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NAFLD Surveillance in the Alaska Native/American Indian Population

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Walden University
2025

Abstract

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Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Philosophy

Public Health- Epidemiology

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Abstract

In the United States, the prevalence of NAFLD is estimated at 24% of the population, and by 2030, the incidence of NAFLD will increase to 100.9 million cases. This study aimed to determine the prevalence and rate of non-alcoholic fatty liver disease (NAFLD) progression in the Alaska Native/ American Indian population (AN/AI) with and without elevated liver function tests. Two research questions guided the study: Do outcomes (abnormal/normal) of LFTs, A1C, lipids, BMI, and inflammatory markers predict or have a relationship with NAFLD progression? Does NAFLD surveillance have a relationship with the patient's outcome as measured by the NAFLD Fibrosis score and FibroScan CAP Score? The theoretical approaches to this study were the transtheoretical model and the health belief model. A quantitative correlational design was used, requiring a minimum sample size of at least 92 participants. Secondary data were obtained from the Alaska Native Tribal Health Consortium Liver Disease and Hepatitis Program database. The inclusion criteria of the study were AN/AI patients with NAFLD. The results of the study indicated that ALT, AST, and Steatohepatitis were significant predictors of NAFLD Fibrosis score. An increase in A1C, triglycerides, and BMI corresponded with an increase in CAP Scores, while an abnormal AST level corresponded to a decrease in CAP Scores. Plasma ALT evaluation resulted in a decrease in NALFD incidence rates. Various organizations may adopt these study findings to help them in formulating guidelines that will help them in educating the members of the public on risk factors of NAFLD, as well as advocate for appropriate mechanisms in mitigating them.

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Chapter 1: Introduction to the Study

Introduction

Obesity is a chronic disease that has been growing for decades. Individuals with high BMI may have other chronic health-related conditions due to obesity. Some health conditions linked to obesity include heart disease, stroke, high blood pressure, diabetes, gallbladder disease, cancer, and sleep apnea (Rexford, 2011). Children are also impacted by obesity. There are many causes and contributing factors to obesity, including behaviors and the individual's genetics (CDC, 2017). The relationship between income and level of education may play a vital role in the rise of obesity (Reimers et al., 2009).

In the United States, the prevalence of obesity has doubled in the past 10 years. Non-alcoholic fatty liver disease (NAFLD) is a disease that has become more prominent due to the obesity crisis. NAFLD is a chronic liver disease characterized by excessive fat accumulation in the liver that is not attributed to alcohol consumption or other liver conditions. It is mostly characterized as a liver disease associated with metabolic syndrome. Metabolic syndrome describes a collection of conditions, including excess fat around the waist, hypertension, high blood sugar, and high triglyceride levels that increase chronic disease risk. Except for excess fat around the waist, the metabolic syndrome does not have visible signs. NAFLD is the hepatic manifestation of metabolic syndrome, and type 2 diabetes mellitus is the pancreatic manifestation. Obesity and type 2 diabetes are considered risk factors for NAFLD, but this could result from an earlier assessment of these conditions.

The prevalence of NAFLD in the United States is between 20% and 30% (Sarwar, 2018). In comparison, China's NAFLD prevalence was predicted to be at 20% by 2020 as well. However, in Japan, about a third of patients, or 20 million patients, were diagnosed with NAFLD (Tanaka, 2019). NAFLD's annual direct medical cost is approximately $103 billion, and both prevalence and costs are expected to rise (Younossi et al., 2016).

In Alaska, obesity has been on the rise for adults and children since 1991. According to the Burden of Overweight and Obesity in Alaska (2010), two out of three Alaska adults are overweight or obese, and children are not far behind them. This population is currently dealing with obesity-related health diseases, such as diabetes, heart disease, cancer, and high blood pressure. Studies have shown that obesity rates doubled from 13% to 27% between 1991 and 2007 (Tanaka, 2019; The State of Obesity, 2017). A recent collaborative study conducted by the Anchorage School District and the State of Alaska, Division of Public Health, found that 36% of all Anchorage School District students and 32% of kindergarten and 1st-grade students were overweight or at risk of becoming overweight. Also, 27% of high school youth are above a healthy weight, with 11% obese. Anchorage is the largest city in the south-central part of the state, with a population of 298,695 since 2015. In the data, among 2 to 4-year-olds, the current obesity rate is 19.1%, making them the second-highest among the 51 states in the United States. Among 10 to 17-year-olds, 14.0% of children are obese, ranking 32nd out of the 51 states. Lastly, the high school students are 14.0% obese and rank 14 out of the 43 states. The data show a huge obesity problem among children in Alaska, among the preschool-age children and high school students (The State of Obesity, 2017). An increase in child obesity prevalence translates to an increase in NAFLD in children, with possible progression to adverse liver outcomes earlier in life.

Researchers have shown substantial interest in NAFLD, as NAFLD's rate increases due to the national obesity epidemic in the United States. NAFLD started receiving recognition in 1980 by Dr. Jurgen Ludwig, a Mayo Clinic pathologist (Tanaka, 2019). New studies in the past have shown that NAFLD is a non-progressive and fundamentally benign disease. However, Dr. Ludwig discovered NAFLD's progressive stage known as non-alcoholic steatohepatitis (NASH; Tanaka, 2019). Current recommendations to screen for NAFLD among patients who have abnormal LFT LFTlikely underestimate NAFLD prevalence since NAFLD can exist with normal LFTs. There is an opportunity to diagnose NAFLD before the liver function is compromised if at-risk patients are proactively and periodically screened.

Researchers have conducted mostly retrospective studies to investigate NAFLD. The literature gap addressed in this quantitative study examined the prevalence and incidence of NAFLD and the probability of NASH and risk factors for identifying the most at-risk patients developing NAFLD in the Alaska Native/ American Indian (AN/AI) population. The obesity rates in the AN/AI population are high, which argues that this could lead to higher rates of NAFLD and NASH. Thus, the prevalence and incidence estimates for NAFLD, the probability of NASH, and risk factors are examined to identify the patients most at risk of developing NAFLD in the AN/AI population. Researchers and health professionals in the AN/AI population might use the study results for education, understanding the rate of NAFLD in their community, and creating innovative approaches for prevention, diagnosis, and risk stratification. A better understanding of NAFLD prevalence and progression in the AN/AI population and its correlation to obesity and metabolic syndrome could help health professionals coordinate efforts to reduce the incidence and mortality rates. Through prevention efforts in the community, lifestyle and nutritional changes, policy changes, and clinical practice can ultimately promote positive social change. Social change influences individual lifestyles, which can be a slow and gradual process.

Chapter 1 introduces the topic and outline of the study's background, problem statement, the purpose of the study, and the research questions and hypotheses. The remaining section in the chapter covers the theoretical framework, nature of the study, operational definitions, assumptions, scope and delimitations, limitations, and highlight the study's significance.

Background

NAFLD is a disease that is highly associated with obesity and type 2 diabetes. A timely diagnosis of NAFLD would help delay complications and comorbidities such as liver scarring, cirrhosis, NASH, and other health-related concerns. According to Alexander et al. (2018), the disease is underdiagnosed and recorded; however, the prevalence of NAFLD increases. NAFLD diagnosing is also limited to the biomarkers and images that could identify fatty liver. Not all overweight, obese, or type 2 diabetics may have or will have NAFLD. Consistent high LFT with the occasion of drinking alcohol are a marker for providers to consider NAFLD if the individual has certain behaviors and health conditions such as high BMI and high cholesterol (Alsabaani et al., 2018). There is no cure for NAFLD, but lifestyle interventions such as losing weight to reduce BMI and healthy eating habits to decrease cholesterol, A1C, and hypertension are necessary. Physical health is another important aspect necessary to maintain a healthy weight and transfer the steatosis out of the liver. Many studies have identified that health providers have been suggesting lifestyle changes without NAFLD diagnoses. Research studies have suggested vitamin E as a treatment option. However, the results have not been significant. NAFLD's prevalence is not known or pursued in a particular ethnicity, gender, or state in the United States. Selected articles related to NAFLD clinical characteristics and development are described below:

Clark et al. (2005) studied bariatric surgery's effectiveness on liver histology in patients with NAFLD. The authors' purpose was "to use a standardized tool to evaluate changes in liver histology that accompany weight loss induced by Roux-en-Y gastric bypass surgery (RYGB)" (Clark et al., 2005). The authors concluded that all NAFLD features resulted after the weight loss from the surgery. However, other research findings reported lower fat percentage after rapid weight loss, but patients' labs and images would still show focal necrosis, bile stasis, portal inflammation, and fibrosis. Duan et al. (2012) determined the clinical characteristics of patients with NAFLD-associated HCC. This research showed that obesity and metabolic syndrome were associated with NAFLD, and the risk factor for HCC due to NAFLD was not determined by cirrhosis. Federico et al. (2017) compared the dietary habits and the nutrient intake in patients with NASH and chronic hepatitis C. The key finding from this study was that the lack of macronutrients and micronutrients intakes affected males and females NASH patients.

Keating et al. (2017) studied the biomarkers of liver steatosis by proton-magnetic resonance spectroscopy (1H-MRS). The authors' purpose of this study was "to determine the accuracy of these indices, and waist circumference (WC), in quantifying the longitudinal change in 1H-MRS-quantified liver fat" (Keating et al., 2017). Stewart et al. (2015) studied the psychological factors and weight loss intervention outcomes. The authors' purpose of this study was to develop hypotheses for future research and clinical interventions regarding relationships between psychosocial factors and weight by evaluating "readiness to change weight-related behaviors, assessing the psychosocial characteristics that may interfere with weight loss, and evaluating how baseline psychosocial features associated with a 6-month change in weight in persons with NAFLD receiving standard medical care" (Stewart et al., 2015). Younossi et al.'s (2011) study assessed the pathologic criteria for NASH and determined liver-related mortality in patients with NAFLD who had a liver biopsy. The study results showed that liver-related mortality was the leading cause of death in patients with NASH. This research demonstrated that liver biopsy was not a proper diagnostic tool. However, a biopsy is currently the only way to diagnose NASH, but it has demonstrated the best probability for liver-related mortality in NAFLD patients.

Problem Statement

In the United States, the prevalence of NAFLD is estimated at 24% of the population, and by 2030, the incidence of NAFLD will increase to 100.9 million cases (Estes et al., 2018). Obesity is the leading risk factor for NAFLD, and in Alaska, the AN/AI obesity rate has increased to 60% between 2010 and 2014 (Alaska Native Health

Status Report, 2017). NAFLD is anticipated to surpass the hepatitis C virus infection as the primary form of chronic liver disease and the leading indication for liver transplants (Neuschwander-Tetri, 2017).

NAFLD is divided into three stages: Non-alcoholic fatty liver (NAFL), NASH, and hepatocellular carcinoma (HCC). Liver-related mortality is the leading cause of death in patients with NASH (Younossi et al., 2016). On average, mild liver fibrosis progresses to cirrhosis in patients with NASH in about 20 years. However, a subset of patients experiences rapid progress between 6 to 15 years. An increase in the prevalence of obesity translates to a rise of NAFLD with possible progression to adverse liver outcomes. There is limited information on the rate of NAFLD progression. A meta-analysis of 11 cohort studies that collected paired liver biopsies of adult patients concluded that liver fibrosis progresses at the rate of one fibrosis stage (F1–F4) per 14.3 years for NAFLD patients and one stage per 7.1 years for NASH patients (Singh et al., 2015). However, the rapid progression of NASH from no fibrosis (F0-F1) at baseline to advanced fibrosis or cirrhosis (F3 or F4) occurs in 20 % of patients in six years. This research study of NAFLD was needed for two reasons: to establish actual prevalence and progression to determine if NAFLD screening should be part of the AN/AI population.

Purpose of the Study

This study aimed to determine the prevalence and rate of NAFLD progression in the AN/AI population with and without elevated LFT. NAFLD is evaluated through the right upper quadrant ultrasound, MRI Elastography, FibroScan, and NAFLD Fibrosis Score. The NAFLD Fibrosis score measures the amount of fibrosis in the liver based on laboratory tests such as fasting glucose, AST, ALT, Albumin, platelet count, and factoring in patients' age and BMI. This study used a quantitative correlational approach. The independent variables included age, BMI, LFT, A1C, fasting glucose, NAFLD Fibrosis Score, FibroScan, MRE, and ultrasound. The study involved gathering secondary data and reviewing registries to understand the factors associated with NAFLD progression and the outcomes to determine if NAFLD surveillance benefited this population.

Research Questions and Hypothesis

RQ1: Do outcomes (abnormal/normal) of LFT, hemoglobin A1C, lipids, BMI, and inflammatory markers predict or have a relationship with NAFLD progression?

Null Hypothesis ($H_0$1): Outcomes (abnormal/normal) of LFT, hemoglobin A1C, lipids, BMI, and inflammatory markers do not statistically significantly predict NAFLD progression.

Alternative Hypothesis ($H_1$1): Outcomes (abnormal/normal) of LFT, hemoglobin A1C, lipids, BMI, and inflammatory markers statistically significantly predict NAFLD progression.

RQ2: Does NAFLD surveillance have a relationship with the patients' outcome as measured by NAFLD Fibrosis score and FibroScan CAP Score?

$H_0$2: NAFLD surveillance does not have a significant relationship with the patients' outcome as measured by NAFLD Fibrosis score and FibroScan CAP Score.

$H_1 2$: NAFLD surveillance does have a significant relationship with the patients' outcome as measured by NAFLD Fibrosis score and FibroScan CAP.

Theoretical Framework

The theoretical approaches to this study were the transtheoretical model (TTM) and the health belief model (HBM), which have been applied to health behavior topics. TTM classifies change behaviors into stages of change that integrate into processes and principles of change (Taylor et al., 2007). The changes do not occur in a linear form but through multiple attempts and failed attempts. TTM constructs include ten processes and principles of change that occur after stages of change. NAFLD is a disease that requires the patient to have a lifestyle change, and researchers have used TTM for obesity research. The TTM is mostly applied to intervention studies, and many studies have used this model in many settings, including churches, schools, and primary care.

The HBM is a theory developed to prevent and detect diseases. The theory also explains health-related behaviors, which can be used as a resource for planning interventions. The model includes six behavior constructs: perceived susceptibility, perceived severity, perceived benefits, barriers to action behavior, cues to action, and self-efficacy. The HBM can be applied to practice if the health professional can first ask if the HBM constructs are associated with health behaviors and second if interventions targeting HBM constructs are effective in changing health behaviors. The research or study should be able to identify health behaviors where interventions can be developed to address all the HBM constructs. For example, people who have chronic diseases and cannot find a way to the clinic after treatment is paid for one intervention.

The HBM can be used in a descriptive-analytical and cross-sectional study. The studies should identify modifying factors, which include age, gender, ethnicity, personality, socioeconomic status, and knowledge. It should also include individual beliefs and actions. Since the time HBM was conceptualized, new theories and innovative ways to test hypotheses have developed. Scholars have found that HBM constructs should be partnered with other constructs from other methods to strengthen the effect of health behaviors (Glanz et al., 2015, p 80).

Nature of Study

The research method and design for this study was a descriptive and correlational quantitative study. The purpose of the research study was to assess NAFLD’s prevalence and progression by reviewing and observing the data to determine if surveillance is necessary for the AN/AI population after reviewing invasive and non-invasive tests in patients with elevated and non-elevated markers. A cross-sectional and longitudinal design is most familiar with a descriptive study, and a predicting and model-testing design is usually associated with correlational design. Clinical data were evaluated to determine the prevalence and progression of NAFLD in any of the designs.

Definition of Terms

Operational definitions used in this study include:

A1C: A1C or hemoglobin A1C (HbA1c) test is a blood test used to diagnose diabetes and pre-diabetes. The test measures the individual average blood sugar levels over the past three months. Scientifically, the test measures the amount of sugar-coated hemoglobin attached to the red blood cell in the bloodstream. An individual can have either Type I or Type II diabetes. For this study, Type II diabetes was the risk factor for developing NAFLD. A normal A1C level was below 5.7%. A prediabetic level between 5.7% and 6.4% indicated pre-diabetes, and a diabetic level was 6.5% and higher (CDC, 2018).

BMI: BMI, also known as body mass index, is the measurement associated with weight and height in relation to the percentage of fat in the body and to determine if a person is a normal weight, overweight, or obese. The unit of measure for BMI is kilograms per square meter. A normal BMI is between 18.5 kg/m2 to 24.9 kg/m2, overweight range between 25.0 kg/m2 to 29.9 kg/m2, and obese weight status is 30.0 kg/m2 or higher. Obesity can also be divided into Class I and Class II obesity. Class I obesity BMI falls between 30 kg/m2 and 34.9 kg/m2, and Class II obesity level is between 35.0 kg/m2 and 39.9 kg/m2. Obese individuals have a greater risk of developing chronic diseases; however, Class II obese individuals are even at greater risk (CDC, 2015).

Cirrhosis: Cirrhosis can be defined as scarred liver tissue. The healthy liver tissue is replaced by scar tissue over time. Cirrhosis can occur to individuals with alcohol abuse, Hepatitis B, Hepatitis C, NAFLD, and many other forms of liver diseases and conditions. Scarring of the liver can also be known as fibrosis (U.S. Department of Veterans Affairs, 2018). Health professionals diagnose cirrhosis through a blood test, physical examination, and imaging. Low platelet count < 140,000/mm3 is an indicator in laboratory findings; enlarged spleen and spider angioma are found in physical examination. Lastly, nodular or dense liver, splenomegaly, varices, caudate lobe hypertrophy, portal and splenic vein distension, and ascites are found in radiology images. However, normal findings do not rule out cirrhosis (U.S. Department of Veterans Affairs, 2018).

Diabetes: Diabetes falls under three different categories: Type I, Type II, and gestational diabetes. Diabetes is a chronic disease involving the pancreas and insulin production within the pancreas. Type I diabetes occurs when the pancreas does not produce enough insulin, and Type II diabetes occurs when the pancreas is unable to effectively use the amount of insulin the body produces, also known as insulin resistance. Type II diabetes is the most common form of diabetes. Gestational diabetes occurs during pregnancy, which can affect the mother's health as well as the baby. Developing Gestational diabetes during pregnancy increases the chance of Type II diabetes (CDC, 2015).

Fasting glucose: Fasting glucose is a laboratory measurement to determine the blood sugar level. Normal fasting blood sugar level is 99 mg/dL or lower, between 100 to 125 mg/dL is considered pre-diabetes, and 126 mg/dL or higher is considered diabetes level (CDC, 2015).

Fibrosis stage: Fibrosis is also known as liver tissues that are scarred due to chronic inflammation of the liver over time and progress through advanced stages of fibrosis. There are five stages of fibrosis, and it is written using capital F and the numbers 0 through 4 to indicate stages from low to advanced stages. F0 = No Fibrosis or no scarring, F1 = Minimal Fibrosis, F2 = Significant Fibrosis, F3 = Severe Fibrosis, F4 = Cirrhosis. Significant fibrosis occurs when the scarring is extended outside the liver, but severe fibrosis, the scarring, has spread and formed bridges with other fibrotic liver areas (U.S. Department of Veterans Affairs, 2018).

FibroScan: FibroScan is also referred to as Transient Elastography. It is a scan used to measure the liver's stiffness and fat percentage in the liver. The ultrasound-based method reports results in kilopascals (kPa) from 2.5 kPa to 75 kPa. NAFLD patients' cut-off score is < 8.4 kPa (U.S. Department of Veterans Affairs, 2018).

Hepatocellular carcinoma (HCC): Hepatocellular Carcinoma, also known as HCC, is the most common type of liver cancer due to cirrhosis. Liver cirrhosis is more common in patients with Hepatitis B and C and patients with a history of alcohol abuse (U.S. Department of Veterans Affairs, 2018).

Inflammatory markers: Inflammatory markers associated with the liver include Platelets, C-reactive protein (CRP), Iron (Ferritin), Malondiadehyde, Plasma Pentraxin 3, Adipocytokines, Adiponectin, Leptin, TNF-α, and interleukin 6 (IL-6).

Magnetic resonance elastography (MRE): MRE is an MRI machine combined with elastography technology that provides an image of body tissue stiffness and the amount of fat accumulation. The machine is used as a non-invasive marker to determine fibrosis stage and fat accumulation in chronic liver disease (Mayo Clinic, 2020).

Metabolic syndrome: Metabolic syndrome represents a set of chronic health conditions due to being overweight or obese, genetics, physical inactivity, and the onset of old age. Metabolic syndrome increases the risk of diabetes, cardiovascular disease, stroke, and other health conditions that block artery walls, such as NAFLD. Metabolic syndrome is diagnosed by 3 of the following five criteria:

- blood pressure ≥130 mmHg systolic or ≥85 mmHg diastolic (or on treatment)
- fasting glucose ≥100 mg/dl (or on treatment)
- triglycerides ≥150 mg/dl (or on treatment)
- HDL cholesterol <40 mg/dl in men or <50 mg/dl in women (or on treatment)
- waist circumference ≥40 inches (102 cm) in men or ≥35 inches (88 cm) in women (U.S. Department of Veterans Affairs, 2018).

Non-alcoholic fatty liver (NAFL): NAFL is the accumulation of fat in the liver, but with no to a limited amount of inflammation or liver damage. NAFL patients with risk factors such as metabolic syndrome, obesity, or diabetes will present with fatty liver on ultrasounds or other imaging, drink modest or no alcohol, whether the liver enzyme laboratory test (ALT) is elevated, and also not diagnosed with hepatitis B or C or other secondary causes such as parenteral nutrition or medications (U.S. Department of Veterans Affairs, 2018).

Non-alcoholic fatty liver disease (NAFLD): NAFLD is a chronic liver disease characterized by excessive fat accumulation in the liver that is not attributed to alcohol consumption or other liver conditions.

Non-alcoholic steatohepatitis (NASH): NASH is the progression and the severe form of NAFLD, which includes steatosis with inflammation and hepatocyte injury.

NAFLD Fibrosis Score: NAFLD Fibrosis Score is a scoring system that uses laboratory values to determine the amount of liver scarring or liver fibrosis. The laboratory tests include serum glucose, platelet count, Albumin, and AST and ALT ratio. The scoring system also factors in the individual age, BMI, and diabetes status. The

NAFLD Fibrosis score includes three categories. A score below -1.455, advanced fibrosis can be excluded; a score between -1.455 and 0.676 is considered indeterminate, and a score above 0.676 is the presence of advanced liver fibrosis (Quest Diagnostics, 2020).

Obesity: Obesity is a chronic disease caused by an excessive amount of fat in the body that can cause other chronic conditions and diseases. An individual with a BMI $\geq$ 30 kg/m2 is considered obese. The rise of the obesity pandemic in the United States is due to lifestyle behaviors such as lack of physical activity and poor nutrition (CDC, 2016).

Liver biopsy: Liver biopsy is an invasive procedure that assesses histologic changes and diagnoses liver diseases. Non-invasive assessments are used to diagnose NAFLD; however, NASH can only be diagnosed after a liver biopsy. A liver biopsy involves some risks, and there are also some contraindications. A patient is at risk for bleeding, organs puncture such as lung, kidney, gallbladder, or intestine, and fatality is a risk for all surgeries. Contraindications to a liver biopsy include a history of unexplained bleeding, tendency to bleed, abnormal Prothrombin time, platelet, and prolonged bleeding time, use of aspirin and NSAID within the previous 7-10 days, blood for transfusion unavailable or unwilling to accept transfusion in case of bleeding, suspected hemangioma or other vascular tumors, inability to identify an appropriate site for biopsy by percussion or ultrasonography, and suspected echinococcal cysts in the liver (U.S. Department of Veterans Affairs, 2018).

LFT (LFTs): LFT (LFTs) are laboratory tests used to determine the liver’s health by evaluating protein and enzyme levels. The liver enzymes found in the liver include Alanine Transaminase (ALT), Aspartate Transaminase (AST), Alkaline Phosphatase

(ALP), and Gamma-glutamyl transpeptidase (GGT). High levels of the enzymes are signs of liver damage. ALP and GGT are also found in bile ducts. Liver proteins that are made in the liver include globulins and albumin, which are total proteins, and prothrombin. Globulin proteins help fight infections through the immune system, and the albumin protein test evaluates the amount of protein in the body. Low levels of both proteins are signs of liver damage. The prothrombin protein's responsibility is to clot the blood. The test measures how much time it takes for the blood to clot. High prothrombin time is a sign of liver damage. Lastly, another liver function test that measures the health of the liver is bilirubin. Bilirubin is a yellow fluid that can leak out of the liver when the liver is damaged. The yellow fluid in the blood can cause jaundice, which is a condition that causes yellowing of the skin and eyes and darkens the urine (American Liver Foundation, 2017).

Lipids: Lipids are also known as fats in the blood. A complete cholesterol test or a lipid panel measures four types of lipids in the blood. They are total cholesterol, which is the sum of cholesterol in the blood. High-density lipoprotein (HDL) cholesterol, which is considered the good cholesterol that fights off the bad cholesterol to keep blood flowing through the arteries, low-density lipoprotein (LDL) cholesterol, which is the bad cholesterol that reduces blood flow and creates fatty buildups known as plaques in the arteries, and triglycerides are fats in the blood and cells due to extra calories that are not used to full the body (Mayo Clinic, 2020).

Liver transplant: A liver transplant is the operation of transplanting a damaged or diseased liver for a healthy liver. A person is not able to survive without a liver. A liver transplant is required for acute liver failure and chronic liver failure. Acute liver failure is when the liver gets damaged rapidly due to Tylenol overdose, viral infections, ingestion of a toxin such as poisonous mushrooms, or an idiosyncratic drug reaction (Roayaie & Feng, 2020). Chronic liver failure occurs over time due to viral hepatitis such as hepatitis B and C, alcoholic liver disease, metabolic liver diseases such as NASH, HCC, and vascular liver disease, which is known as Budd-Chiari syndrome, which prevents blood flow to the hepatic veins due to clotting. Autoimmune liver diseases are also chronic liver diseases. They are autoimmune hepatitis, cholestatic liver diseases; primary biliary cirrhosis, which is when the small bile ducts get damaged within the liver; primary sclerosing cholangitis, which is when the inside and outside get damaged; neonatal sclerosing cholangitis, which is an infection and scarring of the bile ducts in the liver of an infant, Biliary atresia is the absence of bile ducts outside the liver, Caroli's disease is the abnormality of the bile ducts within the liver, and TPN-induced cholestasis, which is the stopping or slowing of normal bile flow also known as bile stasis and caused by intravenous nutrition, termed total parenteral nutrition (TPN). Lastly, chronic liver failure can be found due to genetic liver disease known as hemochromatosis, which is excess iron deposition in the liver; Wilson's disease, which is abnormal copper metabolism; alpha-1 anti-trypsin deficiency, which is the lack of a digesting protein, Glycogen storage disease (type I, III, IV) which is inherited metabolic disorder, and Tyrosinemia which is a disorder of tyrosine metabolism (Roayaie & Feng, 2020).

Ultrasound: Ultrasound is an imaging method that uses high-frequency sound waves outside the body to create images within the body (Mayo Clinic, 2020).

Assumptions

According to Al-Habil (2011), assumptions are facts the researcher believes to be accurate, which can affect the study's result. This study included several assumptions. The first assumption was that the sample of study participants from the Liver Disease and Hepatitis Program (LDHP) database might not be an adequate representation of the AN/AI population in Alaska. A second assumption was that the data collection process would give insight into whether most NAFLD patients experience elevated LFT before being diagnosed. A third assumption was that minimal information would be available in the LDHP database and electronic health record (EHR) about patients' outcomes after being diagnosed.

Scope and Delimitations

This study was limited to the LDHP database sample of NAFLD participants. There is only one LDHP in Alaska who serves the entire region. The study was conducted within the Indian Health Services organization. Data from the LDHP database and EHR included in this study were LFT, hemoglobin A1C, lipids, BMI, inflammatory markers, diabetes status, age, and gender. The second delimitation is the study location. The geographical location is unique, and there are healthcare disparities such as transportation, and the findings may not apply to other parts of the United States. Lastly, the third delimitation was that patients were entered into the database with only a suspicion of NAFLD, diagnosed with NAFLD with other diagnoses, or may not have a FibroScan or Ultrasound result. The study findings may be limited due to how much

NAFLD information was collected before the FibroScan machine was introduced in the LDHP registry.

Limitations

There are a few potential limitations. The main limitation was the lack of information the data set provided for each dependent variable and about the patient's diet, which may help understand the relationship between a 6-month to 2-year FibroScan. The AN/AI was also considered a vulnerable population in a research study. This study sought approval from the Institutional Review Board (IRB) to protect the patient's rights.

Significance of the Study

Obesity is the primary contributing factor that leads to developing NAFLD, leading to fetal liver disease outcomes. The morbidity and mortality rates have increased historically due to lifestyles. The study provided NAFLD's prevalence and progression in the AN/AI population. Public health could use the data to develop policies and interventions in the AN/AI communities. For example, universal screening is an intervention that could be put in place. Interventions that reduce the prevalence of liver disease outcomes regarding NAFLD need to be more accessible and re-aligned with the public health mission; however, the challenge remains even in high-resource settings.

Summary

Chapter 1 summarized and defined NAFLD and included a brief discussion on the link between obesity and metabolic syndrome with NAFLD in the United States. In addition, this chapter included an outline of the purpose, nature, research questions, hypotheses, theoretical framework, limitations, delimitations, and significance of this study. Chapter 2 provides a systematic review of the literature to gain insight into the existing knowledge gap regarding NAFLD.

Chapter 2: Literature Review

Introduction

According to Younossi et al. (2018), NAFLD affects at least a third of the global population, and its prevalence continues to surge across the world. Studies estimated that the worldwide prevalence of NAFLD is one billion (Younossi et al., 2016). In the United States alone, Younossi et al. (2018) projected that at least 80 million individuals will suffer from NAFLD, with 25% of cases progressing to NASH. Because NAFLD is linked to other chronic illnesses, including obesity, metabolic syndrome, diabetes, cardiovascular complications, and dyslipidemia, its prevalence in different ethnicities is imperative, if not essential, for the development of appropriate therapeutic interventions for managing the condition (Dharmalingam & Yamasandhi, 2018; Tutunchi et al., 2019; Wong et al., 2016).

Previously, studies have suggested that NAFLD is more prevalent in some ethnicities than others. In particular, Younossi et al. (2018) reported that the prevalence of NAFLD was higher in Hispanics compared to the white population and African Americans. However, there are still inconsistencies in the extent to which NAFLD is prevalent in different races because the current information is mixed and does not provide an extensive overview of the extent to which NAFLD is prevalent in other races and inform appropriate interventions for combating its alarming prevalence.

This study aimed to address this gap by examining the prevalence of NAFLD in AN/AI and document appropriate behavior-based interventions for combating the severity of the disease. This chapter covers the literature search strategies that were used to abreact the articles used in the study. In addition, an exhaustive literature review and synthesis relating to the theoretical framework grounding the current study, the prognosis of NAFLD, epidemiology, an overview of the NAFLD, prevalence of NAFLD, risk factors, management of NAFLD, and behavior-based interventions.

Literature Search Strategy

As explained by Shen et al. (2016), a well-researched and analyzed literature review provides the researcher and the readers with critical information relating to the topic terms prior knowledge and the gaps in knowledge that need a researcher to address. Therefore, to ensure that existing concepts and knowledge thoroughly support the present study, an all-encompassing literature search was conducted. Several databases that publish high-impact scholarly or peer review articles were searched. The databases searched include Ovid MEDLINE, Ovid MEDLINE In-Process, Ovid EMBASE, CINAHL, MEDLINE, and the Cochrane Library. The search terms included prevalence of NAFLD, the incidence of NAFLD, and risk factors related to NAFLD, fatty liver and or NAFLD natural history, theories, epidemiology of NAFLD and RA, and metabolic syndrome, obesity, diabetes, hyperlipidemia, as well as gender and NAFLD.

Research articles published from 2016 to 2020 were considered for the study and reviewed. Studies that were not within the selected timeframe were included if seminal works or empirical reviews from significant publications were on the topic. Articles were included if they:

1. Discussed the prevalence of NAFLD,
2. Examined or explores risk factors for NAFLD,

3. Examined interventions for the management of NAFLD,
4. Investigated NAFLD in different races, and
5. Were published from 2016-2020.

In conducting the review, I omitted studies or articles that:

1. Did not primarily discuss NAFLD,
2. Did not address the severity and prevalence of NAFLD, its prognosis, in terms of race or ethnicity,
3. Had limited information relating to the prevalence of NAFLD or were less authoritative and
4. Lacked the original publication date.

Theoretical Framework

Transtheoretical Model (TTM)

I used the TTM and the HBM to ground the present study. The TTM model helped understand people's behavioral changes (Prochaska & DiClemente, 1983) and described how individuals move enthusiastically through the five different stages or phases of behavioral changes. The TTM has, according to Hayotte et al. (2020), extensively been used to explain and comprehend behavior, including the adoption of positive behaviors for managing various health conditions (Liu et al., 2017).

According to Kang and Kim (2017), the four primary constructs of TTM for behavior change include self-efficacy, decisional balance, and change processes. Supporters of the TTM theory contend that individuals start to perceive significant benefits rather than disadvantages by adopting positive, appropriate, and constructive changes in their behaviors as they advance through the stages (Hayotte et al., 2020; Liu et al., 2017). According to Kang and Kim, TTM theory, which acts as a primary guideline for positive health behavior changes, is based on the premise that people who are attempting to change their behavior could experience a set of changes relating to their readiness to change, including pre-contemplation (not intending to make changes or denying the need for change), contemplation (seriously considering making changes), preparation (making small changes), action (actively engaging in exercise for less than six months), and maintenance (exercising regularly for at least 6 months; Hayotte et al., 2020).

As one of the key constructs of the TTM model, self-efficacy is considered useful in changing various health conditions because people with high self-efficacy positively respond to challenging emotions (Hayotte et al., 2020). Nigg et al. (2019) stated that individuals who have high self-efficacy tend to accept more challenges while persisting with their respective appointed tasks despite the existence of obstacles. In this case, people are likely to adopt a new behavior if they find that the resulting benefits outweigh the cons of behavior change (Nigg et al., 2019). Researchers have widely used the TTM model to understand the impact of lifestyle change on the management of obesity and other health behavior topics (Nigg et al., 2019). While TTM classifies behavior change in different stages, it is essential to underscore that the changes are not linearly represented but through multiple and highly multifaceted attempts that could either be positive or negative (Kang & Kim, 2017).

For instance, Kang and Kim (2017) used the TTM model to study the psychological outcomes of weight-loss interventions on obesity management. Likewise, TTM has been widely used in different settings such as churches, learning institutions, and primary healthcare to recommend appropriate behavior change interventions for various medical conditions. Another construct of the TTM model is the decisional balance, which refers to an individual destemming the pros and cons of changing.

As elucidated by Nigg et al. (2019), TTM is a foundational health change behavior theory that researchers have used to understand how behavior change can promote positive practices that lead to the effective management of different health conditions. In this case, TTM can be used to advance behavior-based interventions that can counter NAFLD's risk factors, including changes in lifestyles. This study used the model to explore various NAFLD risk factors and how behavior-based interventions can be used to combat the widespread prevalence of NAFLD globally.

Health Belief Model (HBM)

The HBM is the second framework that guided the present study. While HBM was developed to support the detection and prevention of diseases, no study has utilized the theory in behavior changes and how much can lead to positive changes that could lead to the prevention of common chronic sickness. According to Ghaderi et al. (2017), researchers use the HBM model to address issues relating to behavior change in patients and how the development of behavior-focused interventions can mitigate the manifestation of chronic diseases that link to human behavior or lifestyle. Likewise, Mohebbi et al. (2019) stated that the HBM model describes various health-related behaviors that form a rich resource of information for planning various clinical interventions to detect and prevent the occurrence of various chronic diseases. HBM comprises six behavior constructs: perceived susceptibility, perceived severity, perceived benefits and barriers to engaging in a specific behavior, indications of action, and self-efficacy.

Based on the above HBM concept, it is evident that while the HBM theory has narrowly been applied by previous research, it is evident that it can be used to recommend appropriate behavior changes. The HBM concept can lead to the effective management of chronic illness, where behavior-based interventions are imperative for short-term and long-term management (Mohebbi et al., 2019). In this case, there is a need to use the HBM model and integrate various modifying factors such as age, gender, ethnicity, socioeconomic factors, and personality in understanding the progression of diseases. Also, the modifying factors can influence change in behavior as far as an individual's health is contextualized.

Mohebbi et al. (2019) advocated that HBM is an extensively researched model and has widely been used to predict health-related behavior among patients, such as recommending a change in patient behavior toward diabetes and obesity management. Ghaderi et al. (2017) reported that HBM's constructs were effective in understanding the epidemiology and prognosis of the disease in different populations based on gender, ethnicity, and socioeconomic status. Subsequently, the model was used to understand the prevalence of NAFLD in other cultures, races, and genders and how behavior change may promote early detection and management of the disease's progression in the selected population.

Review of Literature

The Natural History of NAFLD

Due to NAFLD's evolving nature, an understanding of its history and evolution remains incomplete and inconsistent. This aspect has significantly limited the development of effective diagnostic criteria and therapeutic interventions (Le et al., 2017). The current surge in the prevalence of obesity and the resulting high rates of diabetes across the spectrum will likely increase NAFLD incidence across the world (Johnson et al., 2018). Studies have often linked NAFLD's cause to the initial growth of end-stage liver disease as people age (Le et al., 2017; Patil & Sood, 2017). As such, a mortality rate has been reported to be higher in patients with NAFLD than in the healthy population with no symptoms or suffer from the disease.

Typically, Trovato et al. (2016) stated that the common cause of death in patients with NAFLD is heart complications followed by liver cancer. However, while NAFLD continues to threaten human life, its exact cause remains unknown among scholars. Nevertheless, studies from the United States approximate that at least 28-30% of the general population is accountable for having steatosis responsible for carrying benign prognosis measured using magnetic spectroscopy (Patil & Sood, 2017; Trovato et al., 2016). Rayyan and Tayyem (2018) conducted a study in Minnesota to explore NAFLD's natural history and established that 3.1% of the people suffering from NAFLD have cirrhosis-related complications. The complications included ascites at 2%, jaundice at

2%, encephalopathy at 2%, variceal bleeding was estimated to be (1%), and HCC at 0.5%. Based on the study findings, which attempted to establish NAFLD's natural history, about 10-30% of the patients with steatosis developed NASH. Notably, NASH development was linked to cirrhosis connected to a poor long-term diagnosis for 2.6% of patients at high risk of developing HCC (Patil & Sood, 2017).

Additional studies suggest that ten years following NAFLD's initial diagnosis, 45% of the NASH and HCC will likely decompensate by 20%. Typically, NAFLD is considered to be a subtle progressing disease that may fail to culminate in end-stage liver disease. As such, it is an exhausting endeavor to identify patients who are likely to develop total liver failure. Kaswala et al. (2016) and Kim et al. (2016) noted that data relating to NAFLD is frequently limited to its predictors and progression to NASH. As such, scholars such as Kim et al. suggested that due to the computing nature and effects of obesity, longitudinal studies are required to aid in the prediction of the critical outcomes for different patients suffering from the disease. While patients with NAFLD have a poorer prognosis, efforts should be directed toward their inclusion in clinical trials so that the progression is well captured from a broader perspective to allow its accurate diagnosis and development of effective interventions (Kaswala et al., 2016). In summary, the natural history parallels the aggressive histological picture, with cohort researchers suggesting a higher morbidity or mortality rate than NAFLD.

In sum, several studies on NAFLD's prognosis were reported many years ago, with the first publication in 1968. As reported by Rayyan and Tayyem (2018), the survival rate of the participants who took part in the study with NASH cirrhosis was estimated to be 75.2%, and the deaths of patients with NAFLD were linked to the resulting complications that accompany the sickness. As soon as cirrhosis grows, its prognosis is negatively influenced by the potential growth of cirrhosis-related complications. Newton et al. (2017) sought to compare NAFLD cirrhosis's natural history with HCV cirrhosis. The researchers established that patients who had NAFLD cirrhosis had lower liver-related difficulties and lower rates of HCC compared to those who had hepatitis C virus (HCV) infections of a similar disease stage (Newton et al., 2017).

Epidemiology

As noted by Bellentani (2017), the spread of NAFLD is worldwide; however, its exact prevalence remains unknown because of the limited accuracy as far as non-invasive makers are concerned, which directly relate to the condition. In particular, liver biopsy is very expensive in diagnosing NAFLD. It provides no other alternative than the use of liver tests, imaging, and spectroscopy methods to diagnose the disease (Perumpail et al., 2017). Tutunchi et al. (2019) reported that community-based surveys have utilized proton NMR spectroscopy to understand NAFLD's prevalence and cause. As of 2018, NAFLD's prevalence was estimated to be 24% globally (Younossi et al., 2018).

In like manner, statistics and data from National Health and Nutrition Examination Surveys (NHANES) suggest that the prevalence rate of NAFLD has quadrupled from 1988 to 2008 in the United States from 46.8% to approximately 75.1% of acute liver diseases (Kumar et al., 2020). As such, researchers have estimated that the prevalence of NAFLD will surge by 21% by 2030 and become one of the leading chronic conditions in the world with an overall prevalence rate of 33.5% in the general population (Kumar et al., 2020). As espoused by Younossi et al. (2018), the largest number of NAFLD cases are from South America with a 31% preference rate, 32 % in the Middle East, 27% in Asia, 24% in the United States, and 23% in Europe. The lowest prevalence rate is in Africa, which has a prevalence rate of 14% (Younossi et al., 2018).

A meta-analysis conducted by Younossi et al. (2018) established that NAFLD prevalence in the United States is mainly through ultrasonography, the Fatty Liver Index, and the International Classification of Diseases. Based on the findings, it was established that the prevalence rates of NAFLD were influenced by race, with Hispanic Americans reporting the highest prevalence standards, immediately followed by Americans. The latter are of European descent and African Americans (Younossi et al., 2016). Although unconfirmed, such disparity in the prevalence rates of NAFLD can be attributed to differences in socioeconomic status, genetic factors, and the existence of MetS (Younossi et al., 2018).

The Meta-analysis results are supported by several previously published studies on the topic and contradict the findings relating to higher rates of conditions such as obesity in the African American population (Sherif et al., 2016). A different assessment data reported by NHANES established that NAFLD considerably posed a sizeable risk in black youths, but for grownups, education was indirectly related (Jaradat, 2017). Younossi et al. (2018) supported such assessments and report that the prevalence of NAFLD in the United States was 30%, with 10.3% of the cases diagnosed with advanced fibrosis.

Health Effects of NAFLD

Besides additional entities such as diabetes, being overweight or obese, high fat, and high blood pressure, NAFLD is epitomized by metabolic syndrome (MetS) (Sarwar, Pierce & Koppe, 2018). The distinction between the two subtypes, NAFL and NASH, is the manifestation of swelling or cell destruction. Histology of liver tissues is the gold standard for NAFLD identification; however, recently, the Pathology Committee of the NASH Clinical Research Network established the NAFLD activity score (Wong et al., 2016). According to Wong et al. (2018), the scores may define the quantity of fat accretion, swelling, and fibrosis. All other probable reasons for liver steatosis, such as alcohol intake, hemochromatosis, viral hepatitis, and specific natural conditions, must be excluded first to precisely detect NAFLD (Wong et al., 2016).

Making a histological contrast between the subtypes is vital because therapeutic interventions for management differ for each. As the ailment advances, those afflicted have a higher possibility of developing fibrosis, cirrhosis, and terminal liver diseases (Kumar et al., 2020). The diagnosis continuum ranges from uncomplicated steatosis (SS) to NASH and, eventually, HCC. This advancement is still partly defined as SS is now shown to be more progressive than initially assumed. As established by Divella et al. (2019), some inherent polymorphisms have a substantial influence on the development and the deviations connected with MetS.

Many studies on the development of NAFLD versus NASH have been conducted to appreciate the connection between them better. According to Sarwar et al. (2018), NASH is accompanied by a lower survival rate than NAFL and demise, mostly caused by heart disease. It was also established that higher liver enzymes, for instance, Alanine Aminotransferase (ALT) and Aspartate Aminotransferase (AST) are predisposing factors for the development of end-stage liver disease (Tutunchi et al., 2019). Originally it was believed that NAFL could not develop to NASH. However, this was disputed by Dharmalingam and Yamasandhi (2018), who stated that in the presence of predisposing factors, NAFL patients could progress to NASH with fibrosis. Patients with slight swelling or fibrosis were at a greater risk for advancement than those with only liver fat accumulation. Any development followed concurrently with elevated ALT, higher weight increase, and higher diabetes occurrence.

HCC, the ultimate stage for NAFLD, is the most prevalent form of primary liver cancer and is the fastest escalating cause of cancer-associated deaths in the US. Prolonged hepatitis C (HCV), hepatitis B (HBV), NAFLD, diabetes, or heavy alcohol consumption are predisposing factors for HCC. Dharmalingam and Yamasandhi (2018) reported that the incidence of HCC has been declining in Japan and parts of China, which were conventionally high-risk areas but snowballed in North America. Polyzos et al. (2019) established that this tendency is a result of higher rates of HCV, HBV, and NAFLD and that Hispanic Americans with HCV or NAFLD have a higher possibility of advancement cirrhosis and HCC.

An exhibition of MetS in the liver has traditionally been considered to be NAFLD. The confirmation of three of five of the following elements entails the identification of MetS. They are plumpness, hypertension, low HDL fat, hypertriglyceridemia, and fasting hyperglycemia. Diagnosis is reached based on over 102 cm waist circumference for males and 88 for females, blood pressure above 135/85, fasting blood glucose above 100 mg/dl, HDL below 40 mg/dl in males and 50 mg/dl in females, and triglycerides exceeding 150 mg/dl (Tutunchi et al., 2019). Polyzos et al. (2019) noted NAFLD had been found to present similar clinical and laboratory data to diabetes and obesity, comprising insulin resistance, higher triglycerides, elevated uric acid, and low HDL fat.

As established by Polyzos et al. (2019), MetS was a significant predisposing factor for NASH. The escalating incidence of obesity and diabetes in the population would increase liver failure in the future, which is the case now. Numerous studies of ALT and NAFLD's connection have established that NAFLD is the common basis for the baffling mild ALT rise (Chandrasekharan & Alazawi, 2019). Dharmalingam and Yamasandhi (2018) recommend that when without viral hepatitis or excessive alcohol intake and high ALT is exhibited, NAFLD is the reason.

Presently, NAFLD is a predisposing factor for many diseases, such as type 2 diabetes mellitus (T2DM), heart disease, chronic kidney disease (CKD), polycystic ovarian syndrome, disruptive sleep apnea, psoriasis, osteoporosis, stroke, acute pancreatitis, and lately with sarcopenia (Chandrasekharan & Alazawi, 2019). After chronic hepatitis C, NAFLD has become the second most prevalent symptom for liver transplant (LT), with fresh LT waitlist registrants rising by 170% from 2004-2013 (Le et al., 2017). NAFLD is equally a cause of the advancement of T2DM, but it is also a result of pre-existent T2DM. Two large meta-analyses established this association, with 58% of NAFLD patients developing T2DM (Fan et al., 2017).

The probability of developing T2DM was realized to be three times higher for patients with NASH versus SS and indicated a greater possibility of NAFLD advancement to NASH and HCC. Generally, diabetes and NAFLD’s co-occurrence in a patient escalates, and problems are associated with both diseases (Anstee et al., 2016). CVD’s elevated possibility has continuously been seen with studies reporting higher carotid artery thickness, a rise in arterial stiffness, the compromised flow of enlarged blood vessels, and endothelial dysfunction (Kim et al., 2016). A 2016 study established that NAFLD’s advancement is linked to the escalated possibility of subclinical carotid atherosclerosis (Bellentani, 2017).

According to Airaghi et al. (2018), while the surge in heart disease cases has been reported; however, there is a need for further research to confirm whether the resultant rise in mortality is due to common predisposing factors or NAFLD itself. An examination of 64,000 individuals revealed that NAFLD was linked with a two-time proliferation in the case and predominant CKD (Airaghi et al., 2018). For instance, with more advanced forms, NAFL with fibrosis and NASH were more certainly associated with CKD in contrast to SS (Doycheva et al., 2017). Evaluations conducted by Airaghi et al. (2018) confirm the correlations between NAFLD’s rising susceptibility and links with predictions indicating a snowballing worldwide outcome.

Management of NAFLD entails treatment of the liver infection combined with the way of life adjustment to minimize the predisposing factors of diabetes, plumpness, and high levels of fat in the blood. Weight loss through adopting healthy food options and workouts has been recommended to clinicians to prevent fat accumulation in the liver, swelling, and scarring (Bellentani, 2017). According to Tutunchi et al. (2019), a 3-5% body weight loss can decrease fat in the liver, thereby improving NAFLD outcomes. Through lifestyle modifications of adopting low-calorie nourishment with enhanced exercises, this can be achieved. Exercise alone without weight loss has been reported to improve NAFLD outcomes; however, a combination of physical activity, treatment, and nutrition modifications would produce better results (Bellentani, 2017). Some NAFLD patients have resorted to bariatric surgery to lose weight, and the benefits have been proven to be beneficial.

Further research needs to be conducted on the efficacy of metformin for NAFLD patients since this treatment has always been prescribed for diabetic patients (Johnson et al., 2018). The recommended choices for weight loss are nutrition modifications and workouts since there is no standardized pharmacological cure. Less than 7% of body fat loss has been considered a silver bullet for NASH patients since it has resulted in disease reversion. However, this routine adjustment is easier said than done (Kaswala et al., 2016). Further research on this topic has established the need for improved treatment and hindrance strategies for dealing with the escalation in the advancement of related conditions since it has become a universal problem (Bellentani, 2017).

Diagnosis and Staging of NAFLD

The America Association Investigation Liver Illnesses expressed and acknowledged NAFLD’s general arrangement as a hepatic fat volume surpassing 5–10% by the liver’s heaviness. Therefore, NAFLD depends on the existence of simple steatosis dictated by histological methodology, weekly average usage of below 140 grams of ethanol for men, and less than 70 grams for women over the last year. NAFLD's effective therapy requires proof of hepatic steatosis on image analysis and histology and the separation of all other causal factors, such as steatosis (Gallacher & McPherson, 2018).

The development of obesity over the last few years has increased in NAFLD. 70 % of overweight individuals with diabetes and high blood pressure were confirmed to have a liver biopsy with steatohepatitis (Gatos et al., 2019). In addition, Gatos et al. (2019) reported that there were 70 to 80% of overweight people from the respondents and 50 to 80% of victims had type 2 diabetes mellitus (T2DM). NAFLD is usually asymptomatic; thus, treatment generally follows a secondary result of unusual liver enzymes or visualization steatosis.

Early detection of NAFLD needs competent and knowledgeable healthcare professionals to prevent fibrosis development toward more late stages. Liver needle puncture biopsy, though intrusive, is a standard technique. Less harmful methods for image analysis instruments did not offer accurate information due to physicians' debatable analysis of the evidence. Imaging instruments like abdominal ultrasound, tabulated tomography, and magnetic resonance imaging are starting to address this need. Ultrasound or imaging is quite useful in medicating steatosis, in which more than 33% of liver cells are steatosis but may be ineffective at a lower level of steatosis (Gangadharan et al., 2017).

Some detection methods, like CT or MRI, may recognize hepatic steatosis, but they cannot be used for steatosis assessment. The integration of MRI and proton magnetic resonance spectroscopy (MRI/1H-MRS) is presently the most precise non-destructive steatosis evaluation metric. The 1H-MRS is the most accurate measurement tool because it describes NAFLD as hepatic fat accumulation with more than 5% of the overall liver weight (Feier et al., 2019). Nevertheless, it is not commonly accessible because the cost of purchasing is very high and cannot be afforded by many healthcare facilities. On the other hand, ultrasonography has become the main use in many healthcare facilities because it is affordable and available to many (Gangadharan et al., 2017). The main problem associated with the use of ultrasonography is the identification of NAFLD, which is riskier than the detection of HCC steatohepatitis, fibrosis, and liver cirrhosis.

The regulated amplification parameter is an innovative ultrasound-based method that evaluates the liver and steatohepatitis rigidity simultaneously using transitory elastography. However, the monitored amplification parameter has not been established at its diagnostic level. Diabetes and being overweight are potential possibility factors for NAFLD (Koch & Yeh, 2018). The existence of Type 2 diabetes mellitus was found to raise the pervasiveness of NAFLD, irrespective of the treatment option significantly. For example, by using a regulated amplification parameter, NAFLD's pervasiveness is approximated at 75% in the Type 2 diabetes mellitus populace and 40% in the general public. Further, it is forecasted at 65% and approximately 37%, respectively, when measured using 1H-MRS. The incidence rate decreases when evaluated by liver ultrasonography, tomography, and plasma ALT (Siu et al., 2018). On the contrary, many populations worldwide research focus their NAFLD classification on less sensitive and perhaps less precise surrogate disease markers, which include increased liver-associated enzymes like aspartate aminotransferase and alanine aminotransferase. Furthermore, serum ALT rates are in the scope universally considered to be usual in a substantial number of NAFLD subjects.

Usually, based mostly on comparison rates of various research centers, the scope for standard AST is about 10 to 40 IU / L, ALT, around 7 to 56 IU / L (Koch & Yeh, 2018). ALT tends to fall as fibrosis advances toward liver disease. Moderate peaks that are usually harmless are three times higher than the average spectrum, and sharp heights are five times greater than the upper maximum of average, which differs by sexual orientation. Furthermore, a precise indicator of an ALT level in terms of skin color or race underlines the lack of proper substitute indicators for NAFLD, mostly in an apparent lack of biopsy (Cubero, 2020). Thus, there is a need to use ground-breaking methods in classifying subjects with NAFLD rather than depending on liver enzyme defects.

Research is ongoing to explore serum risk factors for NASH because it is linked to increased apoptosis. Thus, apoptosis blood markers could help differentiate NASH from hepatic steatosis. Apoptosis triggers caspases that form a range of contaminants, including cytokeratin-18 (CK-18), a primary amine hepatocyte filament protein that can be identified via a Tests using an M30 antibiotic recognize NASH victims (Rinella & Sanyal, 2016). Nevertheless, liver biopsy offers an excellent evaluation of steatosis, hepatocellular injury, swelling, and fibrosis, including its opportunity to show the existence of hepatocyte ballooning and deterioration associated with steatosis mostly as the main histological element which differentiates NASH from easy steatosis (Dulai et al., 2017). Further, since only 7–30% of NAFLD patients throughout the global population had such evidence of biopsy for precise assessment, Younosis et al. reassessed and confirmed that perhaps the worldwide incidence of NASH is around 1.5 and 6.45% and that of United States from an average rate of 8.69% (approximately 7.2 and 14.63%). As far as fitness is concerned, results suggest that the histological analysis of NASH could be authenticated in about 47% of all NAFLD instances among overweight people (Rinella & Sanyal, 2016).

Liver injury is the undue accumulation of cellular proteins, including collagen, in several liver problems, such as NAFLD. The fibrosis phase is a critical histological factor for predicting mortality (Dulai et al., 2017). There are known predictive factors of fibrosis, which is an underpass to liver failure. Most of these health conditions include maturity (> 45–50), Body mass index (> 28–30 kg / m2), insulin sensitivity, high blood pressure, and hypertension (Thrasher & Abdelmalek, 2016). Setting up liver fibrosis is crucial across all NAFLD patients to target individuals with active disease who could eventually develop liver-related health problems, including hepatocellular disorder and portal hypertension.

Non-invasive and an implicit evaluation conducted from all individuals with severe liver illness, like kids, often include medical tests like liver function (low albumin), full blood count, and clotting profile. It is worth acknowledging that perhaps the prevalence of Type 2 diabetes massively enhances atrial fibrillation's pervasiveness comparable with those of NAFLD (Drolz et al., 2018). In brief, an initial analysis of NAFLD is fundamental to counteracting the development of the illness. Liver biopsy is invasive and, therefore, cannot be practiced regularly. The NAFLD exercise rating is essential as part of the therapeutic process. However, the rating for fibrosis is necessary.

Each level of fibrosis rating represents the severity of the disease within the liver. Some non-invasive fibrosis visualization assessments in the industry, like FibroScan, provide liver stiffness metrics utilizing pulse-echo ultrasound as a potential marker for fibrosis. Also, a sound radioactivity impulse uses conventional B-mode ultrasounds to generate an ultrasonic pulse and evaluate liver cells' reaction as a shave upsurge speed (Leong et al., 2020). The Centers for Disease Control and Prevention developments that diabetes is likely to influence the growth rate of fibrosis.

NAFLD in Alaska Native/ American Indian (AN/AI)

Studies indicate that NAFLD is the leading contributor to chronic liver disease in the AI/AN, a condition that is attributed to the predominance of risk factors for NAFLD in the region, including obesity, hypertriglyceridemia as well as type 2 diabetes (Alkhalili et al., 2017; Jacobs-Wingoet al., 2016; Narayanasamy et al., 2020). For instance, one reason why NAFLD is prevalent in AN/AI is related to the prevalence of risk factors such as obesity, which is currently ranked between 24%-40% and the highest in all other American ethnic groups. Likewise, studies demonstrate that the prevalence of diabetes, a crucial risk factor for NAFLD, is much higher in AN/AI than any other ethnic group and ranges from 9.7% to 19.7% (Pratte et al., 2019). Notably, it is worth underscoring that the prevalence of these risk factors and conditions, which are a precursor for NAFLD in AN/AI, are projected to increase in the future, heightening NAFLD's risk the region.

One factor that contributes to the prevalence of NAFLD in AN/AI is alcohol consumption. As noted by Mera et al. (2019), alcohol consumption has, for years, been linked to the predominance of NAFLD in NA/IA because lifestyle plays an important role in the prevalence of NAFLD. A recent study estimated that 65% of all deaths in NA/AI were attributed to chronic liver disease (Narayanasamy et al., 2020). As such, the purpose of this study was to investigate the prevalence of NAFLD in AN/AI in terms of the risk factors, interventions, management, and prevalence and how its prevalence can be combated.

Risk Factors for NAFLD

Gender, Age, and NAFLD

Typically, NAFLD prevalence varies based on gender. The predominance of NAFLD and NASH is higher in males compared to females. According to meta-analysis studies, females have a lower danger of liver failure compared with male gender through their regenerative stage. Johnson et al. (2018) stated that women are at a lower risk of getting NAFLD than men, particularly during the reproductive period (Leone et al., 2019). Women experiencing upper-body obesity, phenotype, and abdominal fat depots are likely to lose their protective capacity and tend to have a higher NAFLD rate than men.

Notwithstanding sexual orientation, age differences play a significant role in determining the prevalence of NAFLD. Based on NHANES’s documentation, NAFLD’s prevalence increased from 3.9% in 1988 to 1994 to 10.7% in 2007-2010. Based on the study findings, it is essential too however, to note that a significant part of the surge in the prevalence of NAFLD was higher and different based on age and ethnicity and was predominately in males and women aged between12-19 years (Younossi et al., 2016).

Even though the analysis includes people aged 30-70 years old, the results suggest that there was a significant rise in the rate of NAFLD prevalence in participants aged 50-60 years, with 16.1 % in 30-40 years, 22.3 % in 41-55 years, 29.3 % in 51-60 years, and 27.6 % in females aged 60 years old (Younossi et al., 2016). In effect, the results were linking the rise and risk of NAFLD to a given age group or range (Tobari & Hashimoto, 2020). In females, the predominance of NAFLD increased with differences in hormonal changes specifically, with 12.5% in women aged 30 to 40 years, 16.1% for those who were 41 to 50 years, 21.6% in women aged 51 to 60 years as well as 25.4% in women aged 60 years and older (Younossi et al., 2018).

According to past research studies, women are in more danger of NAFLD disorders. However, the findings lack validity because it was not society-based hence sensitive to possible favoritism (Younossi et al., 2016). Founded on third information collected from NHANES, many researchers showed that NAFLD is hugely prevalent in males than in females. Dichotomizing persons to lean and fat-obese individuals shows that perhaps the lean NAFLD group was most widely women (Loguercio & Gravina, 2019). Integrating statistics patients from NASH health study Net individuals with operation showed that NASH was more prevalent among women. Unlike men at a ratio of approximately 2:1, they were potentially generating higher illness hardships in females, conversely, sex differences between those seeking and obtaining medical care.

Collectively, such results-oriented unknowns about the impact of sex on NAFLD. The variety of interventions could lead to sex differences in the pervasiveness of NAFLDs (Herath et al., 2019). Previous studies have suggested that women are at a higher risk of suffering from NAFLD than males. However, it is essential to underscore that some of these studies were not essentially population-based and were inherently subjected to ascertainment bias (Younossi et al., 2016). On the other hand, data released by NHANES suggest that most of the studies conducted on NAFLD reveal that the condition is more prevalent in men than in females. Nevertheless, upon dichotomizing participants into different groups, specifically the lean and overweight-obese sub-groups, Younossi et al. (2018) established that NAFLD was more predominant in females than males. By utilizing raw data from 698 participants to investigate the prevalence of NAFLD, Younossi et al. (2016) established that NAFLD burden and prevalence were higher in men than women among those who sought medical interventions. As such, the current findings depict mixed conclusions relating to the extent to which NAFLD is prevalent based on gender differences.

According to Younossi et al. (2018), while there are inconclusive findings on NAFLD's predominance in different genders, it is worth noting that practical factors may contribute to gender variations in NAFLD's prevalence is contextualized. For instance, the role that insulin resistance has remained unknown and controversial as it is closely linked to NAFLD (Bellentani, 2017). Hartmann and Schnabl (2018) attributed insulin resistance to the higher rates of NAFLD in men (4.3%) than women (1.6%). These results are explained using the higher waist-to-hip circumference ratio in men than women responsible for accumulating fatty acids.

As supported by Younossi et al. (2016), the difference in NAFLD prevalence across the genders is linked to the differences in the west-to-hip ratio, which is directly related to visceral adipose tissue correlated with hepatic insulin resistance. Alcohol consumption is another aspect that could be linked to the differences in NAFLD prevalence between males and females. In particular, Rayyan and Tayyem (2018) reported that alcohol consumption was linked to variations in NAFLD predominance between males and females. According to the findings, alcohol consumption in males directly contributes to NAFLD progression compared to women who did not take alcohol. However, as noted by Villanueva-Ortega et al. (2019), one of the critical questions relates to the impact of alcohol on NAFLD's progression and prevalence. Longitudinal studies such as Rayyan and Tayyem (2018) have shown that light consumption of alcohol is linked to a minimum but statistically significant risk for various diseases such as NAFLD.

Other attributes, such as individuals' lifestyles and hormones, may impact the gender disparity in NAFLD prevalence. According to research, individuals with NAFLD had equal levels of insulin resistance and obesity to those without NAFLD. However, men with NAFLD took more non-diet soft drinks per week compared to females. A new report found the prevalence of NAFLD was equivalent in intra-pubertal young males and higher in post-teenage categories, at 51.2%, while in NAFLD, young ladies were the most prevalent in the teenage cohort (Bouchi et al., 2017).

Ethnicity and NAFLD prevalence

Ethnicity is another factor influencing NAFLD's frequency, with the most significant numbers being reported in Hispanics, followed by non-Hispanic whites and African Americans. According to Younossi et al. (2018), statistics relating to NAFLD prevalence in Hispanics tend to double (45%-58%) compared to African Africans. The latter have 24%-35%, with Latinos reported having a higher rate of prevalence (Kalia & Gaglio, 2016). Similar findings show that genetic factors play a significant role in determining NAFLD prevalence rates in different ethnicities.

Another research suggests that Hispanics have a higher incidence than black Americans who have lesser NAFLD pervasiveness than white Americans. According to statistics from the third NHANES, both African American and Mexican women have a higher potential risk for circulatory illness, including hypertension, lack of exercise, advanced Body Mass Index, and diabetes compared with American females with similar socioeconomic status. The rising incidence of hepatic steatosis in Hispanics is the increased rate of obesity and IR (Manco, 2017). However, there is no clarification for the smaller percentage of hepatic steatosis in Black Americans for the same purpose. According to the Insulin Confrontation Atherosclerosis Report, black citizens were resilient compared with Hispanics. On the other hand, Hispanics have an increased concentration of NAFLD than black Americans with 24% and 10%, respectively. There could perhaps be an IR inconsistency. The disparities in NAFLD by ethnicity are theorized to originate from inequality in the prevalence of adiposity (hypodermic vs. innards), and variations in triglycerides since black Americans possess somewhat fewer VAT and lesser triglycerides compared with Hispanics. Additionally, black Americans are more resilient to triglyceride accumulation in the instinctual stomach section and IR-related hypertriglyceridemia (Saab et al., 2016).

Obesity and NAFLD

Globally, studies estimate that the prevalence of NAFLD in obese individuals is about 30% -37%. However, the most exciting findings are reported by Polyzos et al. (2019), who say that abdominal obesity, associated with waist circumference, is significantly related to NAFLD. For instance, a recent study conducted in 2017 established that NAFLD was strongly correlated with visceral adiposity, signifying that obesity is a crucial risk factor for NAFLD. Similarly, Divella et al. (2019) demonstrated that visceral adipose is a high-risk factor for NAFLD.

As reported by Sarwar et al. (2018), obesity is a global healthcare problem. In the US, at least 300,000 deaths are related to obesity annually. As such, Divella et al. (2019) and Sarwar et al. suggested that obesity tends to increase the risks of developing chronic illnesses such as insulin resistance, cardiovascular complications, high blood pressure, and NAFLD, among others. As defined by Sarwar et al., obesity refers to an excess amount of body fat. Typically, the healthy amount or level of body fat ranges from 25%-30% in females and 18%-23% in men. In effect, females with at least 30% body fat and men with 25% body fat are obese (Burini et al., 2019; Sarwar et al., 2018).

Typically, a moderate increment of 2 kg in weight inside is considered a risk factor for NAFLD. Younossi et al. (2018) stated that obesity has also is a primary additive factor that increases steatosis and is linked to alcohol use (Qiu et al., 2017). Even though it is usual to have NAFLD in overweight individuals, it is increasingly important to show NAFLD's severity in patients with liver scarring. Globally, the combined occurrence of being overweight in NAFLD is noted to be 51%.

Sleep Deprivation and NAFLD

Lack of sleep is a common medical problem for thousands of people across the world. Epidemiological studies demonstrate that lack of sleep is connected to overweight, which plays a vital role in NAFLD's pathogenesis. Of late, segment bunch specialists have portrayed that the absence of rest might be fundamentally connected to NAFLD with a risk of 1.28 in males and 1.71 in females. A recent study by Wei et al. (2020) suggested a statistically significant relationship between the increased risks of NAFLD and sleep deprivation and poor sleep patterns in Koreans. In a different study by Shen, Wang, and Yan (2016), it was established that sleep deprivation was closely linked to NAFLD in Japanese men who took part in the study that sought to investigate the relationship between sleep deprivation and its prevalence of NAFLD.

While the exact mechanism of sleep deprivation and its link to NAFLD remains unknown, several possible explanations have been provided by different studies. For instance, Wijarnpreecha et al. (2016) stated that sleep disturbance and short duration could weaken insulin signaling and glucose tolerance. Also, studies such as Sarwar, Pierce, and Koppe (2018) have also noted that sleep deprivation can induce the progression of insulin resistance and subclinical inflammation in females. In particular, Jullian-Desayes et al. (2020) stated that sleep deprivation induces inflammatory cytokines, including interleukin-6, connected with NAFLD progression, and alters the hormonal balance of leptin or ghrelin, which generally regulate appetite.

Diabetes and NAFLD

According to Tilg et al. (2017), pre-existing medical conditions, particularly type 2 diabetes, are statistically associated with NAFLD prevalence. At least three-quarters of individuals diagnosed with type 2 diabetes are reported to have NAFLD. Similar thoughts are expressed by Dharmalingam and Yamasandhi (2018), who state that type 2 diabetes is linked to insulin resistance resulting in NAFLD. As such, Wei et al. (2020) state that type 2 diabetes is a significant risk factor of NAFLD (Scorletti & Byrne, 2016).

Genetic Factors and NAFLD

Recent studies suggest a direct link between the prevalence of NAFLD and genetic factors (Chandrasekharan & Alazawi, 2019). In particular, Severson et al. (2016) adduce that hereditary factors play a significant effect on individuals’ vulnerability to NAFLD and the subsequent progression to other advanced acute conditions. According to Scorletti and Byrne (2016), considerable inter-individual variance in terms of genes and susceptibility to NAFLD has been reported, and its prevalence rate among the affected group of people is alarming. Severson et al. (2016), Sookoian and Pirola (2017), and Trépo and Valenti (2020) show that genetic factors may cause individuals only to have NAFLD while in others, the conditions may progress to NASH, fibrosis, and its acute stage, which is liver cirrhosis.

Notably, researchers such as Sookoian and Pirola (2017) have established that gene proteins play an invaluable role in regulating hepatic metinalom, especially among the four types of genes (TM6SF2, PNPLA3, NCAN, and PPP1R3B) that facilitate the progression of NAFLD into its advanced stage. The most important thing to note is that genes such as PNPLA3 and TM6SF2 tend to replicate in different ethnicities and locations differently, influencing the disease’s severity and prevalence among individuals (Chandrasekharan & Alazawi, 2019; Sookoian & Pirola, 2017).

While obesity, lifestyle practices, and insulin resistance are considered to be the leading risk factors of NAFLD, it is evident that environmental factors and genetic materials significantly influence NAFLD's progression and prevalence in individual differences (Sookoian & Pirola, 2017). Given Chandrasekharan and Alazawi (2019) and Sookoian and Pirola (2017), the heritability and interethnic variants susceptibility demonstrate that genetic factors could play a significant role in dictating the phenotypic expression of NAFLD. Trépo and Valenti (2020) and Umano et al. (2017) stated that in most cases, in not all, NAFLD clutters for families having individual genetic variations on TM6SF2, PNPLA3, NCAN, and PPP1R3B genes may increase their hereditary chances of NAFLD by 27% among family members. In particular, the common genetic variant that links to NAFLD is the missense mutation (Barbara et al. , 2018; Chandrasekharan & Alazawi, 2019).

Reputable evidence from epidemiological and familial-aggregation research and twin studies has typically provided rich and extensive knowledge on NAFLD and its relatable outcome as far as genes are concerned (Severson et al., 2016). Based on the currently available information, the heritability estimations range from 20% to -70%, contingent on the study design utilized, ethnicity/race, and the research methodology used, in addition to the imaging technology used in the study (Severson et al., 2016; Sookoian & Pirola, 2017). Twin studies have shown that ALT levels, which mostly reflect liver fat content, are considered a heritable trait explained by up to 60% of the genetic factors (Barbara et al., 2018; Eslam & George, 2019). Given the above literature and synthesis, it is evident that genetic factors are key risk factors for NAFLD.

Eating habits could reinforce steatohepatitis by modifying hepatic triglyceride absorption and antioxidant digestion, and implicitly by influencing insulin levels and post-prandial triglyceride absorption (Anstee et al., 2016). Many researchers have described that diverse cultural and cultural categories have considerable variation in nutrition. A study in the United States established that Latinos significantly consumed starch with a smaller proportion of vigor, unlike African Americans and whites who tend to consume small portions (Dowla et al., 2018). White Americans had lower cholesterol consumption than in the other two categories, and Black Americans had a relatively high consumption of sugary foods.

Economic and Clinical Cost of NAFLD

Currently, the medical and societal cost associated with NAFLD in the US is approximated to be $292 billion (Younossi et al., 2016). However, current statistics project an increase in NAFLD patients' costs to increase by approximately 18% from 2000-2035. In this regard, it is evident that as long as NAFLD's medical effects continue to surge, the financial and societal burden related to the condition will also quadruple. A recent public report in European countries reputed that NAFLD's annual economic burden was €35 billion in four countries: Germany, France, Italy, and the UK (Burini et al., 2019; Sookoian & Pirola, 2017).

Epitomized with such an enormous clinical and economic burden, which is estimated to increase in the next two decades, Pirola (2017) projected NAFLD to pose an insurmountable hurdle to society exponentially. For instance, a systematic review conducted by Abdelmalek (2016), including 976 Medicare beneficiaries diagnosed with

NAFLD who were hospitalized from January 2010 to December 2010, indicated that the mean annual total payment for an individual was approximately $11,000. A different review conducted by Younossi et al. (2016) on 29, 5258 patients who benefited from Medicare and had NAFLD from 2005-2010 reported a sharp increase in annual charges for NAFLD for patients in 2005 of at least $2,624 to 5,132 in 2010. The current projections show that the US's Medicare claims are expected to increase from the current $103 billion to $188 billion, including economic and societal costs (Gordon et al., 2019). Based on the above literature, it is essential to note that the financial burden attached to NAFLD is enormous, and hence the end to ensure that its detection and screening are improved for early therapeutic interventions.

As one of the acute conditions, NAFLD has a set of health-related challenges. Approximately 64 million people in the United States and 52 million in the UK are reported to be influenced by the disease (Younossi et al., 2018). As such, there is a global surge in the number of patients suffering from NAFLD compared to other diseases or medical conditions considered to be life-threatening (Bril & Cusi, 2017). In effect, the primary focus is to ensure that there is a quick discernment of patients experiencing NAFLD who are at the highest risk of developing liver problems (Younossi et al., 2016).

NAFLD's prevalence has surged significantly in the recent past globally, especially in the last 2 decades. Notwithstanding the current standard liver biopsy symptomatic test, some non-obtrusive strategies are accessible for NAFLD examination across the world. By utilizing aminotransferase as a primary laboratory test for liver-related complications, NAFLD aminotransferases' dominance increased to 7.9% in the

United States (1988-1992) with severe liver conditions in 69% of the participants (Younossi et al., 2018). They use aminotransferase rates as an assessment research center for the examination of liver ailments. Shen et al. (2016) noted that a conducted meta-analysis recently shows that the use of hepatic ultrasonography in the diagnosis has provided an opportunity for reliable and more accurate detection of severe NAFLD, currently considered the best screening approach globally.

Reports show that NAFLD ultrasound analysis predominance is at least 17% in India and 46% in the United States. MRS stays the preferred exact and substantial non-aggressive symptomatic examination with a 33% NAFLD pervasiveness revealed in the Dallas Heart Study (Sherif et al., 2016). The center and South America report the most significant NAFLD rate at 31% and 32%, with the lowest rate in Africa's continent at 13.5% (Chowdhury & Younossi, 2016; Younossi et al., 2018). The variations in NAFLD's predominance are linked to the differences in the sample used in the study, diagnostic methods, dietary, and lifestyle practices.

Management of NALFD

According to a recently published report, obesity has been identified as the leading risk factor for NAFLD. According to Younossi et al. (2018), it is linked to antioxidant balance impairment, causing inflammation in liver tissues (Kobyliak et al., 2017). Conversely, the most significant indicator of NAFLD development and progression is arguably related to weight gain, which makes weight loss management an invaluable aspect of the long-term management of NAFLD as it is a key predictor of decline in liver aminotransferases or fat (Keating & Adams, 2016; Younossi et al., 2018).

Younossi et al. (2016) stated that the primary predictor of NASH resolution is the extent to which weight is managed. A decrease in weight would lead to reduced fatty acid in the liver and reduce adipose tissue inflammation to enhance insulin sensitivity and subsequent improvement in liver histology. Rayyan and Tayyem (2018) reported that patients are encouraged to change their lifestyle behaviors by engaging in weight loss practices to ensure that they lose less than 10% of their body weight to realize a significant change in cardiovascular risk. In addition to weight management, Younossi et al. (2018) noted that physical activity and diet modifications are other interventions that can be used to manage NAFLD.

Summary

Numerous studies have established a reliable connection between NAFLD, metabolic syndrome, and obesity. According to Younossi et al. (2018), inadequate identification and NAFLD reporting are why fewer cases than expected in the most extensive preventive care study. Patients are still advised to adopt healthier lifestyle options since it has been established that this condition is more common among senior citizens (Younossi et al., 2016).

Other predisposing factors for the high incidence rate entailed being male of Mexican American descent, type 2 diabetes, high cholesterol levels, high blood pressure, metabolic syndrome, heart disease, and high values for waist circumference, BMI, liver test function, eGFR, FibroScan and APRI scores (Trovato et al., 2016). Consistent with

Sarwar, Pierce, and Koppe (2018), major predisposing factors for NAFLD among type 2 diabetes patients are increased BMI, lower HDL levels, and poor nutritional regulation. Nonetheless, health professionals are also encouraged to conduct imaging assessments to identify NAFLD caused by metabolic syndrome and considerable variations in biochemical indicators to observe fatty liver epidemiology.

Examination of epicardial adipose tissue volume using MR imaging has been reported to be linked to NAFLD (Eslam & George, 2019). From these results, diabetes patients with slight steatosis have been advised to seek medical attention to decrease the probability of developing heart disease (Barbara et al., 2018). In line with Wei et al. (2020), highly acidic urine in both men and women has been reported as a predisposing factor for NAFLD. Consequently, clinicians have been advised to perform imaging examinations and consider other factors like high urine acidity, metabolic syndrome, and biochemical indicators in NAFLD diagnosis.

Barbara et al. (2018) stated that overweight and obese NAFLD patients: a case-control study" concluded that the control group had lower serum FFA than the NAFLD cases, which was considered an additional biochemical indicator. NAFLD patients were reported to have similar NAFLD activity scores and Steatosis Activity Fibrosis scores; however, the systems have restrictions in determining NASH scores (Fan et al., 2017). Consequently, Polyzos et al. (2019) resolved that health professionals should also consider using nonHDLc/HDLc indicators to predict NAFLD susceptibility.

NAFLD among non-obese patients is referred to as lean NAFLD. A survey involving 95,924 subjects conducted by Dharmalingam and Yamasandhi (2018) established that 8.16% of the population reported lean NAFLD. A non-intrusive method involving the use of Serum Uric Acid was used on non-obese patients to diagnose NAFLD, mainly concentrating on the status of fatty liver. The study's main objective was to establish the association between Serum Uric Acid and NAFLD occurrence in non-obese patients. It was found that subjects who had more fatty liver exhibited higher levels of Serum Uric Acid.

Type 2 diabetes and obesity are the main risk factors linked to NAFLD. Early diagnosis of the condition is necessary to avoid complications and related diseases, such as cirrhosis, liver scarring, NASH, and other medical apprehensions. As stated by Tutunchi et al. (2019), only a few cases of NAFLD are being detected and reported, yet there is an upsurge in the condition. The challenge with NAFLD identification is that it is restricted to biomarkers and images that detect fatty liver.

According to Sarwar et al. (2018), constant LFT for alcohol users are an indicator of NAFLD that providers should exploit when individuals start exhibiting specific health problems, for instance, high BMI and elevated cholesterol levels. However, not every obese or type 2 diabetic will develop NAFLD. Above and beyond, there is no treatment for the condition other than weight loss to reduce BMI and adopt a healthy diet to lower cholesterol levels, AIC, and high blood pressure. Maintaining a healthy body mass through regular workouts is advised to expel steatosis out of the liver. However, even without detecting NAFLD, health practitioners have been recommending lifestyle changes. Chapter 3 presents a discussion of the research methods and procedures that were used to collect data for analysis on the prevalence and the rate of NAFLD progression in the AN/AI population with and without elevated LFT.

Chapter 3: Research Method

Introduction

The purpose of this quantitative correlational study was to assess the relationships between age, gender, BMI, LFT, A1C, fasting glucose, NAFLD Fibrosis Score, FibroScan, MRE, ultrasound, and NAFLD progression. Obesity and metabolic syndrome are high-risk factors for NAFLD. The current high prevalence and projected growth of NAFLD worldwide on NAFLD in the Alaskan American Indian population (AN/AI), this research has a high potential to benefit the AN/AI patients and the broader scientific community. This research examined the prevalence and incidence estimates for NAFLD, the probability of NASH, and risk factors to identify the most at-risk patients of developing NAFLD in the AN/AI population. Secondary data were obtained from the ANTHC EHR charts and the ANTHC LDHP database.

Chapter 3 contains an overview of the methodology used for this study. This overview includes the study design, population, sampling method, sample size, instrumentation, and data analysis methods. Ethical considerations and study limitations are also described.

Research Design and Rationale

Research Methodology

I employed a quantitative methodology in this study. A quantitative research methodology uses numerical data to allow for statistical analyses, helps reduce biases, and is based on an objectivity paradigm (Bowers, 2017). Quantitative research measures include statistical, mathematical, or numerical analyses of data collected through questionnaires and surveys or by manipulating preexisting statistical data using computational techniques. A qualitative approach was not appropriate because the study did not focus on exploring a phenomenon or establishing a theory, model, or definition (Allwood, 2012).

Study Design

I employed a non-experimental quantitative study with a correlational design to determine if there were relationships between age, BMI, LFT, A1C, fasting glucose, NAFLD Fibrosis Score, FibroScan, MRE, ultrasound, and NAFLD of Alaska Native/American Indian patients. A non-experimental quantitative methodology with a correlational design was most appropriate for specific reasons. First, the study included numerical data that were analyzed to test hypotheses (McCusker & Gunaydin, 2015). Second, the choice of a non-experimental quantitative method with a correlational design ensured research objectivity as the researcher was separated from the research participants (McCusker & Gunaydin, 2015). Third, there was no manipulation of independent variables; thus, this study was a non-experimental quantitative method with a correlational design (McCusker & Gunaydin, 2015). Additionally, a non-experimental quantitative method with a correlational design was the correct design for the current study because the objective was to identify and evaluate the relationship between the dependent variables and the independent variables.

The use of a correlational quantitative research design meant the research was non-experimental. I measured variables and assessed the statistical relationship between them while excluding any influence from unrelated variables (Geddes, 2003; Rovai &

Jordan, 2004; Schenker & Rumrill, 2004). The analyzed data helped the researcher verify if there was statistically significant evidence supporting a relationship between the variables of interest.

According to Curtis et al. (2016), a correlational research design is a tool that allows researchers to assess the relationships between variables in a setting where variables can be measured numerically. One significant advantage of utilizing a correlational study is that the researcher can explore the magnitude of the aforementioned statistical relationships between variables and whether they are related or not (Babbie, 2013). Multiple regression was utilized in order to address the following research questions and hypotheses:

RQ1: Do outcomes (abnormal/normal) of LFT, hemoglobin A1C, lipids, BMI, and inflammatory markers predict or have a relationship with NAFLD progression?

> $H_0$1: Outcomes (abnormal/normal) of LFT, hemoglobin A1C, lipids, BMI, and inflammatory markers do not statistically significantly predict NAFLD progression.

> $H_1$1: Outcomes (abnormal/normal) of LFT, hemoglobin A1C, lipids, BMI, and inflammatory markers statistically significantly predict NAFLD progression.

RQ2: Does NAFLD surveillance have a relationship with the patients' outcome as measured by NAFLD Fibrosis score and FibroScan CAP Score?

> $H_0$2: NAFLD surveillance does not have a significant relationship with the patient's outcome as measured by NAFLD Fibrosis score and FibroScan CAP Score.

$H_1$2: NAFLD surveillance does have a significant relationship with the patient's outcome as measured by NAFLD Fibrosis score and FibroScan CAP Score.

Multiple regression was used to assess a relationship between a continuous dependent variable and either quantitative or categorical independent variables. The dependent variable NAFLD Fibrosis score was measured at the interval level of measurement. The NAFLD fibrosis score was composed of six variables, including age, hyperglycemia, BMI, platelet count, albumin, and AST/ALT ratio as independent indicators of advanced liver fibrosis (Angulo et al., 2007). The computational formula that was used to calculate the NAFLD score was as follows:

NAFLD fibrosis score = -1.675 + 0.037 × age (year) + 0.094 × BMI (kg/m2) + 1.13 × IFG/diabetes (yes = 1, no = 0) + 0.99 × AST/ALT ratio - 0.013 × platelet count (×109/L) - 0.66 × albumin (g/dL)

The NAFLD was unbounded mathematically, and this variable was measured at the interval level of measurement, which was required to perform multiple regression. Since the research questions pertained to the relationships between these types of variables, multiple linear regression was the best fit for data analysis for this study. Regarding research question one, multiple regression was used to predict a dependent variable measured as either the interval or ratio level, NAFLD progression in this case, based on independent variables, outcomes (abnormal/normal) of LFT, hemoglobin A1C, lipids, BMI, and inflammatory markers (Mertler & Vannata, 2013). Additionally, multiple regression analysis also determined the overall fit and the relative contribution of each of the predictors to the total variance explained (Mertler & Vannatta, 2013). In multiple regression, covariates may be added to the model in order to control for the effects they may have. Regarding research question two, multiple regression was used to assess the relationship between the continuous dependent variable, Fibrosis score, and the independent variable, consumption of AN/AI native food (yes/no). Additionally, other factors can be controlled. Multiple regression was also utilized to address research question three, in which the dependent variables were patients' outcomes (normal/abnormal measurements of LFT, A1C, fasting glucose, and NAFLD Fibrosis Score) and the independent variable NAFLD diagnosis (yes/no).

Population and Sample Selection

According to the 2010 Decennial Census, the percentage of the population who identify as American Indian or Alaska Native alone is 0.9% in the United States or 2.9 million people, and 1.7% or 5.2 million people identified as American Indian or Alaska Native alone or in combination with another race (United States Census Bureau, 2012). This study utilized data from the Alaska Native Tribal Health Consortium (ANTHC) LDHP database. The study employed purposive sampling. Purposive sampling is a non-probability sampling technique in which the researcher relies on their judgment when choosing members of the population to participate in the study based on the characteristics of a population and the objective of the study (Yang & Banamah, 2014). Purposive sampling was conducted because it has certain advantages applicable to this study. These include greater accessibility, faster speed, and lower costs associated with recruiting samples for the study (Coy, 2008). A purposive sampling strategy was chosen for the study because participants needed to meet a specific set of inclusion criteria to be eligible to participate in the study (Yang & Banamah, 2014). The inclusion criteria of the study were AN/AI patients in Alaska with NAFLD.

Quantitative sample size.

A priori power analysis was conducted initially using G*Power version 3.1.9.1.6 to determine the required minimum sample size for the study (Erdfelder et al., 1996). The study considered four factors in the power analysis, which included the significance level, also known as the Type I error, the effect size, the power of the test, and the statistical technique. The Type I error is the possibility of rejecting a null hypothesis, given that it is true (Haas, 2012). A 95% confidence level is used in most quantitative studies to provide sufficient statistical evidence for a test (Creswell & Poth, 2017). The effect size is the relationship measurement between the variables being measured in a study (Cohen, 1988). Cohen (1988) categorized effect size into small, medium, and large. Berger et al. (2013) reported that a medium effect size is significant, which provides a balance between having too strict (small) and too lenient (large) effect size. Lastly, the power of a test is the probability of correctly rejecting a null hypothesis (Sullivan & Feinn, 2012). In most quantitative studies, 80% power is usually used (Sullivan & Feinn, 2012). The statistical test to be used for this study is multiple linear regression. In order to conduct multiple regression to detect a medium effect size at a 5% level of significance, with 80% power, a minimum sample size of at least 92 participants was required. Figure 1 below provides this information.

Figure 1

*G*Power Sample Size Calculation for Linear Multiple Regression*

F tests - Linear multiple regression: Fixed model, R^2 increase

Analysis:	A priori: Compute required sample size		
Input:	Effect size f^2	=	0.15
	α err prob	=	0.05
	Power (1-β err prob)	=	.8
	Number of tested predictors	=	5
	Total number of predictors	=	7
Output:	Noncentrality parameter λ	=	13.8000000
	Critical F	=	2.3231265
	Numerator df	=	5
	Denominator df	=	84
	Total sample size	=	92
	Actual power	=	0.8035036

Sources of Data

As mentioned earlier, secondary data were obtained from the ANTHC LDHP database in order to address the research questions. The ANTHC is a non-profit tribal health organization designed to serve Alaska Native and American Indian peoples' health needs living in Alaska (The Alaska Native Tribal Health Consortium, 2020). In collaboration with the more than 175,000 indigenous and American Indian people in Alaska, the ANTHC provides health services, including integrated medical care at the Alaska Native Medical Center, wellness initiatives, disease testing and prevention, rural provider training, and rural water and sanitation facilities (The Alaska Native Tribal Health Consortium, 2020). The goal of The LDHP is to improve the health of indigenous and American Indians in Alaska who are either at risk of viral hepatitis or other liver diseases (The Alaska Native Tribal Health Consortium, 2020). Permission to use data from the LDHP database was sought for this study.

Validity

External Validity

External validity refers to the degree to which the study results can be generalized to the population. The studies that are utilizing convenience sampling present challenges to external validity in research (Etikan, 2016). Studies that involve purposive samples, such as this study, may have issues with the generalizability of the study findings to broader populations of interest (Etikan, 2016). This study was delimited to the LDHP database sample of NAFLD participants. There is only one LDHP in Alaska that serves the entire region, and the study was conducted within the Indian Health Services organization. Thus, the current study was generalizable to the AN/AI population.

Internal Validity

Internal validity refers to the validity of the findings within the research study. Testing hypotheses can involve threats to the validity of interpretation for quantitative researchers. Quantitative research may involve rejecting null hypotheses or failing to reject null hypotheses (Martin & Bridgmon, 2012). Consequently, threats to conclusive findings occur when quantitative researchers encounter a Type I error, which involves rejecting a valid null hypothesis (Ibrahim et al., 2013). The internal validity was improved by ensuring that the assumptions of multiple regression are met, which include normality of residuals, absence or outliers, independence, homoscedasticity, absence of multicollinearity, and linearity.

Reliability

ANTHC LDHP database maintained by the ANTHC was assumed to be reliable and updated with accuracy. There was no evidence to suggest that these two sources are other than valid and reliable sources of data for the study variables.

Data Collection and Management

Permission to access the data was sought to gain access to the data from the ANTHC LDHP database. Alaska Native/American Indian patients with NAFLD were included in this study. The variables included in the data set were age, BMI, LFT, A1C, fasting glucose, NAFLD Fibrosis Score, FibroScan, MRE, ultrasound, and NAFLD progression.

Data Analysis Procedures

Analysis of the resulting quantitative data was conducted using the statistical software suite Statistical Package for the Social Sciences (SPSS) version 23. The data were cleaned by examining the dataset for missing data (Field, 2013). If a value was missing, the entire case was removed from the analysis (listwise deletion). A case was dropped from the analysis in listwise deletion because it had a missing value in at least one of the specified variables. The analysis was only run on cases that had a complete set of data. Categorical variables (i.e., nominal variables) were dummy-coded for regression (Field, 2013).

Descriptive statistics of the data for the predictor and dependent variables were reported. A frequency and percentage summary was obtained for categorical variables. At the same time, the measure of central tendencies of means and standard deviations and minimum and maximum values was conducted for continuous demographic variables, such as age.

In order to address the research questions, multiple linear regression was conducted to test the following models for each specific research question:

RQ 1: Do outcomes (abnormal/normal) of LFT, hemoglobin A1C, lipids, BMI, and inflammatory markers predict or have a relationship with NAFLD progression?

- NAFLD Fibrosis Score = b_o + b_1 Age + b_2 Gender + b_3 liver function test + b_4 Hemoglobin A1C + b_5 Lipids + b_6 BMI + b_7 Inflammatory markers
- FibroScan CAP Score = b_o + b_1 Age + b_2 Gender + b_3 liver function test + b_4 Hemoglobin A1C + b_5 Lipids + b_6 BMI + b_7 Inflammatory markers

RQ 2: Does NAFLD surveillance have a relationship with the patients' outcome as measured by NAFLD Fibrosis score and FibroScan CAP Score?

- NAFLD Fibrosis score = b_0 + b_1Age + b_2Gender + b_3 NAFLD surveillance
- FibroScan CAP Score = b_0 + b_1Age + b_2Gender + b_3 NAFLD surveillance

Prior to conducting multiple linear regression, the testing of parametric assumptions was first accomplished. Parametric assumptions are statistical tests conducted to determine when normality or homogeneity of variance assumptions are met or satisfied (Mertler & Vannatta, 2013). Mertler and Vannatta (2013) said that multiple regression analysis includes linearity, normality, homoscedasticity, and multicollinearity (Mertler & Vannatta, 2013). Plots of the standardized residuals and the standardized predicted values were examined to assess linearity and homoscedasticity. If the plots were not curvilinear, there would be no violations of the assumption of linearity (Field, 2013; Tabachnick & Fidell, 2012). Additionally, if the plots formed a rectangular pattern, there was no violation of the homoscedasticity assumption (Field, 2013; Tabachnick & Fidell, 2012). A Shapiro-Wilk test of normality was used to determine if the data were normally distributed (Field, 2013; Tabachnick & Fidell, 2012). Kurtosis and skewness statistics were generated to assess normality further. Finally, the variable inflation factor (VIF) was calculated for each variable to determine if there was a violation of multicollinearity between any two variables (Mertler & Vannatta, 2013). If the VIF fell below 10, there was no violation of the multicollinearity assumption (Field, 2013; Tabachnick & Fidell, 2012). Outlier detection was assessed through visual inspection of the boxplots. The study variables and their operationalization appear in Table 1 below.

Table 1

Operationalization of Study Variables

Variable	Level of measurement	Type of variable	Operationalization	RQ
Age	Interval	Independent	Measured in years	1,2,3
Gender	Nominal	Independent	0 = male, 1 = female	1,2,3
Liver function	Nominal	Independent	0 = abnormal, 1 =	1
test	Nominal	Independent	normal	1
Hemoglobin	Nominal	Independent	0 = abnormal, 1 =	1
A1C	Nominal	Independent	normal	1
Lipids	Nominal	Independent	0 = abnormal, 1 =	1
BMI			normal	1
Inflammatory markers	Interval	Dependent	0 = abnormal, 1 = normal	2,3
FibroScan CAP Score	Interval	Dependent	0 = abnormal, 1 = normal	2,3
NAFLD Fibrosis score				
			Fibrosis scores range from 0 to 4	

Ethical Considerations

Permission was sought to access data from the ANTHC LDHP database. Any identifying information regarding the patients, such as names, telephone numbers, and addresses, was not collected.

Limitations

A limitation is a boundary imposed on the study by its nature. A quantitative analysis assumes that there was no interference or manipulation of data for the study (Field, 2013). Limiting factors also include lag, which applies to any data because it takes time to collect, analyze, and publish. A lag factor is the time it takes to collect and analyze data prior to publication.

There were a few potential limitations. The main limitation was the lack of information the dataset may provide for each dependent variable and about the patients' diet, which may be helpful in understanding the relationship between a six-month to two-year FibroScan. The AN/AI is also considered a vulnerable population in a research study. This study sought approval from the Institutional Review Board (IRB) to protect the rights of the patients.

Another limitation of the study was the use of convenience sampling, which limits the generalizability of study findings relative to probabilistic or random sampling techniques. Additionally, a correlational design could not deduce any cause-and-effect relationships between the study variables, as there was no manipulation of independent variables.

Summary

The purpose of this quantitative correlational study was to assess the relationships between age, gender, BMI, LFT, A1C, fasting glucose, NAFLD Fibrosis Score, FibroScan, MRE, ultrasound, and NAFLD progression. Secondary data were obtained from the ANTHC LDHP database in order to address the following research questions:

RQ1: Do outcomes (abnormal/normal) of LFT, hemoglobin A1C, lipids, BMI, and inflammatory markers predict or have a relationship with NAFLD progression?

RQ2: Does NAFLD surveillance have a relationship with the patients' outcome as measured by NAFLD Fibrosis score and FibroScan CAP Score?

This chapter provided a comprehensive description of the quantitative correlational research design used for this study. The results and findings from the data analysis are presented in Chapter 4, along with the tables and graphics, providing the descriptive results and inferences regarding the study variables' underlying connection. Following the findings' interpretations are provided in Chapter 5, along with the study's limitations, recommendations for providers and future studies, and implications for positive social change.

Chapter 4: Results

Introduction

This study examined the risk factors of NAFLD and NASH and risk factors for identifying patients who are most at risk for developing NAFLD in the AN/AI population using the LDHP database. Specifically, the following research questions and hypotheses were addressed:

RQ1: Do outcomes (abnormal/normal) of LFT, hemoglobin A1C, lipids, BMI, and inflammatory markers predict or have a relationship with NAFLD Fibrosis score?

$H_0$1: Outcomes (abnormal/normal) of LFT, hemoglobin A1C, lipids, BMI, and inflammatory markers do not predict or have a relationship with NAFLD Fibrosis score.

$H_1$1: Outcomes (abnormal/normal) of LFT, hemoglobin A1C, lipids, BMI, and inflammatory markers predict or have a relationship with NAFLD Fibrosis score.

RQ2: Do outcomes (abnormal/normal) of LFT, hemoglobin A1C, lipids, BMI, and inflammatory markers predict or have a relationship with FibroScan CAP Score?

$H_0$2: Outcomes (abnormal/normal) of LFT, hemoglobin A1C, lipids, BMI, and inflammatory markers do not predict or have a relationship with FibroScan CAP Score.

$H_1$2: Outcomes (abnormal/normal) of LFT, hemoglobin A1C, lipids, BMI, and inflammatory markers predict or have a relationship with FibroScan CAP Score.

The following is a description of the sample demographics, as well as a presentation of the results of statistical analysis conducted with SPSS software for each of the two research questions of this study. Descriptive statistics include measures of means and standard deviations for variables measured at the interval level of measurement and frequencies and percentages for variables measured at the nominal level of measurement. Additionally, the parametric assumptions of multiple regression were assessed, which included the assumptions of linearity, homoscedasticity, absence of multicollinearity, independence of observations, normality of regression residuals, and absence of outliers (Field, 2018). Multiple regression was conducted with SPSS software, and significance was assessed at the 5% level. A summary of the findings of this study is provided.

Description of Sample Demographics

The sample included N = 3816 participants consisting of 937 (23.9%) males and 1377 (35.2%) females. The ages of participants ranged from 18 to 92 years (M = 54.48, SD = 14.60). There were 1602 (40.9%) that did not provide their sex. Regarding race, there were 2,230 (56.9%) AN/AI and 84 (2.1%) non-native participants. There were 1,602 (40.9%) that did not provide information regarding race. Tables 2 and 3 provide this information.

Table 2

Sex

	Frequency	Percent
Male	937	23.9
Female	1377	35.2
Missing	1602	40.9
Total	3916	100.0

Table 3

Race

	Frequency	Percent
AN/AI	2230	56.9
Non-Native	84	2.1
Missing	1602	40.9
Total	3916	100.0

Study Measures

The independent (predictor) variables of this study included BMI, triglyceride level, A1C, alanine transaminase (ALT) level, aspartate transaminase (AST) level, Steatohepatitis, age, and gender. The two dependent variables included NAFLD Fibrosis scores and FibroScan CAP Scores.BMI ranged from 14.70 to 74.60 (*M* = 34.86, *SD* = 7.87); triglyceride levels ranged from 24.00 to 1874.42 (*M* = 179.43, *SD* = 118.28); A1C ranged from 4.10 to 12.55 (*M* = 6.15, *SD* = 1.14); ALT ranged from 7.66 to 1230.03 (*M* = 59.84, *SD* = 57.07); and AST ranged from 12.54 to 1188.13 (*M* = 47.99, *SD* = 49.24). Regarding the dependent variables, NAFLD Fibrosis scores ranged from 2.1 to 75.0 (*M* = 10.54, *SD* = 10.70), and FibroScan CAP Scores ranged from 0.00 to 400.00 (*M* = 306.22, *SD* = 55.51). Table 4 provides this information.

Table 4

Descriptive Measures of Study Variables

	Minimum	Maximum	*M*	*SD*
BMI	14.70	74.60	34.86	7.87
FS	2.1	75.0	10.54	10.70
CAP	.0	400.0	306.22	55.51
Trig	24.00	1874.42	179.43	118.28
A1C	4.10	12.55	6.15	1.14

ALT	7.66	1230.03	59.84	57.07
AST	12.54	1188.13	47.99	49.24

The variables ALT and AST were re-coded such that values less than 40 were coded as normal, and 40 or greater were coded as abnormal. Regarding ALT, 37.2% were abnormal, and 21.7% were normal. Regarding AST, 26.0% were abnormal, and 33.0% were within normal levels. Additionally, regarding Steatohepatitis, there were 174 (4.4%) participants with Steatohepatitis and 481 (12.3%) without Steatohepatitis. There were 3261 (83.3%) participants who did not have results for Steatohepatitis. Tables 5, 6, and 7 provide this information.

Table 5

ALT Category

	Frequency	Percent
Normal	851	21.7
Abnormal	1457	37.2
Missing	1608	41.1
Total	3916	100.0

Table 6

AST Category

	Frequency	Percent
Normal	1291	33.0
Abnormal	1017	26.0
Missing	1608	41.1
Total	3916	100.0

Table 7

Steatohepatitis

	Frequency	Percent
	3261	83.3
No	481	12.3
Yes	174	4.4
Missing	3261	83.3
Total	3916	100.0

Handling of Missing Data

As mentioned earlier, *N* = 3816 participants were included in the study. The percentages of missing data for the study variables ranged from 26.6% to 83.3%. With such data, if a value is missing, the entire case is removed from the analysis (listwise deletion). A case is dropped from the analysis in listwise deletion because it has a missing value in at least one of the specified variables. The analysis is only run on cases that have a complete set of data. Thus, multiple regression was conducted with SPSS utilizing listwise deletion, which is the default process in SPSS. Table 8 provides the frequencies and percentages of missing cases for each study variable.

Table 8

Missing Cases of Study Variables

	N	*M*	*SD*	Missing	
				Count	Percent
Age	2314	54.48	14.60	1602	40.9
BMI	2305	34.86	7.87	1611	41.1
FS	3231	10.54	10.70	685	17.5
CAP	2875	306.22	55.51	1041	26.6
Trig	2220	179.43	118.28	1696	43.3
A1C	2204	6.15	1.14	1712	43.7

ALT	2308	59.84	57.07	1608	41.1
Sex	2314	.60	.49	1602	40.9
Steatohepatitis	655	.27	.44	3261	83.3

Testing of Parametric Assumptions

Prior to conducting multiple regression, the assumptions of linearity, homoscedasticity, absence of multicollinearity, independence of observations, normality of regression residuals, and absence of outliers were assessed (Field, 2018). There was linearity and homoscedasticity as assessed by visual inspections of scatter plots of predicted versus standardized regression residuals. The scatter plots provided in Figures 2 and 3 reveal no apparent pattern, and the data points appear to be random, thus supporting the assumptions of linearity and homoscedasticity (Field, 2018).

Figure 2

Scatter Plot of Predicted Versus Standardized Regression Residuals (DV: NAFLD Fibrosis score)

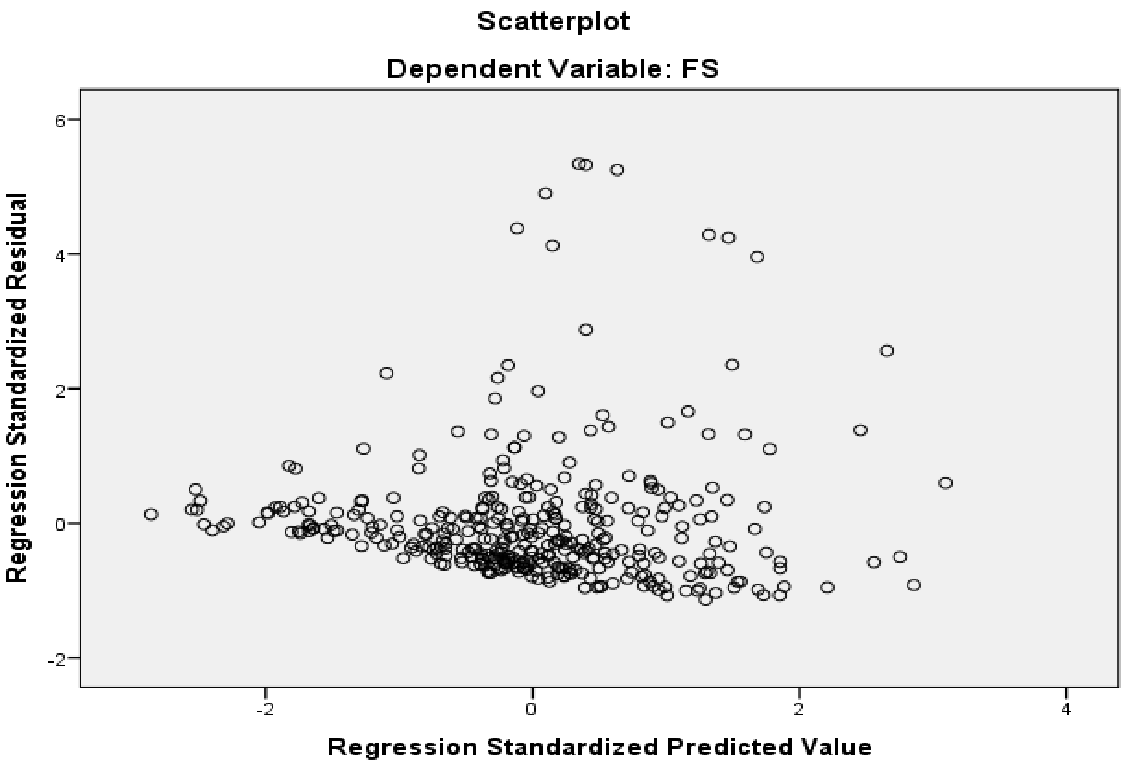
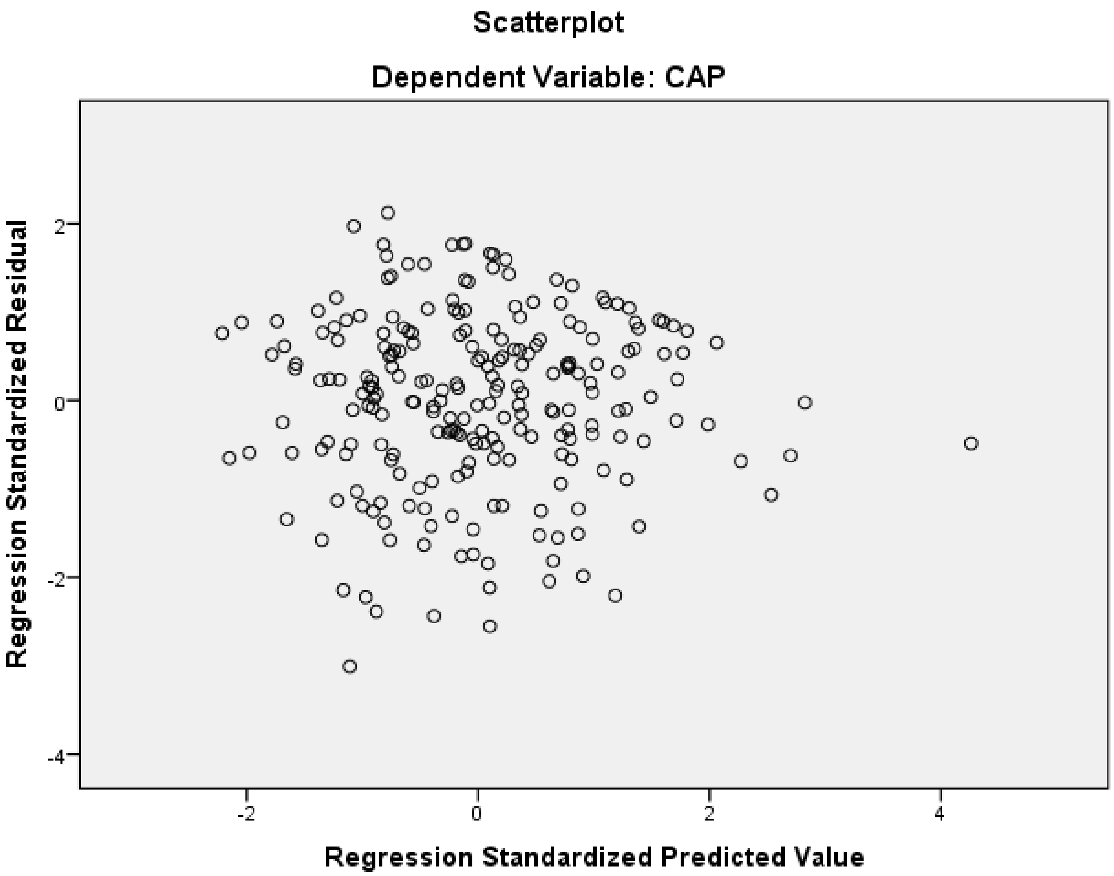


Figure 3

Scatter Plot of Predicted Versus Standardized Regression Residuals (DV: FibroScan CAP Score)



There was independence of observations as assessed by Durbin-Watson statistics ranging from 1.5 to 2.5. There was no evidence of multicollinearity, as assessed by VIFs less than 10. There were no outliers as assessed by standardized scores ranging from -3 to + 3. Lastly, there was approximate normality of regression residuals as evaluated through visual inspection of histograms of regression residuals (Figures 4 and 5).

Figure 4

Histogram of Regression Residuals (DV: DV: NAFLD Fibrosis score)

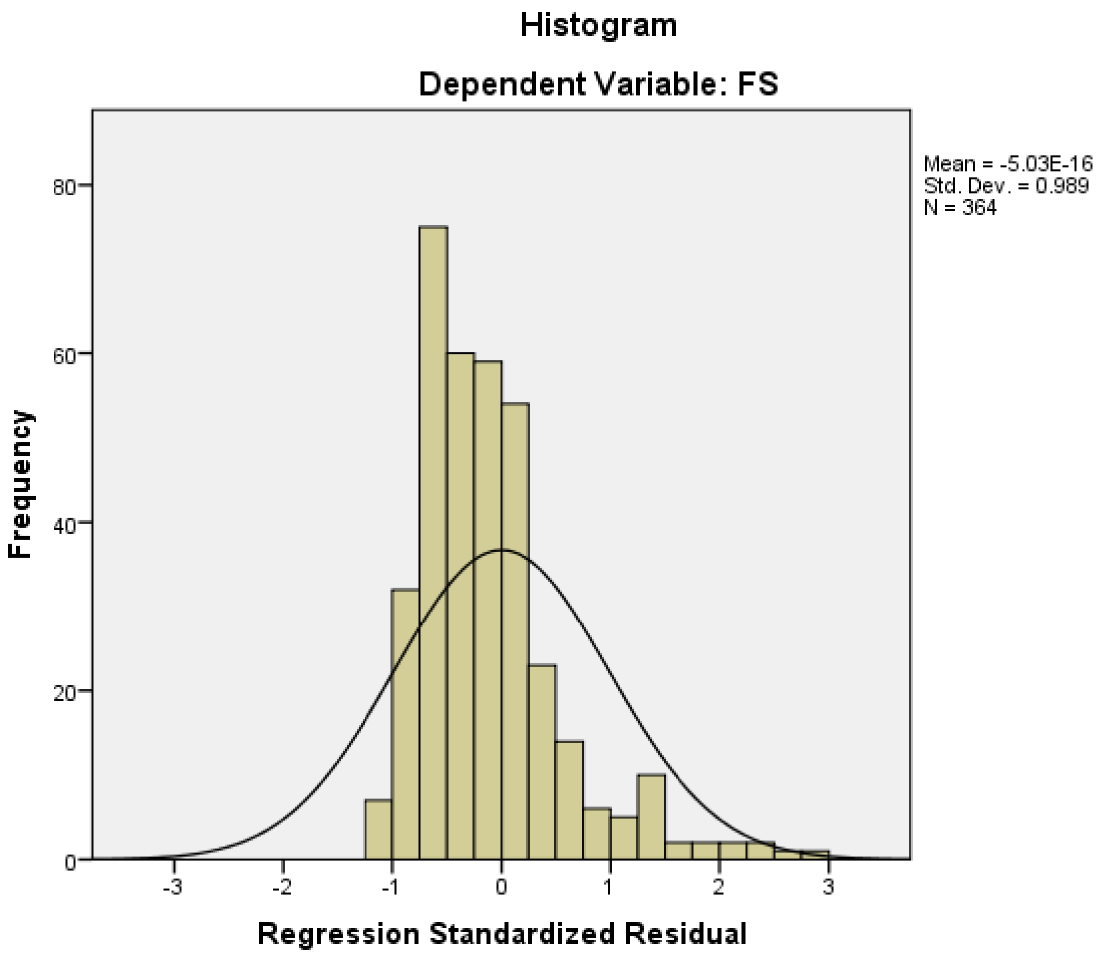
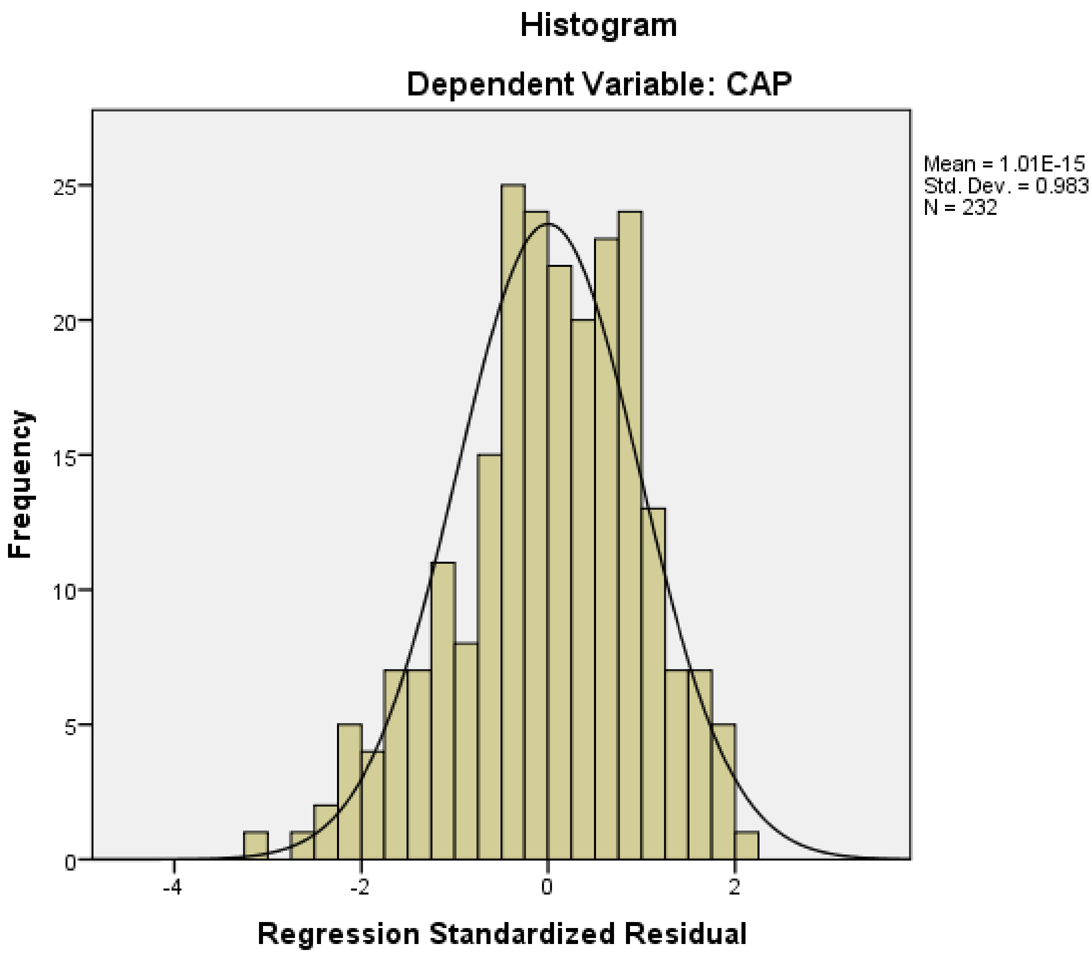


Figure 5

Histogram of Regression Residuals (DV: FibroScan CAP Score)



Results of Multiple Regression

Multiple regression was conducted with SPSS software in order to address this first research question and hypotheses:

RQ1: Do outcomes (abnormal/normal) of LFT, hemoglobin A1C, lipids, BMI, and inflammatory markers predict or have a relationship with NAFLD Fibrosis score?

$H_0$1: Outcomes (abnormal/normal) of LFT, hemoglobin A1C, lipids, BMI, and inflammatory markers do not predict or have a relationship with NAFLD Fibrosis score.

$H_1$1: Outcomes (abnormal/normal) of LFT, hemoglobin A1C, lipids, BMI, and inflammatory markers predict or have a relationship with NAFLD Fibrosis score.

The overall model was significant, F (8, 363) = 4.340, $p < .001$). The model explained 6.9% of the variance in predicting NAFLD Fibrosis score. Among the eight predictors, only three were significant. ALT (B = -5.668, p = .001), AST (B = 5.364, p = .001), and Steatohepatitis (B = 4.402, p = .002) were significant predictors of NAFLD Fibrosis score. An abnormal ALT value corresponds to a decrease in NAFLD Fibrosis score, whereas an abnormal AST value and Steatohepatitis corresponds to an increase in NAFLD Fibrosis score. Table 9 provides this information.

Table 9

*Multiple Regression Coefficients for Age, Sex, ALT, AST, A1C, Triglycerides, BMI, and Steatohepatitis Predicting NAFLD Fibrosis Score**

	Unstandardized coefficients		Standardized coefficients	t	p	Collinearity statistics
	B	SE	β			VIF
(Constant)	-.317	5.640		-.056	.955	
Age	.097	.051	.106	1.919	.056	1.190
Sex (female)	.377	1.281	.015	.294	.769	1.019
ALT (Abnormal)	-5.668	1.731	-.208	-3.274	.001	1.576
AST (Abnormal)	5.364	1.560	.217	3.439	.001	1.550
A1C	.802	.554	.079	1.447	.149	1.174
Triglycerides	-.010	.007	-.073	-1.351	.178	1.146
BMI	.097	.086	.060	1.126	.261	1.105
Steatohepatitis	4.402	1.414	.163	3.113	.002	1.067

* F (8, 363) = 4.340, $p < .001$

Multiple regression was conducted with SPSS software in order to address this second research question and hypotheses:

RQ2: Do outcomes (abnormal/normal) of LFT, hemoglobin A1C, lipids, BMI, and inflammatory markers predict or have a relationship with FibroScan CAP Score?

$H_0$2: Outcomes (abnormal/normal) of LFT, hemoglobin A1C, lipids, BMI, and inflammatory markers do not predict or have a relationship with FibroScan CAP Score.

$H_1$2: Outcomes (abnormal/normal) of LFT, hemoglobin A1C, lipids, BMI, and inflammatory markers predict or have a relationship with FibroScan CAP Score.

The overall model was significant, *F* (8, 231) = 7.716, $p < .001$). The model explained 18.9% of the variance in predicting the FibroScan CAP Score. Among the eight predictors, four were significant. AST (*B* = -22.328, *p* = .016), A1C (*B* = 7.417, *p* = .029), triglycerides (*B* = 0.138, *p* = .001), and BMI (*B* = 2.583, $p < .001$) were significant predictors. An abnormal AST level corresponds to a decreased FibroScan CAP Score. Increasing A1C, triglycerides, and BMI corresponds to increasing FibroScan CAP Scores. Table 10 provides this information.

Table 10

Multiple Regression Coefficients for Age, Sex, ALT, AST, A1C, Triglycerides, BMI, and Steatohepatitis Predicting FibroScan CAP Scores *

	Unstandardized coefficients		Standardized coefficients	*t*	*p*	Collinearity statistics
	B	*SE*	*β*			VIF
(Constant)	144.415	33.185		4.352	.000	
Age	.269	.291	.061	.924	.357	1.230
Sex (female)	-6.089	7.494	-.049	-.812	.417	1.020
ALT (Abnormal)	7.034	10.181	.052	.691	.490	1.614
AST (Abnormal)	-22.328	9.236	-.182	-2.418	.016	1.610
A1C	7.417	3.369	.141	2.201	.029	1.167
Triglycerides	.138	.041	.215	3.373	.001	1.157
BMI	2.583	.508	.319	5.089	.000	1.120
Steatohepatitis	11.087	7.683	.088	1.443	.150	1.057

* *F* (8, 231) = 7.716, $p < .001$).

Summary

This study examined the risk factors of NAFLD and NASH and risk factors for identifying patients who are most at risk for developing NAFLD in the AN/AI population using the LDHP database. Specifically, the following research questions and hypotheses were addressed:

RQ1: Do outcomes (abnormal/normal) of LFT, hemoglobin A1C, lipids, BMI, and inflammatory markers predict or have a relationship with NAFLD Fibrosis score?

$H_0$1: Outcomes (abnormal/normal) of LFT, hemoglobin A1C, lipids, BMI, and inflammatory markers do not predict or have a relationship with NAFLD Fibrosis score.

$H_1$1: Outcomes (abnormal/normal) of LFT, hemoglobin A1C, lipids, BMI, and inflammatory markers predict or have a relationship with NAFLD Fibrosis score.

RQ2: Do outcomes (abnormal/normal) of LFT, hemoglobin A1C, lipids, BMI, and inflammatory markers predict or have a relationship with the FibroScan CAP Score?

$H_0$2: Outcomes (abnormal/normal) of LFT, hemoglobin A1C, lipids, BMI, and inflammatory markers do not predict or have a relationship with FibroScan CAP Score.

$H_1$2: Outcomes (abnormal/normal) of LFT, hemoglobin A1C, lipids, BMI, and inflammatory markers predict or have a relationship with FibroScan CAP Score.

The results of multiple regression conducted to address the first regression revealed that ALT (B = -5.668, p = .001), AST (B = 5.364, p = .001), and Steatohepatitis (B = 4.402, p = .002) were significant predictors of NAFLD Fibrosis score. An abnormal ALT value corresponds to a decrease in NAFLD Fibrosis score, whereas an abnormal AST value and Steatohepatitis corresponds to an increase in NAFLD Fibrosis score. The results of multiple regression conducted in order to address the second research question revealed that AST (B = -22.328, p = .016), A1C (B = 7.417, p = .029), triglycerides (B = 0.138, p = .001), and BMI (B = 2.583, p < .001) were significant predictors. An abnormal AST level corresponds to a decreased FibroScan CAP Score. Increasing A1C, triglycerides, and BMI corresponds to increasing FibroScan CAP Scores.

Chapter 5: Discussion, Conclusions, and Recommendations

Introduction

The purpose of this quantitative correlational study is to assess the relationships between age, gender, BMI, LFT, AIC, fasting glucose, NAFLD Fibrosis Score, Fibro Scan, MRE, ultrasound, and NAFLD progression. This study sought to examine the prevalence and incidence estimates for NAFLD, the probability of NASH, and risk factors to identify the most at-risk patients of developing NAFLD in the AN/AI population. Obesity and metabolic syndrome have been identified as the high-risk factors for NAFLD. Conducting this study has the potential benefit to the AN/AI patients as specific risk factors affecting the NAFLD patients will be known, and appropriate recommendations will be offered to assist them in eliminating and reducing the probability of becoming obese and having metabolic syndromes. The results of this study form a vital contribution to public health as appropriate interventions are likely to be put in place, especially in AN/AI communities, with the aim of reducing the prevalence of liver disease outcomes regarding NAFLD needs by formulating and advocating for policies that assist in eliminating the current high prevalence.

The study was guided by two research questions, and their hypothesis were used to guide the current study. The multiple regression analysis was conducted to address each research question and hypothesis. The first research question and hypotheses were addressed as follows;

RQ1: Do outcomes (abnormal/normal) of LFT, hemoglobin A1C, lipids, BMI, and inflammatory markers predict or have a relationship with NAFLD Fibrosis score?

$H_0$1: Outcomes (abnormal/normal) of LFT, hemoglobin A1C, lipids, BMI, and inflammatory markers do not predict or have a relationship with NAFLD Fibrosis score.

$H_1$1: Outcomes (abnormal/normal) of LFT, hemoglobin A1C, lipids, BMI, and inflammatory markers predict or have a relationship with NAFLD Fibrosis score.

The overall model was significant, $F(8, 363) = 4.340$, $p < .001$). The model explained 6.9% of the variance in predicting NAFLD Fibrosis score. Among the eight predictors, only three were significant. ALT ($B = -5.668$, $p = .001$), AST ($B = 5.364$, $p = .001$), and Steatohepatitis ($B = 4.402$, $p = .002$) were significant predictors of NAFLD Fibrosis score. An abnormal ALT value corresponds to a decrease in NAFLD Fibrosis score, whereas an abnormal AST value and Steatohepatitis corresponds to an increase in NAFLD Fibrosis score.

The second multiple regression analysis was conducted on the following second research question and hypotheses:

RQ2: Do outcomes (abnormal/normal) of LFT, hemoglobin A1C, lipids, BMI, and inflammatory markers predict or have a relationship with FibroScan CAP Score?

$H_0$2: Outcomes (abnormal/normal) of LFT, hemoglobin A1C, lipids, BMI, and inflammatory markers do not predict or have a relationship with FibroScan CAP Score.

$H_1$2: Outcomes (abnormal/normal) of LFT, hemoglobin A1C, lipids, BMI, and inflammatory markers predict or have a relationship with FibroScan CAP Score.

The overall model was significant, F (8, 231) = 7.716, p < .001). The model explained 18.9% of the variance in predicting the FibroScan CAP Score. Among the eight predictors, four were significant. AST (B = -22.328, p = .016), A1C (B = 7.417, p = .029), triglycerides (B = 0.138, p = .001), and BMI (B = 2.583, p < .001) were significant predictors. An abnormal AST level corresponds to a decreased FibroScan CAP Score. Increasing A1C, triglycerides, and BMI corresponds to increasing FibroScan CAP Scores.

Interpretation of the Findings

The findings from the first research question and hypotheses were found to significant predictor, F (8, 363) = 4.340, p < .001) of NAFLD Fibrosis score with ALT (B = -5.668, p = .001), AST (B = 5.364, p = .001), and Steatohepatitis (B = 4.402, p = .002) being the specific predictor for NAFLD Fibrosis score. AN abnormal ALT value was found to correspond to a decrease in NAFLD Fibrosis score, while abnormal AST and Steatohepatitis corresponded to an increase in NAFLD Fibrosis score. The findings of this study are supported by Siu et al. (2018), which established that plasma ALT evaluation resulted in a decrease in NALFD incidence rates. The current study's findings are in line with Tutunchi et al. (2019) by indicating that ALT and AST as predisposing factors for the development of end stage of liver NAFLD. Chandrasekharan and Alazawi (2019) indicated that there exists a connection and common basis between ALT and NAFLD which is in alignment with the current study findings.

Previous researchers, such as Dharmalingam and Yamasandhi (2018), linked ALT with the presence of NAFLD in the absence of excessive alcohol intake or viral hepatitis which support the current findings that indicated that ALT was a predictor of NAFLD Fibrosis score. The link of ALT with NAFLD is still supported by previous researchers such as Koch and Yah (2018) who indicated that ALT decrease as Fibrosis advanced towards liver disease. Histological analysis of NASH is found to be predictor of NAFLD to an extent to 47% as established by Rinalla and Sanyal (2016) which is in alignment with current study findings. The study by Kaswala et al. (2016) and Kim et al. (2016) are consistent with the current study findings indicating that progression of NASH was linked to be a predictor of NAFLD. Previous researchers such as Sarwar et al. (2018) are supported by the current findings as they established that there exists a connection between NAFLD and NASH with an indication that existence of NASH is accompanied by lower survival rate of an individual with NAFL.

The findings from the second research question and hypotheses were found to be overall predictor F (8, 231) = 7.716, $p < .001$). The model explained 18.9% of the variance in predicting the FibroScan CAP Score. The predictors of AST (B = -22.328, p = .016), A1C (B = 7.417, p = .029), triglycerides (B = 0.138, p = .001), and BMI (B = 2.583, $p < .001$) were significant predictors. An increase in A1C, triglycerides, and BMI corresponded with an increase in FibroScan CAP Scores, while an abnormal AST level corresponded to a decrease in FibroSCan CAP Scores. The currents study findings are supported by previous researchers, such as Polyzos et al. (2019) who established that clinical and laboratory tests of parameters such as triglycerides are determiners of NAFLD.

This study findings are supported by Mayo Clinic (2020) establishing that increase in triglycerides are detectable by FibroScan CAp Scores as fat in blood and cells have increased. The exceeding of 150mg/dl of triglycerides determined by FibroScan CAP Scores have been indicated by Tutunchi et al. (2019) that are similar to this study outcomes. AST has been identified as a predisposing factor for developing liver disease by previous researchers such as Tutunchi et al. (2019) which is in line with this study results indicating that an increase in AST level contributes to a decrease in FibroScan CAP Scores.

The findings from the current study contrast with previous study findings that indicated that gender was a predictor to the NAFLD with women being reported to have a lower risk factor than men especially during their reproductive period (Johnson et al., 2018). Even though gender was not found to be a risk factor in this study the previous researchers such as Leone et al. (2019) established that women tend to have a higher percentage of NAFLD rate as compared to their counterpart men. Additionally, past studies by Younossi et al. (2016) also differed with this study findings as it reported that gender was key determiner to the prevalent of NAFLD as women were found to be more endangered than men.

Other past researchers such as Herath et al. (2019) established that sex had impacts on NAFLD as it contributed to pervasiveness of NAFLD. In different studies conducted by Younossi et al. (2016) also contrasted with this study findings as it noted that men had a higher NAFLD prevalence as compared to women. Further findings by Rayyan and Tayyem (2018) differed with this study findings as they established that consumption of alcohol among different gender could alter increase the prevalence rate of NAFLD among men as compared to women. Alcohol consumption in males directly contributed to NAFLD progression when compared to women who did not take alcohol.

The current study did not find age to be prevalent factor of NAFLD which is contrasting with previous study findings such as that of Younossi et al. (2016) that indicated that age was a prevalence of NAFLD. Younossi et al. found that males and females aged between 12-19 years had higher prevalence for NAFLD as compare to their older counterparts. Younossi et al. also established that older females above 40 years were had higher prevalence rate of NAFLD as opposed to their counterparts. The contrast is also found between the current research findings and the report established by Tobari and Hashimoto (2020) that indicated that age groups were linked to the rise and risks of NAFLD.

The current study did not find ethnicity and genetics to be a prevalent factor, which contrasted some of the previous researcher's findings. A study conducted by Younossi et al. (2018) found a statistical significance of gender to NAFLD as Hispanics were found to have a higher prevalence of 45-58% as compared to their counterpart, African Americans. Kalia and Gaglio's (2016) findings also contrasted this study's findings as they indicated that genetics played a key role in determining the significance of NAFLD prevalence rate in different ethnicities. Additionally, a past study by Younossi et al. (2018) attributed genetic factors as one prevalent rate of NAFLD.

The findings by Jaradat (2017) indicated that genetics were responsible for high sizeable risk factor for Black youths to NAFLD. Similar findings were reported by Kalia and Gaglio (2016) indicating that genetic factors contributed to higher prevalence rate of NAFLD to Hispanic as compared to Latinos. Chandrasekharan and Alazawi (2019) also noted that there existed a direct link between genetic factors and prevalence of NAFLD which result in contradicting the current findings from this study. Further previous findings contradict the findings from this study as they indicated that hereditary factors played a significant role in individual's vulnerability to NAFLD and the subsequent progression to other advanced acute conditions. Additionally, Scorletti and Byrne (2016) indicated that genes in inter-individual increased their susceptibility to NAFLD resulting in difference prevalence rate in different groups of individuals.

The genetic factor even though not found to be a factor in the current study is also supported by previous researchers such as Sookoian and Pirola (2017) and Trépo and Valenti (2020) who established that NAFLD in different individuals was caused by genetic factors which led to progression to other different worse conditions such as acute stage. Similarly, the study by Sookoian and Pirola differ with current findings by indicating that genes materials and other environmental factors influenced the NAFLD progression and prevalence resulting in supporting genetic and hereditability as a risk factor of NAFLD. The studies by Trépo and Valenti and Umano et al. (2017) further contrast the current study findings by reporting that individual genetic variations tend to TM6SF2, PNPLA3, NCAN, and PPP1R3B genes tend to increase the chances of family hereditary of NAFLD by 27%. The genetic variant of missense mutation is linked to NAFLD as reported by Barbara et al.(2018) and Chandrasekharan and Alazawi (2019) who contrasted this study findings.

TTM has contributed to expounding the concept of the need to control NAFLD through change of individual behaviors more so on lifestyle to yield positive benefits to an individual (Nigg et al., 2019). Obesity management is crucial in establishing change as well as in gaining positive health benefits. The findings of this study are supported by TTM as there is need to develop appropriate intervention to counter the risk factors of NAFLD by managing lifestyle. HBM also forms a strong foundation for this study as it focuses on addressing behavioral changes in patients and developing new interventions to mitigate the manifestation of chronic illnesses such as NAFLD by addressing lifestyle behavior (Ghaderi et al. 2017).

The findings of this study show the need to manage NAFLD through adoption of appropriate lifestyle behaviors. These two theoretical models focus attention on understanding the prevalence of a chronic illness such as NAFLD so as to develop appropriate intervention based on the need to address these illnesses. The predictors of NAFLD established by this study offer support to both transtheoretical and health belief models as they raise the need to mitigate the patient’s behaviors that are aggregating and increasing their risk factors, leading to the increasing rate of mortality and morbidity. The need to control individual weight is important to ensure they do not develop obesity state that is likely to increase their chances of illness. Change of life-style is important in predicting behavior management and promote early detection and management of various illnesses.

Limitations of the Study

Researchers have faced several limitations while conducting this study. The sample population of this study was limited to AN/AI, which represents 0.9% of the entire population in the US. Limiting the sample population to only one race may not have given appropriate results for the study. Failure to involve other races from different parts of the world contributed to reducing the generalizability of this study's findings. The data used from the ANTHC LDHP were not tested or proved for their reliability and accuracy as they are contained in the already established database of liver disease and hepatitis programs whose sources are unverifiable, resulting in a decrease in the level of generalizability of the study findings.

Reliance on secondary data limited the researcher's ability to gather additional data from participants, especially on their diet for a period of the last six months to two years required in determining FibroScan score. The lack of additional information that is vital to the researcher limited the generalizability of the study findings. This study used correlational research designs, which could not offer an in-depth analysis of the cause-and-effect relationship between the set study variables. The lack of manipulation of study variables could limit the generalizability of the study findings.

Recommendations for Further Research

The findings of this study have given rise to several recommendations for further research. Further study should be conducted with the aim of determining the preference and rate of NAFLD progression in a different population other than Alaska Native/American Indians with and without elevated LFT. Conducting this further research will increase the generalizability of this study's findings. Further study should be conducted with the same topic to determine the prevalence and rate of NAFLD progression in different geographical settings and using databases for data collection. Different health records should be used to ensure comparability of the source documents as well as to increase the validity and reliability of the information.

Further study should be conducted using a mixed-method approach. The use of this approach will offer the researcher an opportunity to collect additional data that may not be provided in the data sets for each dependent variable. Additionally, the researcher may be able to collect additional data that may help them determine a cause-and-effect relationship that could not be determined by the current study. Further study should be conducted to determine the prevalence risk factors and appropriate procedures as well as mitigating obesity. The current study has offered an insight on prevalence and rate of NAFLD progression with and without elevated liver function test living behind unaddressed areas on prevalence of risk factors and appropriate procedures for mitigating obesity that ought to be addressed.

Further research should be conducted to narrow the gap of contrast whether genetics is a contributor to the risk factors of NAFLD. The contrast that has arisen from the current study and previous studies calls for further research in narrowing the existing gap. Further study should also seek to establish whether prevalence factors of gender and age also contribute to NAFLD. The prevalence of gender as well as age have also been established by previous researchers as risk factors of NAFLD leading to increment of individual susceptibility to NAFLD.

Implications

The findings of this study may help individuals and families adopt new behaviors and lifestyles that reduce the chances of becoming obese. The reduction of susceptibility of obesity could help in mitigating the risk factors of NAFLD from progressing to other acute stages. Sharing the knowledge from this research to different individuals and their family members may increase their level of awareness, which will contribute in engaging in interventions that will assist in management and mitigation of chronic health conditions.

Various organization may adopt these study findings to help them in formulating guidelines that will help them in educating the members of the public on risk factors of NAFLD as well as advocate for appropriate mechanism in mitigating them. Health Sectors of Alaska Native could use the results from this research to formulate policies within the health sectors to assist the individuals suffering from obesity and those at the risk factors of becoming obese.

Conclusion

The purpose of this quantitative correlational study was to assess the relationship between gender, BMI, LFT, A1C, fasting glucose, NAFLD Fibrosis Score, Fibro Scan, MRE, ultrasound, and NAFLD progression. The prevalence and incidence of NAFLD and probability of NASH, and risk factors were identified as the most risk factors for patients developing NAFLD in AN/AI. The study established an overall significance for two research questions that were being tested. An abnormal ALT value corresponds to a decrease in NAFLD Fibrosis score, whereas an abnormal AST value and Steatohepatitis corresponds to an increase in NAFLD Fibrosis score in answering the first research question, while an abnormal AST level corresponds to a decreased FibroScan CAP Score. Increasing A1C, triglycerides, and BMI corresponds to increasing FibroScan CAP Scores. The study offers a clear highlight for developing robust interventions for mitigating the problems emanating from the prevalence of risks of obesity, specifically NAFLD.

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