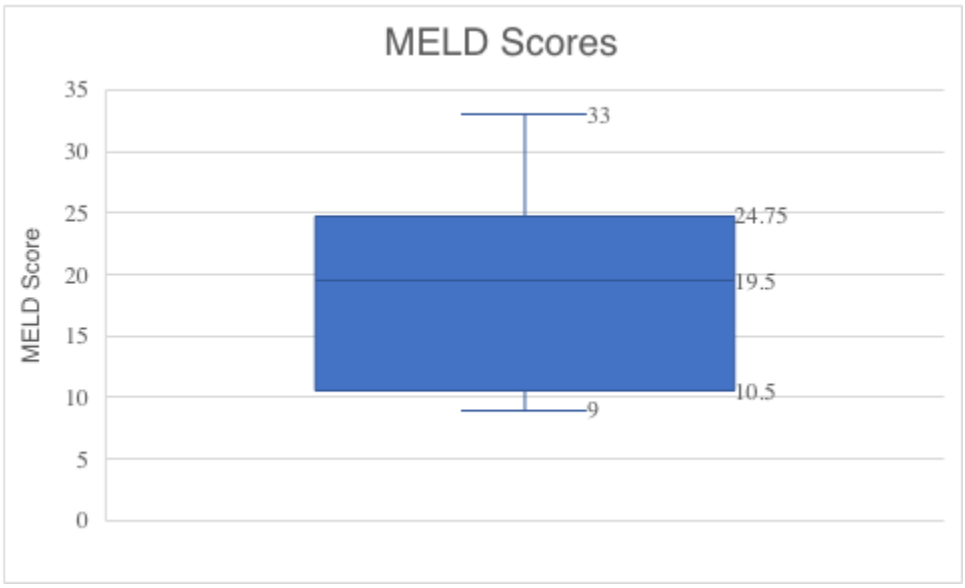
MELD Scores of Ages 40-49 2018 & 2019



MELD Scores of Ages 50-59 2018 & 2019

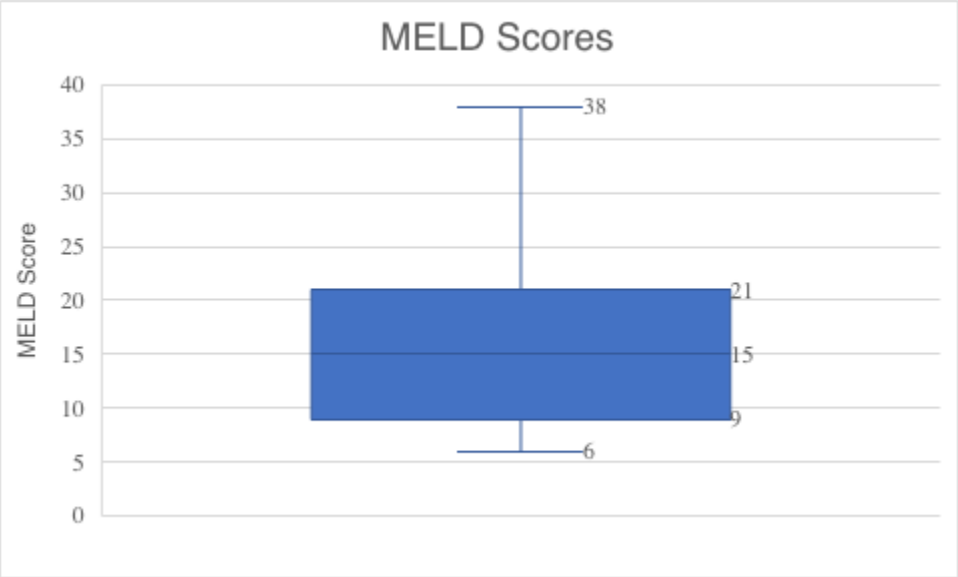


MELD Scores of Ages 60-69 2018 & 2019



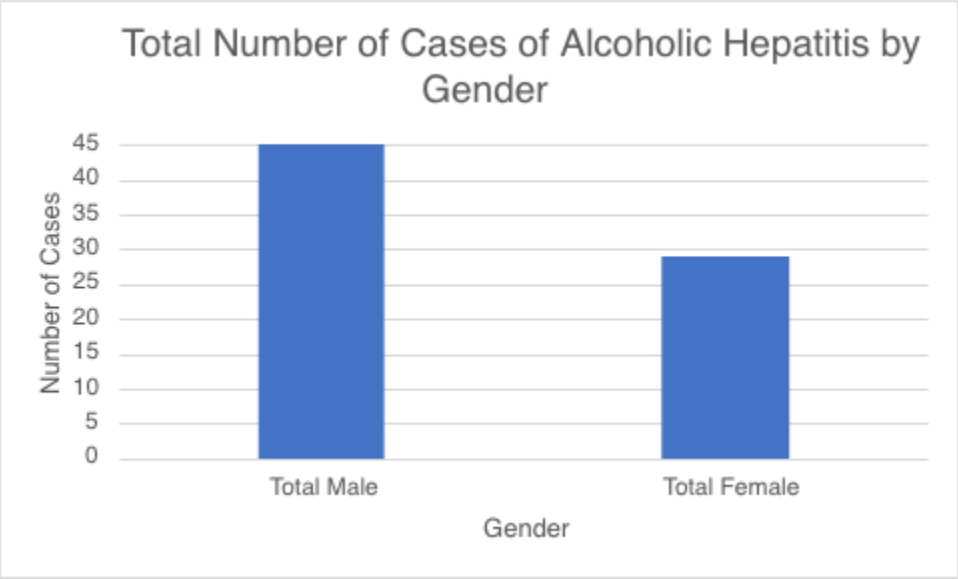
1/1/2020 - 12/31/2021 Results:

MELD Scores for 2020 & 2021

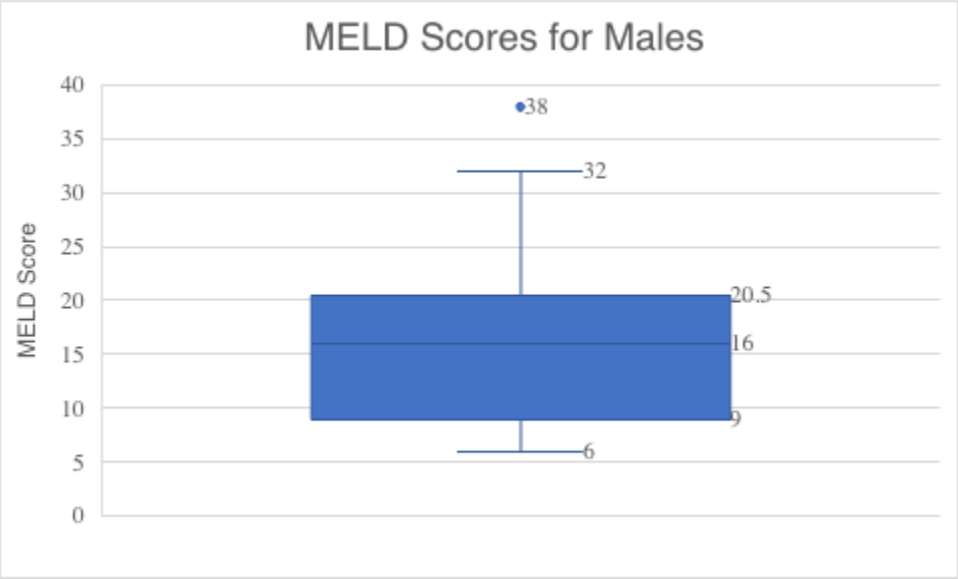


Average MELD Score: 15.93

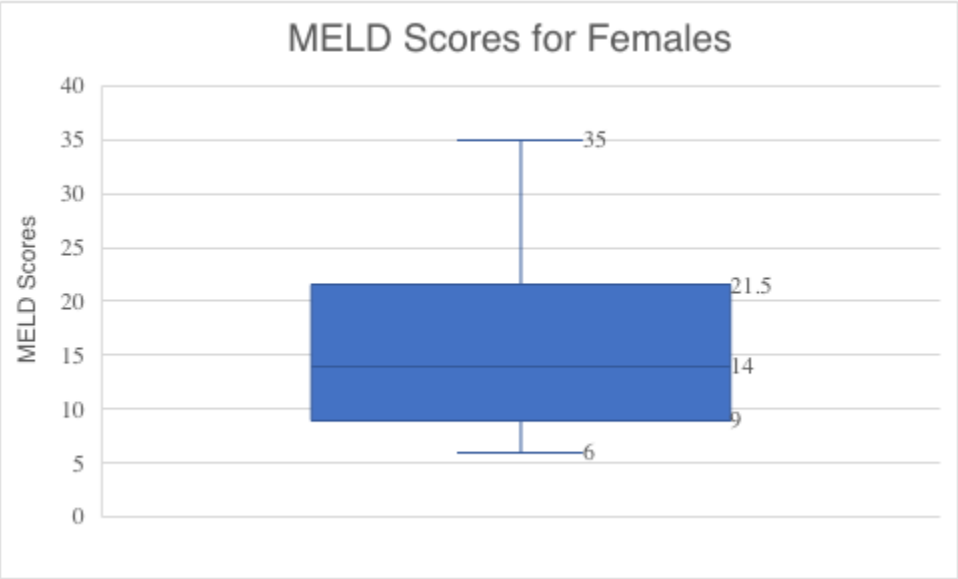
Total Number of Cases of Alcoholic Hepatitis by Gender for 2020 & 2021



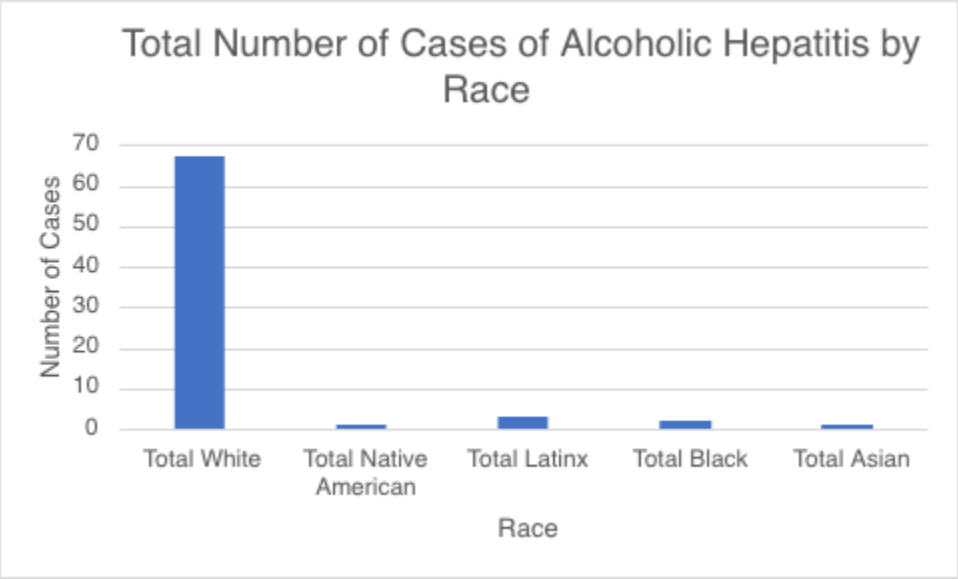
MELD Scores for Male for 2020 & 2021



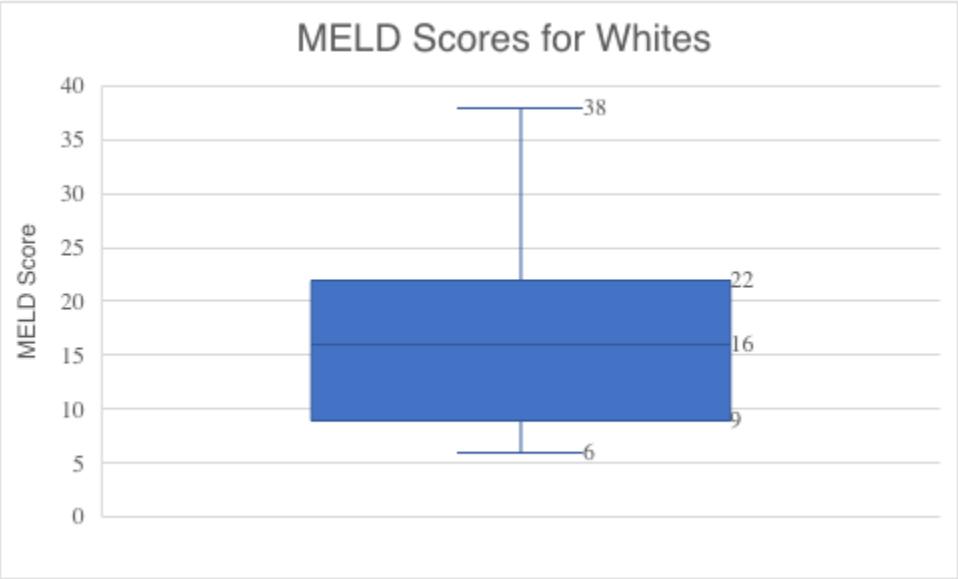
MELD Scores for Female for 2020 & 2021



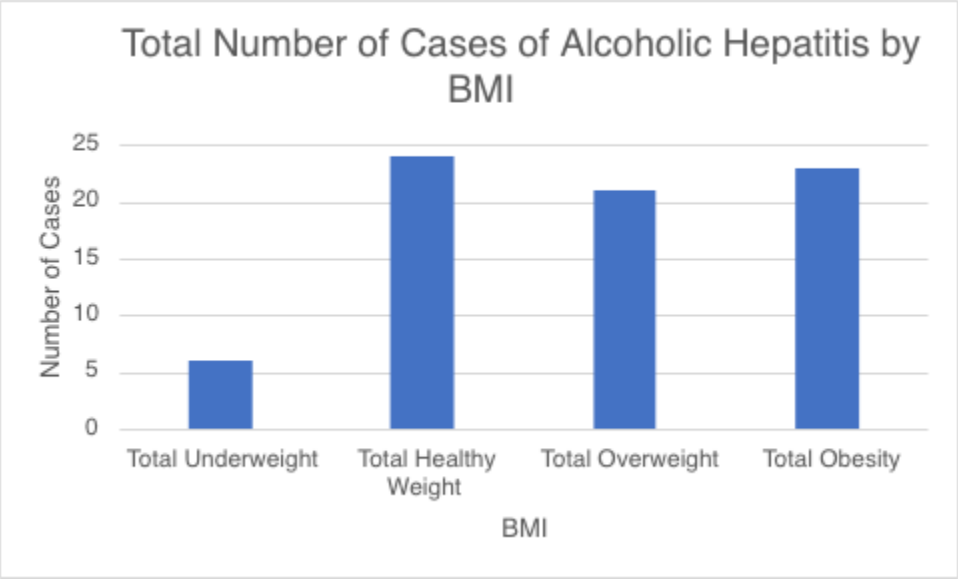
Total Number of Cases of Alcoholic Hepatitis by Race for 2020 & 2021



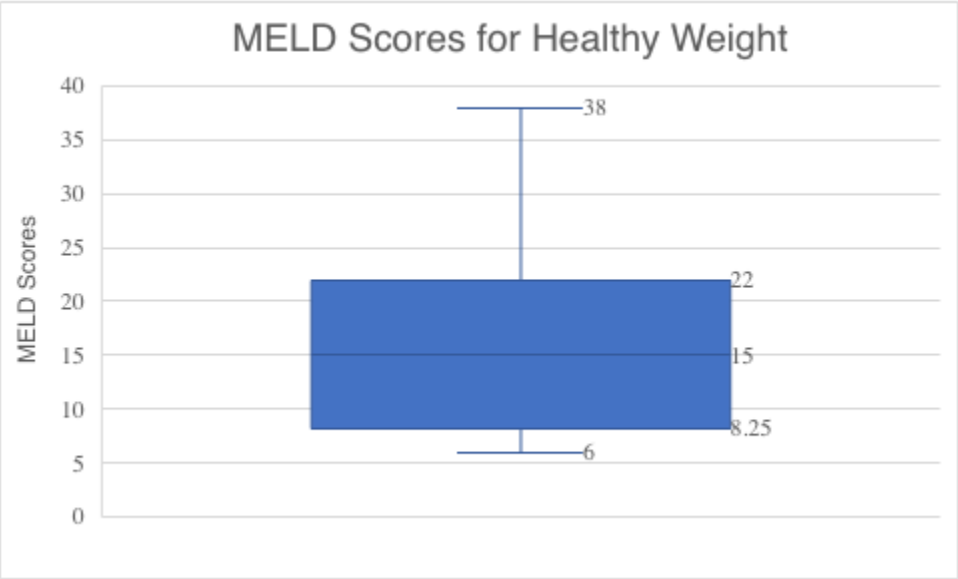
MELD Scores for White for 2020 & 2021



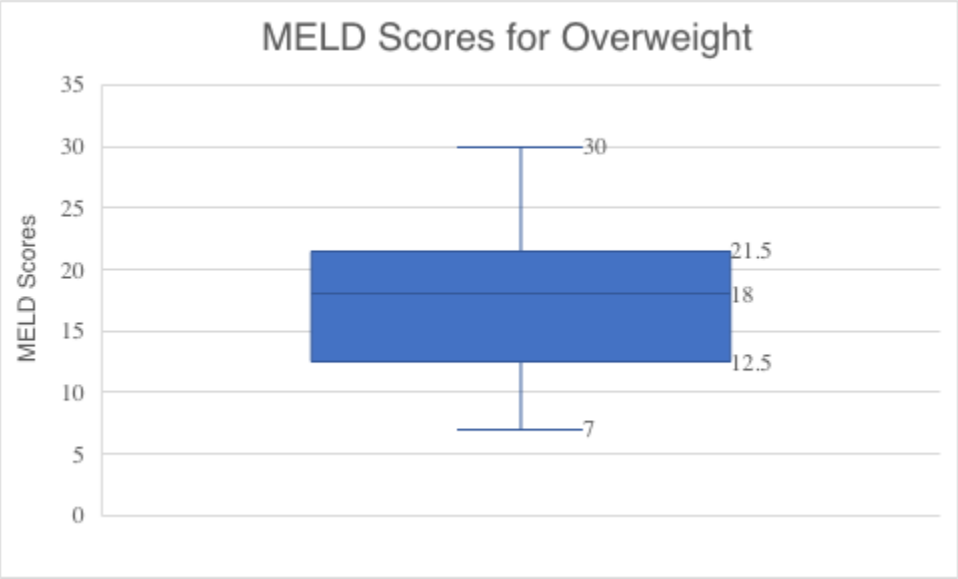
Total Number of Cases of Alcoholic Hepatitis by BMI 2020 & 2021



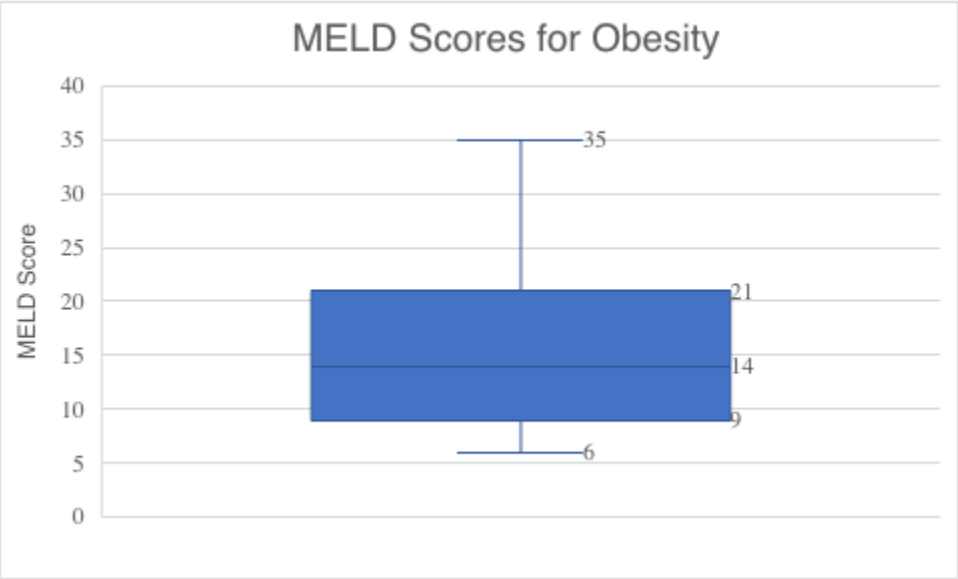
MELD Scores for Healthy Weight 2020 & 2021



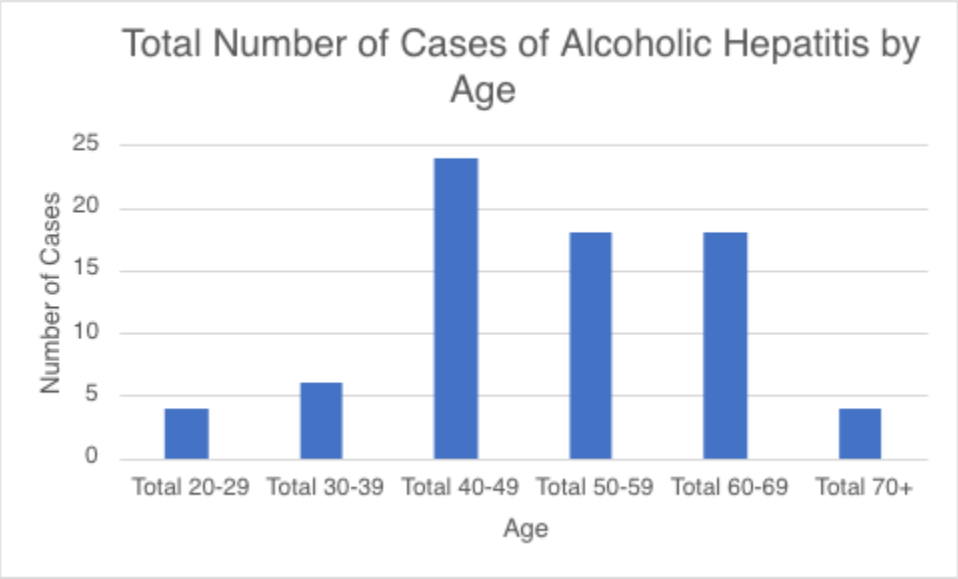
MELD Scores for Overweight 2020 & 2021



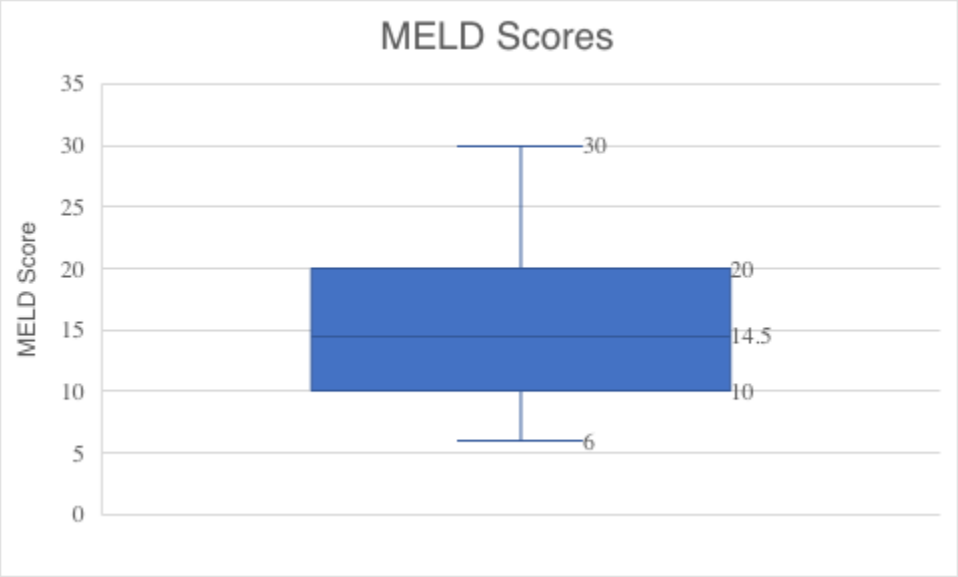
MELD Scores for Obesity 2020 & 2021



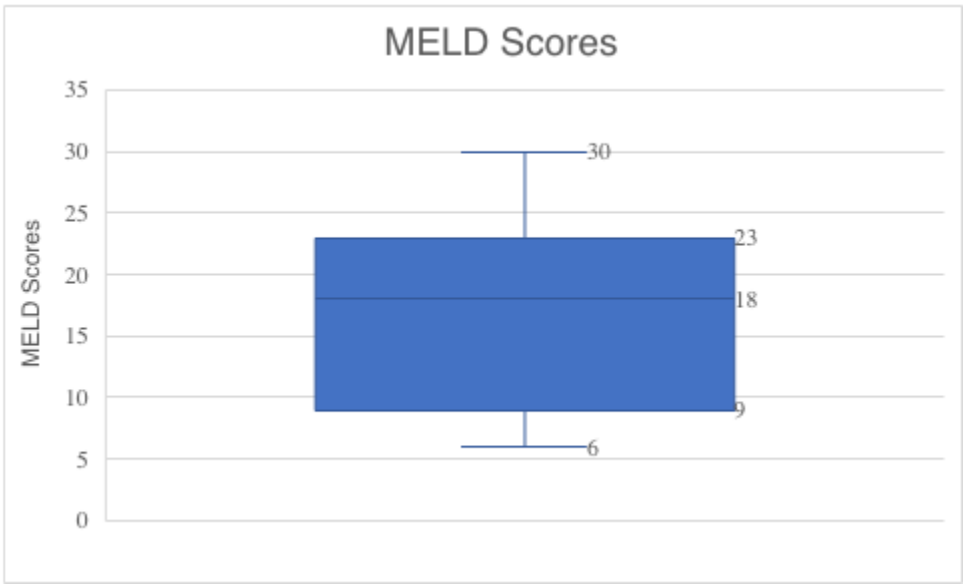
Total Number of Cases of Alcoholic Hepatitis by Age 2020 & 2021



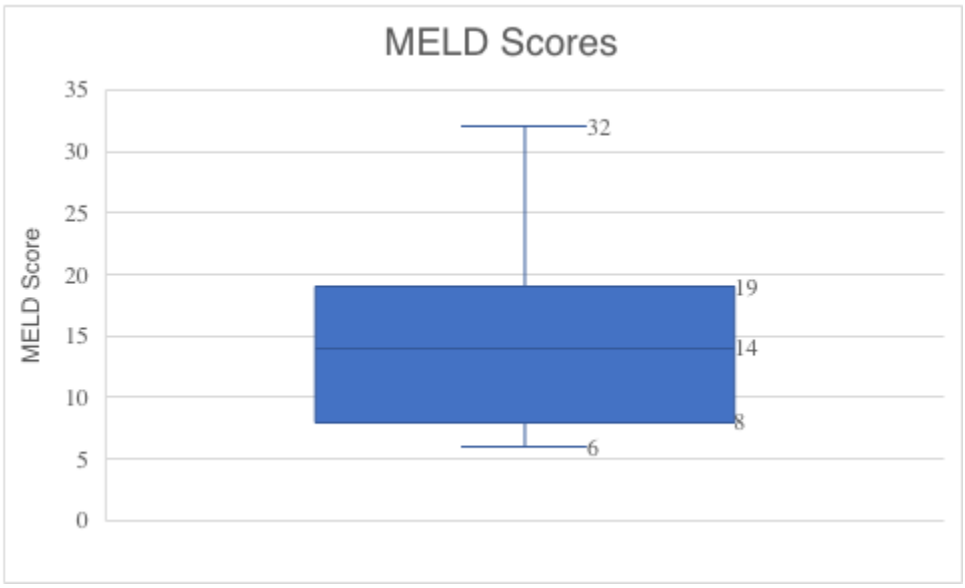
MELD Scores of Ages 40-49 2020 & 2021



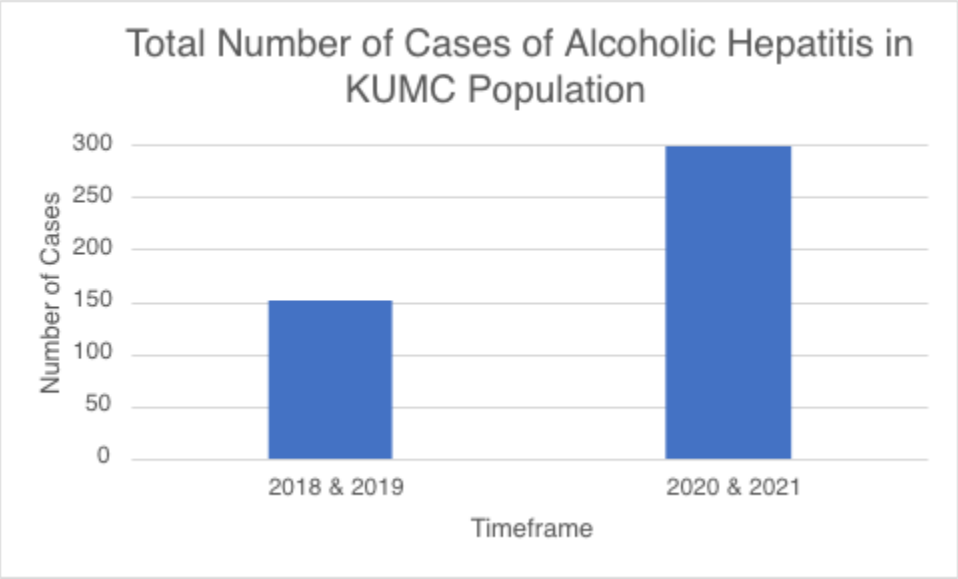
MELD Scores of Ages 50-59 2020 & 2021



MELD Scores of Ages 60-69 2020 & 2021



2018 & 2019 and 2020 & 2021 Alcoholic Hepatitis Cases Comparison



MELD Score Data Breakdown 2018 & 2019:

	Minimum	1st Quartile	Median	3rd Quartile	Maximum	Outliers
Total	6	11	17	22	33	-
Male	6	10	16	22	33	-
Female	7	15.25	19	22.75	28	-
White	6	10.25	17	22	33	-
Healthy Weight	7	15	19	22	29	-
Overweight	8	12.5	18	22.5	33	-
Obesity	6	9	14	22.5	29	-
40-49	6	11.5	16	22.75	27	-
50-59	7	10	16	21.5	28	-
60-69	9	10.5	19.5	24.75	33	-

MELD Score Data Breakdown 2020 & 2021:

	Minimum	1st Quartile	Median	3rd Quartile	Maximum	Outliers
Total	6	9	15	21	38	-
Male	6	9	16	20.5	32	38
Female	6	9	14	21.5	35	-
White	6	9	16	22	38	-
Healthy Weight	6	8.25	15	22	38	-
Overweight	7	12.5	18	21.5	30	-
Obesity	6	9	14	21	35	-
40-49	6	10	14.5	20	30	-
50-59	6	9	18	23	30	-
60-69	6	8	14	19	32	-

All of the bar graphs, box-and-whisker plots, and tables were made using the sample size data, except for the *2018 & 2019 and 2020 & 2021 Alcoholic Hepatitis Cases Comparison: Total Number of Cases of Alcoholic Hepatitis in KUMC Population* bar graph. This particular bar graph took into account the total number of Alcoholic Hepatitis cases regardless of any missing data (ex. Age, gender, race, BMI). The minimum, 1st quartile, median, 3rd quartile, and Maximum for the 2018 & 2019 timeframe was 6, 11, 17, 22, and 33, respectively. The average was 17.23. The 2018 & 2019 sample size consisted of 70 patients. The 2020 & 2021 sample size consisted of 74 patients. The *Total Number of Cases of Alcoholic Hepatitis by Gender for 2018 & 2019* was 45 for male and 25 for female. The minimum, 1st quartile, median, 3rd quartile, and Maximum for the males for the 2018 & 2019 timeframe was 6, 10, 16, 22, and 33, respectively. The minimum, 1st quartile, median, 3rd quartile, and Maximum for the females for the 2018 & 2019 timeframe was 7, 15.25, 19, 22.75, and 28, respectively. The *Total Number of Cases of Alcoholic Hepatitis by Race for 2018 & 2019* was 56 for white, 4 for latinx, 4 for black, and 1 for pacific islander. The minimum, 1st quartile, median, 3rd quartile, and Maximum for the white for the 2018 & 2019 timeframe was 6, 10.25, 17, 22, and 33. The *Total Number of Cases of Alcoholic Hepatitis by BMI for 2018 & 2019* was 3 for underweight, 20 for healthy weight, 21 for overweight, and 21 for obesity. The minimum, 1st quartile, median, 3rd quartile, and Maximum

for the healthy weight for the 2018 & 2019 timeframe was 7, 15, 19, 22, and 29. The minimum, 1st quartile, median, 3rd quartile, and Maximum for the overweight for the 2018 & 2019 timeframe was 8, 12.5, 18, 22.5, and 33. The minimum, 1st quartile, median, 3rd quartile, and Maximum for obesity for the 2018 & 2019 timeframe was 6, 9, 14, 22.5, and 29. The *Total Number of Cases of Alcoholic Hepatitis by age for 2018 & 2019* was 3 for 20-29, 4 for 30-39, 12 for 40-49, 29 for 50-59, 16 for 60-69, and 1 for 70+. The minimum, 1st quartile, median, 3rd quartile, and Maximum for ages 40-49 for the 2018 & 2019 timeframe was 6, 11.5, 16, 22.75, and 27. The minimum, 1st quartile, median, 3rd quartile, and Maximum for ages 50-59 for the 2018 & 2019 timeframe was 7, 10, 16, 21.5, and 28. The minimum, 1st quartile, median, 3rd quartile, and Maximum for ages 60-69 for the 2018 & 2019 timeframe was 9, 10.5, 19.5, 24.75, and 33. The minimum, 1st quartile, median, 3rd quartile, and Maximum for the 2020 & 2021 timeframe was 6, 9, 15, 21, and 38, respectively. The average was 15.93. The *Total Number of Cases of Alcoholic Hepatitis by Gender for 2020 & 2021* was 45 for male and 29 for female. The minimum, 1st quartile, median, 3rd quartile, and Maximum for the males for the 2020 & 2021 timeframe was 6, 9, 16, 20.5, and 32, respectively. The minimum, 1st quartile, median, 3rd quartile, and Maximum for the females for the 2020 & 2021 timeframe was 6, 9, 14, 21.5, and 35, respectively. The *Total Number of Cases of Alcoholic Hepatitis by Race for 2020 & 2021* was 67 for white, 3 for

latinx, 2 for black, 1 for asian, and 1 for native american. The minimum, 1st quartile, median, 3rd quartile, and Maximum for the white for the 2020 & 2021 timeframe was 6, 9, 16, 22, and 38. The *Total Number of Cases of Alcoholic Hepatitis by BMI for 2020 & 2021* was 6 for underweight, 24 for healthy weight, 21 for overweight, and 23 for obesity. The minimum, 1st quartile, median, 3rd quartile, and Maximum for the healthy weight for the 2020 & 2021 timeframe was 6, 8.25, 15, 22, and 38. The minimum, 1st quartile, median, 3rd quartile, and Maximum for overweight for the 2020 & 2021 timeframe was 7, 12.5, 18, 21.5, and 30. The minimum, 1st quartile, median, 3rd quartile, and Maximum for obesity for the 2020 & 2021 timeframe was 6, 9, 14, 21, and 35. The *Total Number of Cases of Alcoholic Hepatitis by age for 2020 & 2021* was 4 for 20-29, 6 for 30-39, 24 for 40-49, 18 for 50-59, 18 for 60-69, and 4 for 70+. The minimum, 1st quartile, median, 3rd quartile, and Maximum for ages 40-49 for the 2020 & 2021 timeframe was 6, 10, 14.5, 20, and 30. The minimum, 1st quartile, median, 3rd quartile, and Maximum for ages 50-59 for the 2020 & 2021 timeframe was 6, 9, 18, 23, and 30. The minimum, 1st quartile, median, 3rd quartile, and Maximum for ages 60-69 for the 2020 & 2021 timeframe was 6, 8, 14, 19, and 32. The total number of cases of alcoholic hepatitis in the entire KUMC population from 1/01/2018-12/31/2019 is 151. The total number of cases of alcoholic hepatitis in the entire KUMC population from 1/01/2020-12/31/2021 is 298.

Discussion

The results of this research project shows that there is a large difference between the number of patients diagnosed with alcoholic hepatitis from 2018 & 2019 to 2020 & 2021. The number of new patients nearly doubled from 151 to 298. However, the severity of alcoholic hepatitis, measured by the patients' MELD Score, did not have a statistically significant difference. The average MELD Score of the patients from the chosen sample sizes went down from 17.23 in 2018 & 2019 to 15.93 in 2020 & 2021. Furthermore, there was not a statistically significant difference of the percentage of patients from the sample size who showed signs of cirrhosis from 94% in 2018 & 2019 to 99% in 2020 & 2021.Within each group of data we analyzed the change in MELD score for the subgroups of data from 2018 & 2019 to 2020 & 2021. The median MELD score decreased for female, white, healthy weight, ages 40-49, and ages 60-69 patients. The median MELD score stayed stagnant for male, overweight, obese patients. The median MELD score increased for ages 50-59 patients. It can be concluded from the sample sizes that the race most affected by alcoholic hepatitis is white. In both timeframes there was an overwhelming amount of white patients diagnosed with alcoholic hepatitis compared to latinx, balck, asian, native american, and pacific islander patients. It can also be seen that men, patients in their 40s, 50s, and 60s, and patients that were

overweight or obese made up a majority of the patients that were diagnosed with alcoholic hepatitis.

Since it usually requires long-term drinking habits to cause severe damage to the liver, a possible theory as to why patients were diagnosed more frequently with alcoholic hepatitis during the COVID-19 pandemic is because people who used to consume a normal or low amount of alcohol before the pandemic, consumed alcohol at an accelerated rate during the pandemic. Since people tend to drink alcohol more when they are depressed, this would have most likely been caused by some sort of mentally painful, sad, or difficult event caused by the pandemic. For example: feeling lonely and secluded, the death of a loved one, or the loss of a job.

These results reinforce that drinking alcohol should never be a solution when one is feeling depressed due to its highly addictive nature and its negative long-term effects. The frequency data shows how important it is to develop safe methods of finding ways to better our mental health when we are feeling down.

Error Analysis

While this research study was conducted using computer programs, I believe there are ways that the project could be strengthened. One way the project could have been improved was by having more alcoholic hepatitis patients in the two sample sizes. This would require making sure that all essential data (serum creatinine, serum creatinine date, serum bilirubin, serum bilirubin date, INR, INR date, serum sodium, serum sodium date, age, gender, race, BMI, and signs of cirrhosis) was there for a greater number of patients. This would allow us to calculate more MELD scores from a wider range of patients and get a better view of the total population of alcoholic hepatitis patients at the University of Kansas Hospitals. Another way that this project could have been strengthened is if more data groups (ex. Gender, race, age, BMI) were analyzed. Some data groups that would be interesting to investigate are county, occupation (at time of diagnosis), and other pre-diagnosed conditions. The county data group would show us locations in which alcoholic hepatitis was most prevalent. The occupation data group would show us if people who had alcoholic hepatitis had recently lost their job, or were unemployed. The pre-diagnosed conditions data group would help us see what conditions are associated with alcoholic hepatitis.

Conclusion

The main objective of this project was to answer the question: how has the frequency and severity of alcoholic hepatitis changed from before the COVID-19 pandemic to now? We measured the severity of alcoholic hepatitis, by calculating a sample size of patients' Model for End-Stage Liver Disease (MELD) score. We determined the frequency of alcoholic hepatitis by comparing the number of patients diagnosed with alcoholic hepatitis from the Universityof Kansas Hospital from two different time frames: 2018-2019 and 2020-2021. The results have shown that the frequency of alcoholic hepatitis has increased from before the pandemic to during the pandemic. Nonetheless, there was no statistically significant difference in the severity of alcoholic hepatitis.

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