DEVELOPMENT OF AN ASSESSMENT AND REFERRAL TOOL FOR ALCOHOLIC LIVER INJURY AMONG ADULTS IN SELECTED COUNTIES IN KENYA

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ATHESIS SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF DOCTOR OF PHILOSOPHY DEGREE IN NURSING OF MOUNT KENYA UNIVESITY

OCTOBER 2022

DECLARATION AND APPROVAL

Declaration by the Student

This thesis is my original work and has not been presented for a degree in any in other university or for any other award.

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DEDICATION

This research I dedicate it to my wife Salome, my daughter Joan and my son Markroy; they always inspired me on hard work.

ACKNOWLEDGEMENT

First and foremost, I want to thank and honor God, the Almighty, for gifting me with innumerable blessings, good health, knowledge, and the opportunity to travel this long trip and complete my thesis. Special thanks to my fellow colleagues for the support throughout the study. I also want to thank my supervisors Prof. Catherine Syombua Mwenda, Dr. Ezekiel Mecha and Dr. Stanley Waithaka for their support and guidance during the proposal and project development. They provided me with the resources I needed to make the best decisions and complete my thesis successfully. May the Almighty God bless you abundantly.

ABSTRACT

Alcohol consumption has been practised for many years in different cultures and societies in the world. Persons who consume alcohol for long periods usually experience adverse bodily harm yet the assessment and referral system on the harm caused is inadequate. Alcohol screening through the use of Alcohol Use Disorders Identification Test (audit) tool is widely acceptable globally. Other alcohol testing tools that are paramount in detection of alcoholic liver injury include the laboratory test for liver biomarkers. This study aimed to correlate the alcohol use disorder identification tests results with the results of the liver biomarkers and then develop an assessment and referral tool for alcoholic liver injury among adults in selected Counties in Kenya. The study was a non-experimental correlational study carried out in Murang'a and Uasin Gishu Counties. The study was divided into three phases. Phase I which included the use of audit tool to evaluate alcohol consumption, was achieved through administration of a structured questionnaire. Participants were required to donate blood samples for evaluation in the laboratories for liver biomarkers. An indpth interview was conducted on clinicians regarding their referral system. Phase II involved analysis of data from the audit tool and laboratory tests for liver biomarkers. Correlation of the blood samples with the audit screening results was an activity of phase II. Phase III involved formulation of an assessment and referral tool for alcoholic liver injury guided by the results of phase II. The study adopted Cochran formula for determination of the sample size. Data was scrutinized, cleaned and entered into a spread sheet using Statistical Package for Social Sciences version 24. Quantitative data was analyzed using descriptive statistical methods of mean, mode, median and standard deviation. Inferential statistics involves Chi-square to show relationships between variables. The analyzed data was then presented in tables, pie charts and frequency graphs. Cumulative score for the audit results were correlated with the biomarker results to develop an assessment and referral tool. Study results on Alcohol Use Disorder Identification Test from the domain of hazardous alcohol use found that on the sequence of alcohol consumption, 71% of the participants consumed alcohol 4 or more times in a week. The test on dependence alcohol use found that on daily or almost daily most of the participants were unable to stop drinking once started, were unable to meet expectations due to drinking and needed a first drink in the morning after a heavy session, they were represented by 51.6%, 51.6% and 66.7% respectively. On harmful alcohol use 82% of the participants desired to cut down on their drinking. Results from the liver biomarkers found that majority (97%) of the participants had alanine aminotransferase levels of 41 to 80 IU/L. Eighty two (88.2%) participants had aspartate aminotransferase elevated to between 35 and 68 IU/L. Gammaglutamyl aminotransferase was elevated in all 93 (100%) of the participants. From the qualitative data the clinicians were not well informed about the World Health Organization and the government referral system for alcoholic liver disease.

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ADH: Alcohol Dehydrogenase

AH: Alcohol Hepatitis

AIH: Autoimmune Hepatitis

ALD: Alcoholic liver Disease

ALDH: Aldehyde Dehydrogenase

ALI: Alcoholic Liver Injury

ALT: Alanine Aminotransferase

ANI: Alcohol Non Alcoholic Index

ALP: Alkaline Phosphatase

AST: Aspartate Aminotransferase

AUD: Alcohol Use Disorder

AUDIT: Alcohol Use Disorder Identification Test

BAC: Breath Alcohol Concentration

BC: Before Christ

BMI: Body Mass Index

BUN: Blood Urea Nitrogen

CAGE: Cut down, Annoyed, Guilty, Eye opener

CDT: Carbohydrate Deficient Transferin

CT: Computed Tomography

CYP: Cytochrome P450

DFI: Discriminant Function index

DM: Diabetes Mellitus

EASL: European Association for the Study of Liver

ESRD: End Stage Renal Disease

EtG: Ethylglucuronide

EtOH: Ethanol

FAEE: Fatty Acid Ethyl Ester.

GAHS: Glasgow Alcoholic Hepatitis Score

GGT: Gamma-Glutamyl Transferase

GSH: Glutathione

HEX: β-Hexosaminidase

HIV: Human Immunodeficiency Virus

IU/L: International Units per Litre

IU: International Units

KHSSP: Kenya Sector Strategic and Investment Plan

LFT: Liver Function Tests

MAST: Michigan Alcoholism Screening Test

MCH: Mean Corpuscular Hemoglobin

MCV: Mean Corpuscular Volume

MKU: Mount Kenya University

MRI: Magnetic Resonance Imaging

NACADA: National Alcohol and Drug Abuse

NACOSTI: National Commission for Science, Technology and Innovation

NALD: Non Alcoholic Liver Disease

PEth: Phosphatydilethanol

RNS: Reactive Nitrogen Species

ROS: Reactive Oxygen Species

SAMe: S Adenosyl Methionine

SAMHSA: Substance Abuse and Mental Health Services Administration

SGOT: Serum Glutamic Oxaloacetic Transaminase

SPSS: Statistical Package for Social Science

UK: United Kingdom

US: United States

USA: United State of America

WHO: World Health Organization

CHAPTER ONE: INTRODUCTON

1.1 Background of the study

Consumption of alcohol has been ongoing for approximately 10,000 Before Christ (BC). Human beings brewed alcohol during festivals and ceremonies (Dumbili, 2015). Before colonization, alcohol consumption was practised in Africa with different socio-cultural roles. People were united in traditions, and alcohol consumption was viewed as a symbol of unity, acceptance, agreement, achievement, and victory. Thus alcohol was a product consumed only on special occasions. It was restricted to specific age groups and a certain amount. The side effects of alcohol were not reported and probably did not occur (Dumbili, 2015).

Alcohol is the most consumed substance globally, with an estimate of over 4 billion persons believed to be alcohol consumers. In comparison, 76.3 million persons suffer from alcohol use disorder (Higgins-Biddle and Babor 2018).

Monk and Heim (2021) mentioned external and internal factors that influence alcohol consumption. These factors were cited as the primary influencers of what content and how much an alcohol consumer will consume. Among the external factors were environmental locations, such as bars either near or far away from the consumers. Other external factors are the composition of social groups, either more women or more men, who could influence how one would think about alcohol. Internal factors were mentioned as the mood of the consumer and alcohol intoxication levels (Monk and Heim 2021).

In a study on global alcohol exposure, it was reported that the prevalence of drinking alcohol increased from 45% in 1990 to 47% in 2017, with a forecast of rising to 50% by 2030 (Manthey, Shield et al. 2019).

A study by Rumgay et al. (2021) reported that globally 4.1% of all newly diagnosed cancer cases in the year 2020 was attributed to alcohol consumption. The study further noted that three-quarters of the alcohol-attributable cancers were in males, with the standard site being in the liver (Rumgay, Shield, et al., 2021).

United Nation (UN) General Assembly in 2015 adopted the "transforming our world: the 2030 agenda to sustainable development" council resolution. The solution was the target for sustainable development goals (SDG). Goal number three focused on strengthening the prevention and treatment of substance abuse, including harmful alcohol and narcotics (Lim, Allen, et al., 2016).

The World Health Assembly in 2013 adopted the WHO global action plan, which discussed the reduction of morbidity and mortality that arise from non-communicable diseases upon getting to the year 2025. The council postulated that morbidity and mortality from harmful alcohol use would reduce by 10% (Organization 2013).

During the meeting, governments and non-governmental organizations were requested to form modalities for achieving these targets. Among the targets, they were informed to set national non-communicable disease targets for 2025 and beyond, develop multisectoral exposure to reduce these risk factors by 2025 and beyond, and measure these outcome results for an action plan (Organization 2013).

The WHO reported that in 2016, about 2 million alcohol users died from harmful alcohol use, represented by 5.3% of all deaths globally (Organization 2019). This pattern of alcohol use was interpreted to show that by that year (2016), heavy alcohol use was high, with approximately 60 grams of alcohol use during a single occasion. The sub-Saharan Countries showed between 45% and 60% (Organization 2019). There was the unavailability of actual data for the prevalence of alcoholic liver injury in some low-income countries and some middle-income countries. It was noted that there were

treatment gaps in treatment interventions on alcoholic liver injury and especially in the low-income and middle-income countries. Therefore lots of development were needed to close these gaps within the medical care facilities (Zewdu, Hanlon, et al. 2019).

Flemming et al. (2021) reported that individual and collective efforts were essential to salvage the already diseased persons and prevention of new cases of Alcoholic Liver Injury (ALI) (Flemming, Djerboua, et al. 2021). Countries focused on their resources and efforts toward prevention, treatment, and referral of alcoholic liver injury persons.

Many countries in the world have high rates of alcohol consumption, particularly among people aged between 15 to 59 years. World Health Organization reported that more than half of the world's alcohol consumption happens in America, Europe, and the West Pacific. Alcohol consumption worldwide among persons aged fifteen years and above was raised from about 5 liters per person in 2005 to about 7 liters per person per day in 2016 (World Health Organization (WHO), 2018)

By 2021, there were 2.4 billion alcohol drinkers; among them, 950 million were heavy drinkers (Asrani, Mellinger, et al., 2021). Combined alcohol-related cirrhosis accounts for 1% of all global deaths, with the rate expected to risers in the coming years (Asrani, Mellinger, et al., 2021).

European countries have high alcohol consumption, on average 11 liters per person per year. Fifteen percent of Europeans, which is about 58 million persons, occasionally drink alcohol of more than 40 grams (g) per day among men and more than 20g within a day among women (European Association for the Study of the Liver, 2012). The European Association for the Study of the Liver in 2021 reported that to realize a reduction in alcohol-related morbidity and mortality, focused solutions on early diagnosis and intervention are required by both governmental and non-governmental sectors. The association reported the need for improving alcoholic liver disease data

management and strong advocacy as among the pillars for reducing alcohol-related liver diseases(Asrani, Mellinger, et al., 2021).

Between 2006 and 2010, the United States of America (USA) experienced an upsurge in alcohol consumption, resulting in about 88,000 alcohol-related mortality (Gonzales et al., 2014). According to the global information system on alcohol and health (GISAH), alcohol consumption is related to 230 different types of human diseases (WHO, 2010).

According to the WHO global strategy to reduce the harmful use of alcohol (2010) report, there was a discrepancy in the capability and capacity on availability of alcohol between different Countries. The report further said a worldwide spread of harmful drinking practises and norms that should be controlled; otherwise, the vices will cause unimaginable harm to the human race (WHO, 2010).

The WHO Global strategy to reduce the harmful use of alcohol (2010) report further mentioned that appropriate engagement was necessary for different sectors of governmental and non-governmental sectors that include but not limited to health, justice, transport, education, agriculture, consumer policy, trade, social welfare and employment((WHO, 2010).

World Health Organization (2018) reported that Africa suffers the heaviest burden concerning alcohol-related diseases, including liver injury, despite Europe having the highest consumers. In Africa, alcohol consumption increased to 32.8 grams of pure alcohol consumed in a day, a 20% increment from 2000 to 2016 (WHO, 2018).

In the UK, Newsome et al. (2018) reported that there was an increase in mortality due to liver diseases, there was an increase of 40% mortality between 1970 and 2010 with increase notably on persons below 65 years who had a 50% increase in mortality (Newsome, Cramb, et al. 2018).

In 2017 1.32 million deaths globally were related to alcohol, with Europe suffering greatest and below the age of 50 suffering great. There is a global increase in alcohol consumption, with an estimated 65% annual increase in alcohol consumption from the year 2009 moving forward (Buchanan and Sinclair 2021).

A study by Rehm et al. (2020) showed that low and middle-income Countries had 16.4% of their people who use alcohol with alcohol use disorder, among them alcoholic liver injury with increased projection for the ALI. It was estimated that the low-income and middle-income countries will have about a 97% treatments gap for ALI by 2030 (Rehm, Neufeld, et al. 2020).

Quante Ming et al. (2016) reported that Germany had experienced a 50% increase in alcoholic liver injury for the last 30 years, which was dated back to the year 2016, and the trend was expected to continue (Quante, Ming, et al. 2016). There was more alcohol consumption in that Country, projecting that the alcoholic liver injury would be high in some years to come.

In Nigeria, consumption of alcohol is evolving fast with changes in the pattern of consumption. Young persons are involved in alcoholic competitions, with the criteria of a winner being one who will drink a lot and within a shorter time without showing signs of intoxication. These competitions are organized from the lower levels in the villages to high levels of national events; most participants are young persons. These competitions are sponsored by the beer and spirit manufacturers who reward the winners with money. The competitions have contributed to heavy drinking among the youth to become winners during the more significant competitions (Dumbili, 2013).

In Tanzania, Francis et al. (2015) reported that young persons were involved in hazardous alcoholic drinking, while in Uganda, Wandera et al. (2015) found that

persons infected with Human Immunodeficiency Virus (HIV) were involved in hazardous alcohol consumption.

Findings from WHO (2018) show that in Kenya, alcohol consumption per capita between 2015 and 2017 was 3.4%, while in some selected African countries such as Ghana, it was 2.7%, and in Ethiopia, it was 2.8%. This signifies that alcohol consumption in Kenya was higher than in these countries. A survey by National Alcohol and Drug Abuse (NACADA) (2012) showed that about 14% of citizens of Kenya aged between 15 and 65 years from all provinces except North Eastern consume alcohol. NACADA (2012) further reported that alcohol is highly abused in Kenya, with increased morbidity and mortality due to its consumption.

According to the Kenya Health Policy, 2014 -2030 towards attaining the highest standard of health reported that in 2009 alcohol use was ranked as number 6 as a risk factor for morbidity and mortality with 2.3% and 2.6%, respectively. The Kenya Health policy 2014 -2030 towards attaining the highest standard of health further reported its fifth objective to minimize exposure to health risk factors through mitigation measures to the negative impact in health on alcohol adulteration and excessive consumption (Kamau and MacNaughton 2019).

According to the Kenya Health Sector Strategic Plan 2018-2023 Transforming Health systems: Achieving Universal Health Coverage disability-adjusted life by risk reported that in 2013 alcohol use in Kenya was ranked as number 8 while in 2017, it was ranked as number 6 risk factor. The Kenya Health Sector Strategic Plan 2018-2023 Transforming Health systems: Achieving Universal Health Coverage further reported that on containment of significant causes of morbidity and mortality, alcohol use was among its area of focus (Sharma 2021).

The world projection of liver cirrhosis by Countries from 2005 to 2030 is 35%, with Japan being projected to reduce liver cirrhosis for its people (Valery, Laversanne, et al. 2018). Julien et al. (2020) reported that global alcohol-related liver cirrhosis is expected to increase from about 9% in 2019 to 15% in 2040; it is also postulated that global death related to alcohol will increase to 14% (Julien, Ayer, et al. 2020)

The WHO (2018) reported that liver disease deaths in Kenya were at 2,514, represented by 0.98% of all total deaths in the Country in 2018. The report further mentioned that the age-adjusted death rate was 11.47 per 100,000. The report did not mention the alcoholic liver disease among the diseases or the mortality due to alcoholic liver disease (Rashid, Kassim Nishtar, et al.).

Alcohol Metabolism

The human liver acts as a primary organ for alcohol metabolism (Thomes, Rasineni, et al., 2021). Consumption of alcohol over a long duration has adverse effects on the functioning of the liver (Rigopoulou, Gatselis, et al., 2021). The liver metabolizes alcohol to more minor toxic metabolites (Thomes, Rasineni, et al., 2021).

The liver parenchyma is involved in the detoxification of toxins from ethanol. Over time the liver biomarkers are elevated, suggestive of liver injury (Rigopoulou, Gatselis, et al. 2021). A characteristic of heavy and prolonged alcohol intake is an alcoholic liver disease (Vatsalya 2020).

Prolonged alcohol consumption thus leads to chronic liver injury with liver inflammation. The process further activates the myofibroblasts, which secrete matrix proteins from the extracellular that regenerate fibrous tissue. The fibrotic process regresses once the causative action stops (Kisseleva and Brenner 2021).

The liver process one alcoholic beverage in one hour. The higher the alcohol content in the body, the more the liver processes. With too much alcohol, the liver is

overwhelmed by the processing; thus, the excess alcohol will continue circulating in the circulating system until it is processed. The unprocessed alcohol can leak into the brain, causing hepatic encephalopathy (Palit, Chattopadhyay, et al., 2021).

Alcoholic liver injury is a metabolic liver problem with pathological progression through the inflammatory processes. During these inflammatory processes, gut microbes translocate to the mesenteric lymphatic and portal systems to activate the endotoxin hepatic macrophage proinflammation (Gao, Ahmad, et al. 2019). The formation of pro-inflammatory biochemicals eventually leads to pathological changes of hepatocytes; these metabolites cause hepatotoxicity with fatty acid oxidation (Gala and Vatsalya 2020). Further activation and response of the immune cells, hepatic chemokines, and cytokines lead to alcoholic liver injury (Gao, Ahmad, et al., 2019).

Ethanol from the stomach and intestine is quickly absorbed into the systemic circulation through diffusion through the gut mucosa and then delivered into the liver via the portal vein. In the liver, alcohol dehydrogenase (ADH) and Aldehyde dehydrogenase (ALDH) are involved in alcohol oxidation that transforms alcohol into acetaldehyde which is toxic to the liver cells. Continuous alcohol consumption leads to further accumulation of alcohol acetaldehyde, causing further damage to the already compromised hepatocytes (Lu, Zhu, et al. 2020).

Alcohol is a toxic compound to body cells and tissues, and its consumption is linked to several changes in cell functioning (Zhu et al., 2012). The site for ethanol oxidation in the human body is the hepatocytes (liver cells), where ethanol is metabolized by the alcohol aldehyde dehydrogenase (liver enzyme) in the presence of Nicotinamide Adenine Dinucleotide (NAD), which is then oxidized into acetate to produce acetaldehyde. Acetaldehyde, the first pass metabolite generated by alcohol oxidation, is

more toxic than alcohol. The acetaldehyde is quickly converted to acetate, which is less toxic (Thomes, Rasineni, et al., 2021).

The acetaldehyde is then oxidized into acetyl-CoA. Acetyl-CoA is used by body cells to synthesize fatty acids, cholesterol, and ketones. These end products are harmful and can damage the hepatocytes or any other cell in the body (Muñiz-Hernández, 2014)

Increased alcohol intake leads to inflammation and oxidative stress of the liver (Liang, Yang et al., 2021). In alcohol metabolisms, free radicals such as Reactive Nitrogen Species (RNS) and Reactive Oxygen Species (ROS) are produced. The two play essential roles in cell apoptosis, inflammation, and fibrosis formation (Liang, Yang et al., 2021).

Further endogenous antioxidants enzymes like catalase and glutathione peroxidase are produced to aid in maintaining homeostasis of the oxidative stress, a situation that is usually depleted with continuous consumption of alcohol (Liang, Yang et al. 2021).

Accumulation of RNS and ROS leads to more damage of the liver cells triggering pro-inflammatory cytokines, which contribute to the progression of alcoholic liver injury (Liang, Yang et al., 2021). The ability of the liver to produce more ROS occurs even more during alcohol consumption. The end result is more alcoholic liver injury damaging the liver cells (Zhu, Jia, et al., 2012).

Alcoholic liver injury is clinically silent at its early stage. Many persons will feel bothered when clinicians mention early diagnosis and intervention. The disease can be so silent that it can only be realized through history taking, AUDIT testing, biomarker tests, or the use of other early diagnostic methods. Mild elevation calls for further scrutiny and follow-up to reduce morbidity and mortality (Khatiwada, Rodriguez, et al. 2020).

When alcohol consumption is stopped, the damaged liver may regain partially or heal completely. This was determined by the extent of liver damage during drinking (Thomes, Rasineni, et al., 2021). Heavy drinking with refined alcohol such as spirits is more damaging because of the highly reactive and binding capacity of its molecules, which disrupt the action of organ cells (Thomes, Rasineni, et al., 2021).

Illicit alcohol is more damaging and can affect the brain, liver, and kidney since the ingredients in the mix may not be well defined. The damage may also be unknown; in many cases, persons present to health facilities when it is too late to salvage the organs (Hayde 2021).

Alcohol-related diseases

It is estimated that global liver diseases for both alcoholic and non-alcoholic causes will increase by 180% from 2015 to 2030. Liver-related deaths will increase by 178% from 2015 to 2030 (Estes, Razavi, et al. 2018). Alcohol consumption has been related to several diseases that include mental illness, cancers, Alcohol Use Disorders (AUD), liver diseases, and colorectal diseases (Yang, Sangwung, et al., 2021).

Chronic sustained alcohol drinking leads to slow progressive liver injury of low-grade and asymptomatic. Despite the alcoholic liver damage, the human body has its defense mechanisms (enzymatic and non-enzymatic), which cause antioxidants to minimize liver damage for possible remodeling (Muñiz-Hernández, 2014). Liver enzymes are proteins that help break down giant molecules into small ones and help big molecules join together and form large structures. Alcohol harms the liver cells through the increased production of liver enzymes necessary for its metabolism. Harmful pro-oxidants that are cytotoxic to hepatocytes are highly involved (Buchanan and Sinclair 2021).

When the liver cells are injured with a bit of remodeling, alcoholic liver cirrhosis sets in as a severe stage of alcohol-related liver injury where normal liver tissue is replaced by scar tissue; the nervous tissue cannot function properly, leading to elevation of the liver biomarkers. It is estimated that chronic alcohol consumption eventually develops to alcoholic cirrhosis, a near end-stage liver injury that progresses to end-stage liver injury with a prognosis of mortality (Yeverino-Gutiérrez, 2020).

During alcohol consumption duration, the Golgi apparatus is disassembled. The liver loses its efficiency functioning to form scars with fatty deposits. These scarred cells cause cirrhosis, and the liver is comprised of its functions to a great extent. It is at this stage that the liver injury is severe, with symptoms such as fatigue, palmar angioma (reddening of the palm), spider angioma (radiating blood vessels beneath the skin), and jaundice sets in (Thomes, Rasineni, et al. 2021).

Additionally, there is alcohol activation of the immune kupffer cells that sensitize the hepatocytes to the inflammatory process that leads to hepatocytes death. The process is followed by a cascade of further sustained cell death that should be stopped; otherwise, the cell death continues (Buchanan and Sinclair 2021).

Patients usually present to the medical facility after a surge of alcohol consumption with symptoms of bilirubin following episodes of nausea, fever, and vomiting. The liver is usually enlarged and tender. The history of alcohol consumption should be elicited and infection excluded. A definitive diagnosis for alcohol use disorder should be made, followed by laboratory investigations.

According to Lacent guidelines (2015), it is paramount to improve expertise and medical facilities in primary care to strengthen the detection and screening of high-risk clients for early liver diseases due to alcohol. Further Lacent guidelines (2015)

recommended that there is a need to promote assessment and referral criteria policies in order to secure liver disease in clients of alcohol consumption through early detection.

Crabb et al. (2020) stated that the public health concept of screening, brief intervention, and treatment referral of patients with alcohol-related illnesses could best be described as assessment and referral for alcohol use.

On a broad spectrum, alcoholic liver injury is grouped as Autoimmune Hepatitis (AIH). Diagnosis of Autoimmune Hepatitis can be difficult and even challenging since the clinical manifestations are incorporated with other diseases such as Non-Alcoholic Fatty Liver Disease (NAFLD) and viral hepatitis (Rigopoulou, Gatselis, et al. 2021).

As such, laboratory testing for the elevation of the liver biomarkers is needed for differential diagnosis. Alcoholic liver injury is linked to Alcohol Use Disorder (AUD) (Rigopoulou, Gatselis, et al., 2021).

Alcohol can be detected in the body within hours of ingestion by testing on the breath, urine, or blood. These are referred to as direct tests, while indirect tests such as AST, ALT, GGT, MCV, and GGT are detected in the blood. Indirect tests detect alcohol in blood over a long period, about one year (Arnts, Vanlerberghe, et al., 2021).

The majority of the patients with severe liver disease have contact with their health facilities. The liver is severely damaged and probably unsalvageable (Lindvig, Hansen, et al., 2021).

The liver

The human liver is an essential organ involved in digestive and metabolic functions (Mahpour and Mullen 2021).

Metabolism of alcohol primarily occurs in the liver with the effects of the toxin expected on the liver cells.

The liver is the biggest organ in the human body; it serves several functions that include detoxifying toxins. It controls the body's chemicals, and waste products circulate in the blood (Akter, Shekhar, et al., 2021). When damaged, the malfunction sets in, and the whole body involving other organs is affected by the toxins that accumulate in the body. Upon abstinence, the liver may or may not rejuvenate, going back to its normal function or near normal.

There are various biochemical tests done to indirectly determine the status of the liver (Akter, Shekhar, et al., 2021). They include physical examination, blood samples for liver function tests, electronic scanning, and histological examination

The liver is the first organ to receive blood with nutrients, toxins, and xenobiotics absorbed from the gastrointestinal system. Thus the liver is vulnerable to injury due to alcohol (Thomes, Rasineni, et al. 2021).

In injury, the liver will regenerate to offer the body a 100% liver-to-body weight ratio to offer required homeostasis. A function that other essential organs such as the lungs and the kidney cannot maintain. Hepatocytes proliferation is controlled by multiple liver extracellular signals that are very rapid, and their pathways are not clearly understood (Michalopoulos and Bhushan 2021).

Heavy drinkers consume more than 60 grams of ethyl alcohol in a day. This is damaging to the liver cells. The liver develops fatty cells, which later turn to steatotic cells causing inflammation with progression to fibrosis (Thomes, Rasineni, et al., 2021).

1.1.1 Microbial Products and Metabolites Contributing to Alcohol-Related Liver injury.

When alcohol is consumed, it settles on the stomach, which acts as a reservoir. The alcohol is then pushed down the gut through the cardiac sphincter. Gao et al. (2021)

reported that the gut metabolism of alcohol continues through the gut-liver axis. Here the liver and the gut communicate where the alcohol metabolites are translocated to the liver. At this level, detoxification starts, and if the alcohol by volume range is high, then the high consequences of liver injury are also expected to be high (Gao, Emami, et al., 2021).

A study in China by Sun (2020) reported that chronic alcohol consumption induces intestinal bacteria and fungi overgrowth. The overgrowth of these bacteria and fungi leads to colonization in the gut (Sun, Wang, et al. 2020).

A study in the US by Samuelson (2019) reported that alcohol causes disruption in the intestinal microbial community, yet how the dysbiotic community interacts is unclear. The study further reported that alcohol products cause more gut permeability with immune over-activation (Samuelson, Gu et al. 2019).

A study in the US by Diehl (2018) reported that alcohol pathogenesis and progression mechanisms are sometimes unclear,, but its processes regulate liver cell plasticity. Diehl (2021) further said that an injured liver leads to the malfunctioning of the morphogenic signaling pathway. This leads to dysregulated repair that increases the liver's short-term and long-term adverse effects. The liver will try to repair the injury in the hope of success.

Occasionally, when the liver is trying to repair, the person adds more alcohol, which leads to more damage than the anticipated repair (Diehl 2018).

This can be described as the frustration in the repair process by the alcohol on the liver. Illicit alcohol may worsen the situation when the toxins are of unknown content and unknown description.

A study in the US by Rungratanawanich et al. (2021) reported that the accumulation of alcohol in the body has far-reaching effects. There is negative cell functioning in the

entire body with diverse cellular responses. Intracellular accumulation stimulates an abnormally protein folding system, resulting in an elevated oxidative stressful situation. What follows is inflammation of the liver with unregulated liver apoptotic signaling pathway causing liver injury. Rungratanawanich et al. (20210 further said that the abnormal proteins bind to other short half live proteins such as albumin, inducing inflammation with dysfunctional cell injury (Rungratanawanich, Qu et al. 2021).

A study in the US by Gandhi (2020) reported that liver fibrosis is reversible. Still, the persistent presence of injury from alcohol and other toxins disrupt the hepatic architecture with interruption to the hepatocyte's blood supply. This leads to excessive accumulation of extracellular matrix, collagens, and fibronectin. These products ensure poor functioning of the liver with nearly irreversible liver injury. This is the cause of morbidity to many alcohol users (Gandhi 2020).

Liver function tests

A liver function test provides clinicians with secondary evidence to evaluate liver disease, for differential diagnosis on jaundice, to monitor the course or response of diseased liver medication, and to detect hepatotoxicity arising from various chemical agents(Akter, Shekhar, et al. 2021).

Liver function test is a clinical practise that involves testing serum samples for bilirubin, alanine aminotransferase, aspartate aminotransferase, alkaline phosphatase, gamma-glutamyltransferase, prothrombin time, and albumin. Some tests are more specific to alcohol than others (Moriles and Azer 2021).

There is no single liver biomarker that can diagnose early alcoholic liver injury or an advanced alcohol liver disease on its own. Therefore the biomarkers complement each other to highly diagnose malfunction of the liver. New forms of liver biomarkers are gaining momentum in the field of diagnosis. Among them is the non-invasive

extracellular cytokeratin 18 (k 18), which can detect the extent or severity of liver damage. It is a hepatocyte death marker with high concentrations on the serum (Vatsalya 2020).

A study in the USA reported known liver biomarkers that can detect ALD progression or severity. About 10% to 20% of heavy alcohol consumers eventually develop ALD. There are efforts to establish unique liver biomarkers that can diagnose liver injury and predict progressive damage, but the world is not yet there (Vatsalya, Gala, et al., 2021).

A study in the USA showed that all the participants' ALT and AST were elevated, which was significant for AUD (Vatsalya, Gala, et al., 2021). A study by Rigopoulou et al. (2021) found that there was a high ratio (AST/ALT >1) in 86% of the participants, with the presence of liver cirrhosis in 63% of the participants. (Rigopoulou, Gatselis, et al. 2021).

Reference range for Liver function tests in Kenya

A study in Kenya by Waithaka et al. (2009) showed that the ALT range was between 0-39 IU/L, AST was between 6-40 IU/L, ALP was between 13-201, while ALB was between 29-52 IU/L. The study further reported that the difference in range for Kenyan samples was likely due to the geographical location of the country, types of equipment and methods of analysis used, and sample sizes for any study. Other causes of variance with other references in ranges of the liver function tests were cited as race, genetics, and dietary intakes, where alcohol intake could influence the dietary intake positively or negatively for liver injury.

Rutayisire (2017) had similar findings where the researcher mentioned that the difference in the variance of liver function tests could be influenced by Geographical region and dietary intake.

Some medications are known to elevate the ALT and AST, including ceftriaxone, cotrimoxazole, phenytoin, carbamazepine, and allopurinol. Others include isoniazid, rifampicin, pyrazinamide, dapsone, and ibuprofen. Periods of increased exercise also raise the levels of transaminase and should be avoided before testing(Moriles and Azer 2021).

LIVER BIOPSY

The liver histological evaluation has been a gold standard for detecting liver diseases (Khalifa, Lewin, et al., 2021). Liver biopsy can be obtained using various methods such as in surgery, laparoscopically, or percutaneous. The transjugular approach can obtain a biopsy from the liver, a delicate but rare procedure. Once the liver tissue is obtained, the particular procedure in clinical differentiation of the disease is triaging. Thus the patient's documented examination and history results are needed by the clinician examining the tissue (Jain, Torres, et al. 2021).

The liver biopsy plays three essential roles: diagnosis, longitudinal monitoring, and assessment of disease severity. There is a discrepancy in inter-reader variability with associated sampling errors despite the three roles. Additional research analysis shows that one biopsy alone can miss the diagnosis in 24 % of the samples. Therefore the need for more serial biopsies may lead to a precision diagnosis of an alcoholic liver injury (Moura Cunha, Navin, et al. 2021).

Liver biopsy is still the best that can be done to evaluate the hepatoparenchyma alcoholic liver disease (Wu and Shah 2021), although its use is minimal compared to other tests.

Liver histology can be used to evaluate fibrosis or response to treatment. It is imperative to do a liver biopsy to evaluate the treatment response. However, cirrhosis prognosis is unpredictable, and one can not have serial biopsies to evaluate on response

to medication or in the determination of prognosis (Jain, Torres, et al. 2021) due to the high risk of liver biopsy procedure that outweighs the benefit of the diagnostic study (Wu and Shah 2021).

Other challenges in routine examination of liver biopsy include the loss of lipids and proteins and other chemical changes when the biopsy is placed in formalin for storage. Lipids play an essential role in fatty liver disease evaluation and cannot be ignored (Ščupáková, Soons, et al. 2018). For liver biopsy results to be dependable, they have to be interpreted by a group of expertise (Berzigotti, Tsochatzis et al. 2021)

Liver biopsy has diagnostic limitations and is risky, making it less ideal for screening of alcoholic liver injury (Moura Cunha, Navin et al. 2021).

Liver function test still has problems indicating the severity of the disease, and as such machine-generated computed scanning may provide more information to predict liver disease within various settings (Akter, Shekhar, et al. 2021).

LIVER IMAGING TESTS

Machine generated computed scanning include but not limited to liver imaging could be inform of ultrasound, Computed Tomography (CT) or Magnetic Resonance Imaging (MRI) (Moura Cunha, Navin et al. 2021).

Liver non-invasive tests are gaining increase favor for diagnosis and prognostication in alcoholic liver disease across several etiologies. Non-invasive score and imaging methods can be used to identify advanced liver fibrosis (Berzigotti, Tsochatzis et al. 2021).

Image source: https://www.medicalnewstoday.com/articles/215638#early-signs

On the image film, the clinician is guided by the fatty cells to diagnose liver disease(Negi, Babica, et al., 2022). The history of alcohol consumption or no alcohol consumption combined with the imaging help the clinician diagnose nonalcoholic fatty liver disease or alcoholic liver disease.

It is reported that in advanced liver disorder, the liver functions deteriorate, a suggestion well evaluated through serum bilirubin. Liver biopsy has lost importance in evaluating alcoholic liver disease (Seitz and Neuman 2021). Alcohol abstinence, even for one year, does not reverse the liver function fully; the liver biomarkers are still elevated, signifying prolonged liver injury (Seitz and Neuman 2021).

There is a challenge to the diagnosis of drug-induced liver injury. The European Association for the study of the Liver provides guidelines on investigations and management of drug-induced liver injury. The guidelines describe liver injuries by classifying them into two groups: the intrinsic or direct class and the idiosyncratic class. The intrinsic class is characterized by a predictable phenomenon on the dose induced; the phenomenon may occur to a large subset of the exposed population but may be of a short onset. The idiosyncratic class of drug-induced liver injury does not depend on dose but rather on the duration of continuous dose induction from week to months and even years (Brennan, Cartlidge, et al., 2021).

Among the specific drug-induced items on the guidelines is alcohol. Others include gender, with females highlighted as a gender at higher risk of progressing to acute state faster than males. The genetic factor is also a drive to drug-induced liver injury (Stephens, Lucena, et al. 2019, Garcia-Cortes, Robles-Diaz, et al. 2020).

In 2014 Iceland reported an increase of drug-induced liver injury from 7% to 20%, while the US reported a similar 16% increase for 2013 to 2014. The prediction was that the percentage could increase further due to alcohol consumption behavior. (Brennan, Cartlidge et al. 2021).

A study in the US found that liver cancer increased by 75% between 1990 and 2015, with alcohol-related cancer accounting for 30% of the increase. The study compared cirrhosis secondary to alcohol among different regions. The statistics in Africa were

unavailable, posing a challenge to predicting the severity of cirrhosis due to alcohol (Vatsalya 2020).

Liver disease can be subdivided into nonalcoholic liver disease and alcoholic liver disease. Nonalcoholic liver disease is described as a liver problem in persons who consume little alcohol or do not consume alcohol. The characteristic of this nonalcoholic liver disease is the presence of fat stored in the liver cells, which helps clinicians to describe it as nonalcoholic fatty liver disease (NAFLD). Nonalcoholic fatty liver disease occasionally will progress to a more severe form referred to as nonalcoholic steatohepatitis (NASH). This form is aggressive, and it advances to liver cirrhosis and liver failure at a near same rate as alcoholic liver disease (Nati, Chung, et al., 2022).

To prevent nonalcoholic fatty liver disease, persons are advised to eat more fruits, consume less fat, maintain a healthy weight, and exercise regularly. Therefore the known risk factors for NAFLD include obesity, high cholesterol, and Diabetes Mellitus (DM) (Nati, Chung, et al., 2022)

Studies have reported an association between NAFLD with progression to kidney disease, with End-Stage Renal Disease (ESRD) being common to these persons (Mantovani, Petracca, et al., 2022).

Nonalcoholic fatty liver disease is emerging as a significant health issue that needs keen follow-up because it could affect a quarter of the world's general population. (Fatima, Moeed, et al. 2022). Nonalcoholic Fatty liver disease can combine with alcoholic liver disease when a person is obese and is a regular alcohol consumer. Due to this, the combination of these two liver diseases worsens the situation of the Liver with a high rate of mortality within a shorter duration (Imajo, Kessoku, et al. 2022).

Alcoholic liver disease is common in persons who drink alcohol. It could be minor or excessive alcohol, and it could be days off occasionally, or it can be regulated or illicit alcohol. Due to alcohol consumption, the Liver accumulates fat inside the liver cells, which induces the inflammation that starts the cell death, followed by scarring and then cirrhosis, where the scarred tissue cannot perform the functions of the Liver (Mantovani, Petracca, et al. 2022).

The Liver tries to adapt to the hostile environment of alcohol by enlarging (hepatomegaly); the problem can escalate to liver cancer or affect other organs such as the kidney and the spleen (DiMartini, Leggio, et al. 2022).

Alcoholic Liver Disease (ALD) represents several diseases that include asymptomatic hepatic steatosis, liver cirrhosis, and alcoholic hepatitis (Rigopoulou, Gatselis, et al., 2021). Alcoholic Liver Disease (ALD) is further subdivided into a narrow spectrum of disorders such as asymptomatic hepatic steatohepatitis, cirrhosis, and liver failure. These subdivisions are elaborated depending on the spectrum of the disorders and their management (Kwong and Puri 2021).

Advanced ALD presents with Alcoholic Hepatitis (AH), which has a high mortality rate due to liver decompensation, portal hypertension, bacterial infection, and renal failure. There is increased permeability of the intestine, disruption of the normal gut flora, and bacterial translocation that cause injury and inflammation to the Liver. There is vasoconstriction leading to portal hypertension (Wu and Shah 2021).

Clinical manifestations of alcoholic liver injury

When detected, the symptoms of alcoholic liver injury persist in 21% to 37% of those detected with the problem (Asrani, Mellinger, et al., 2021). Some noticeable signs include pain in the right quadrant, nausea and vomiting, diarrhea, and decreased appetite. Other clinical manifestations of alcoholic liver injury include jaundice which

can be seen on the eyes or the skin. There could be edema of the lower limbs, fever and shivering, itchy skin, and ascites. It is reported that jaundice and tremors are severe signs of alcoholic liver disease. Other signs include clubbing the fingernails, general body weakness with muscle wasting, or blood in the stool. Symptoms for alcoholic liver injury can be silent (Flemming, Djerboua, et al., 2021)

Albumin is synthesized by the Liver approximately 10 grams per day. Albumin helps bound bilirubin that is conjugated and is water-soluble. Bilirubin is a by-product of hemoglobin catabolism, and it possesses cytoprotective and antioxidant functions. Thus low circulating levels are associated with beneficial antioxidant activities, while high levels are associated with severe toxicities (Ma, Zheng, et al., 2022).

The bilirubin is transported for excretion in urine. When the Liver is diseased, albumin is not readily secreted and not readily available for the bilirubin. Due to this, the bilirubin will appear as the yellow coloration of the skin (causing itching) or on the sclera of the eyes (Ma, Zheng, et al., 2022).

1.2 Statement of the problem

Alcohol use is a growing global problem, with its effects increasing the global burden on non-communicable diseases (Lindvig, Hansen, et al., 2021). Alcoholism results in an estimated 4% of all deaths annually in the world. As such, mortality due to alcohol consumption is greater than mortality due to Acquired Immunodeficiency Syndrome (AIDS) or tuberculosis (WHO 2018). Similarly, alcoholism is regarded as the lead factor for mortality and morbidity in persons aged between 15 and 59 years, particularly males; it is the number 8 leading risk factor to mortality and morbidity in all ages for male and female persons (WHO 2018).

In 2016, the world had 2.4 billion people known to drink alcohol; among them, 39.5% were harmful alcohol users. In the same year, 3 million deaths were related to alcohol

consumption. These were 5.3% of all deaths, higher than deaths due to hypertension and diabetes mellitus combined (Asrani, Mellinger, et al., 2021).

The European Association for the Study of the Liver in 2021 reported lifetime alcohol consumers amounting to 2.4 billion persons, among them 950 million heavy drinkers. In 2017 there were 23.6 million persons with alcohol-related liver disease, and 1% of all global deaths were due to alcohol liver disease. (Berzigotti et al. 2021)

Alcohol-related mortality is on the rise in the US. The rise is postulated to be over 3% in every decade. There is an emphasis on early detection of the disease, with lots of efforts on diagnostic procedures of alcohol-related liver fibrosis(Rasmussen, Thiele, et al., 2021).

In the United States, during the last two decades, mortality due to alcohol consumption has doubled (Lindvig, Hansen, et al. 2021) While it is estimated that death due to Alcoholic Liver Injury (ALI) in the same area will triple by the year 2030 (Scholey, 2020)

A study in Latin America reported that low and middle-income countries have high mortality rates despite low alcohol consumption. (Arab, Bataller, et al. 2020) The proposal to reduce alcohol consumption by 2025 to 10% has been slow in most world regions (Arab, Bataller, et al. 2020). Most countries do not have public health plans on reducing alcohol by 2025 to 10% (Arab, Bataller, et al. 2020).

Clinical manifestation is non-specific and occasionally asymptomatic. Clinicians have verbalized challenges in the early detection of the disease. There is no known specific diagnosis of the disease, a combination of tests have been used to conclude that the disease is alcoholic liver injury. Clinicians have errored on several occasions, and none

can specifically tell with certainty that their patients are showing early symptoms of alcoholic liver disease.

Research has not given hope of near future discoveries in early clinical manifestations of alcoholic liver injury. People who drink alcohol continue drinking unabated without caution that soon they were culprits of alcoholic liver injury.

The diagnosis of alcoholic liver injury relies on a verbal report on alcohol consumption combined with excluding other liver diseases(Rigopoulou, Gatselis, et al., 2021).

There is scanty information on prognostic prediction on alcoholic liver injury with the knowledge gap left to clinicians who may estimate the severity of the disease and aided by liver biomarkers, biopsy results, and imaging predictions on the status of the patient (Rasmussen, Thiele, et al. 2021).

The reduction of alcoholic liver injury requires multifaceted focus by governmental and non-governmental organizations on reducing alcohol consumption, early identification, treatment, and socioeconomic education on alcohol consumption (Asrani, Mellinger, et al., 2021).

A study in Canada sought to estimate the impact of alcohol consumption by 2040; it was reported that cirrhosis due to alcohol will by 2040 have reached unmanageable status if measures are not put in place to cub the undetected early symptoms of alcoholic liver injury (Flemming, Djerboua, et al. 2021).

Given the dominance of alcohol in the world capped with efforts by alcohol-producing companies to make more profit, the world is likely to experience more alcoholic liver injury stretching the family and societal finances to the extremes. Families will likely

spend more resources to treat their loved ones while governments will set bigger portions of their budget to treat citizens with alcohol-related diseases.

A study in Canada postulated that about 90% of all liver cirrhosis diagnoses were due to alcoholic liver injury (Flemming, Djerboua et al. 2021).

The alcoholic liver disease accounts for 25% of all deaths due to liver cirrhosis. Less diagnosis in medical facilities on liver disease is under-reported globally. This can lead to severe setbacks whose effects can be damaging, especially to low-income and middle-income Countries (da Cunha, Botelho et al. 2022).

Screening of alcohol liver disease needs a practical approach with proper methods of patient triage in our health care facilities. The guiding principles should focus on screening for early detection of the disease. Proper and dependable screening tools are a focus to the achievement. Screening in some resource constrain areas may be a challenge, and as such, research should design methods to enhance this approach. Other modalities to reduce the cost of health management should be encouraged (Manthey, Shield et al. 2019).

There should be free services to the clients affected by alcohol to encourage them to sought for the services. These free services may help realize more abstinence and more persons using medication due to alcoholism. The model of free services has worked well with HIV medication compared to rehabilitation centers that are said to be very expensive.

A report on global alcohol exposure between 1990 and 2017 reported decreased alcohol abstinence from 46% in 1990 to 43% in 2017. On the contrary, there was an increase in

alcohol consumption from 45% in 1990 to 47% in 2017 with an estimated increase to 50% by 2030 (Manthey, Shield et al. 2019).

The interpretation of these statistics was that global reduction of harmful alcohol use was unlikely; the cost of treating the disease was likely to get high. Families and Countries' burden for treatment was likely to increase, with mortality highly expected to increase. Thus modalities for early detection and early treatment of the disease are essential.

The Kenya Health Policy for 2014 -2030 prescribes treatment for substance use and overdose. Different forms of treatment in this protocol include management of psychiatric disorders, prevention of relapse, and psychosocial intervention. Treatment of alcoholic liver injury is given no preference in the different forms of treatments in this protocol. It is postulated that mortality due to alcohol consumption is related to alcoholic liver injuries and not behavior-related diseases of alcoholism.

Majority of Kenyans who are heavy consumers of alcohol with a long duration of consumption die of alcoholic liver injury diagnosed as liver cirrhosis. Either liver cirrhosis is diagnosed late at an advanced stage, or consumers die with symptoms without proper diagnosis. Due to poor diagnostic mechanisms for alcoholic liver injury in Kenya, statistics for morbidity and mortality due to this problem are scanty or unavailable. Also, clinicians working in the health sector do not have proper diagnostic tools for alcoholic liver injury.

Laboratory tests for liver injury are expensive and not always available in many medical facilities, particularly those in the lower tiers (tier 1,2 and 3) in the Kenya health sector, including the dispensary, health centers, and referral institutions respectivelly. Therefore it costs a client a lot of time and money to evaluate liver injury

due to alcoholism. The tests are not done on many occasions, and clients continue with alcohol consumption unabated. Therefore this study aimed to develop an assessment and referral tool for liver injury to enable early detection.

1.3 Purpose of the study

This study aimed to develop an assessment and referral tool for persons with alcoholic liver disease. The tool will facilitate early detection of ALI and subsequently help to refer the clients for early management. Clients of alcoholism will incur less cost to have the liver evaluated of ALI.

1.4 Research Objectives

1.4.1 Broad Objective

To develop an assessment and referral tool for alcoholic liver injury among adults of alcohol consumption in selected counties in Kenya.

1.4. 2 Specific Objectives

i. To establish AUDIT screening results for alcoholic liver injury among adults who consumed alcohol in selected counties in Kenya
ii. To determine levels of alcoholic liver biomarkers among adults who consumed alcohol in selected counties in Kenya.
iii. To correlate AUDIT test results with liver biomarkers among adults who consumed alcohol in selected counties in Kenya.
iv. To develop a strategy for assessment and referral of alcoholic liver injury among adults who consumed alcohol in selected counties in Kenya.

1.5 Research Questions

i. What are the AUDIT screening results for alcoholic liver injury among adults of alcohol consumption in selected counties in Kenya?

ii. What are the levels of alcoholic liver biomarkers among adults of alcohol consumption in selected counties in Kenya?

iii. What is the relationship between AUDIT test results and liver biomarkers in alcoholism among adults of alcohol consumption in selected counties in Kenya?

iv. What are the measures that can be put in place for assessment and referral in alcoholic liver injury among adults of alcohol consumption in selected counties in Kenya?

1.6 Hypothesis

H_o- There is no significant relationship between Alcohol Use Disorder Identification Tool and liver biomarkers in assessment and referral of alcoholic liver injury.

H_1- There is significant relationship between correlation of AUDIT and alcoholic liver biomarkers with development of an assessment and referral tool for alcoholic liver disease.

1.7 Justification

Various studies have highlighted the importance of testing alcohol overuse among persons of different ages. They have described behavior changes due to daily, weekly or monthly use of alcohol. Laboratory tests for liver biomarkers are practice of evaluating liver injury emanating from the consumption of alcohol but the practice is not easily available to all citizens especially to the lower tiers of health services in Kenya. Mortality due to alcoholism has been experienced in the two counties with highest alcohol consumption (Murang'a and Uasin Gishu) but it is not caused by

behavior changes of alcoholism. The mortality is due to organ malfunction or non-function which is highly suspected to be liver injury. Liver injury can be detected through elevated levels of liver biomarkers and not by behavior changes. In Kenya there is no tool that can be used to detect alcoholic liver injury. The Kenyan government has focused on the big four agenda as a way to improve living standards for its people. The fourth pillar of this agenda is affordable universal health care. By developing an assessment and referral tool for ALD in adults, many clients will benefit from services of early detection and referral which has previously been expensive and not readily available especially in the tier two and three medical facilities. Nurses and other clinicians was re-educated on how to use the developed tool for ease of use and it is expected that more clients was detected early unlike previously where such a tool to detect liver disease was not available. The information about this tool for assessment and referral for ALD will be shared with counties and national government for use in the entire country.

1.8 Scope of the study

The aim of this study was to develop an assessment and referral tool for alcoholic liver injury. Information was gathered from participants using the AUDIT tool while samples of blood were acquired to detect the levels of various liver biomarkers. Both results were correlated to eventually develop the assessment and referral tool. This study covered all persons who consume alcohol, were above the age of 18 years and sought medical assistance from the counties of Murang'a and Uasin Gishu. Participants were those who had been consuming or were on-going consumers of alcohol and were willing to be diagnosed for alcoholic liver disease. The study was carried on within a period of six months from June to September 2021.

1.9 Study Limitation

Due to the societal stigma on alcoholism it was expected that individuals or relatives of persons associated with alcohol consumption would be restricted from participating in the study. Also it was expected that this being a special group of participants who are vulnerable, they would not easily understand the benefit of the study. Their availability in participation could be low as few sought medical advice on their own and majorities would do so with the help of relatives. It was also expected that the participants could fear the repercussion of giving true information regarding their alcohol consumption and as such the information given could not be accurate.

1.10 Delimitation

The researcher and research assistants involved relatives of the participants, informed them about the benefit of the study and offered opportunity for them to ask questions which the researcher and research assistants answered to the satisfaction of the relatives. The researcher and research assistants requested the relatives to explain to the participants of this study benefits to individuals and to the society which involved development of an assessment and referral tool for adults alcoholic. Upon contact with the participants the researcher or research assistants explained the benefit of the study to individuals and the society.

1.11 Assumption of the Study

It was assumed that the information given by the participants regarding their alcohol consumption was true and that they did so in their stable state of mind. It was also assumed that the participants were not coerced by relatives or other persons to seek medical assistance due to alcoholism but they sought for medical assistance upon their own will and under their power.

1.12 Operational definition of Key Terms

Abstainer: A person who has been drinking alcohol but has stopped.

Alcohol biomarkers: These are laboratory test indicators on alcohol ingestion or exposure.

Alcohol Screening: This is the application of a test to detect alcohol abuse or alcoholism.

Alcohol unit: Equivalent to one bottle of 500mls with an alcoholic content of 3.5%.

Alcohol use disorder: Significant physical impairment or psychological distress resulting from alcohol use.

Alcoholic Liver Disease: This is pathological state of the liver following alcohol consumption.

Alcoholic liver injury: Damage to the liver caused by ingestion of alcohol.

Alcoholism: A medical condition where an individual is addicted to alcohol.

Assessment: Gathering of data relevant to the alcohol consumption by a client

Binge drinking: Alcohol consumption that leads to increase of blood alcohol content to 0.08g/dl.

Biomarker: A biochemical outcome for measure of a disease progress or effect of therapy.

Drink: A solution that include alcohol as its main ingredient.

Drinking: Consumption of alcohol.

First generation alcohol: Brands of alcohol drinks produced by brewing companies with alcohol by volume percentage of less than 10%.

Frequent drinking:- Consumption of alcohol for five or more days per week

Heavy drinking: Consumption of alcohol, 6 units or more in women and 8 units or more in men

Liver cirrhosis; This is a hepatocellular disease where the healthy tissue of the liver is replaced by scar tissue whose physiology is lost.

Medical Treatment: Therapeutic care offered to clients while within or without a health facility with the purpose to cure pathology due to alcohol consumption.

Referral: A follow-up care for clients with medical problems due to alcohol consumption.

Screening: Application of a test to members of a population with the aim of detecting a disease or disorder.

Sensitivity: Ability of a test to correctly identify persons with a disease

Second generation alcohol: Brands of alcohol drinks produced by brewing companies with alcohol by volume percentage of greater than 10% but less than 15%.

Specificity: Ability of a test to correctly identify persons with-out a disease

Third generation alcohol: Brands of alcohol drinks produced by brewing venders with alcohol by volume percentage of greater than 15% but less than 41%.

Tool: A designed model for use by clinicians to elicit certain information from the client.

Validity: Ability of a test to indicate persons with a disease and those without a disease.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This chapter describes the AUDIT screening and various laboratory biomarkers used as diagnostic studies in liver injury, then review studies done that associate the AUDIT with liver biomarkers in alcoholic liver injury. The chapter also evaluate research studies previously conducted by other researchers which relate to development of an assessment and referral tool for alcoholic liver injury.

2.2 Alcohol Use Disorder identification screening

The Alcohol Use Disorder Identification Test (AUDIT) screening tool was developed to identify excessive alcohol use that could be a possible cause of medical conditions (Flemming, Djerboua et al. 2021), after identification of the disease early intervention to prevent further disease development is recommended. Various studies have been done on the tool that concluded on its sensitivity and specificity. Mitra (2020) reported that AUDIT had a 67% sensitivity and 95% specificity to alcohol

The AUDIT screening tool was intended to identify persons with alcohol use disorder, then for those with hazardous alcohol use the health care workers were to offer brief advice, for dependence use, they were to offer counselling and further evaluation while for harmful use, the health care workers were to offer diagnostic and referral services (Rehm, Neufeld et al. 2020) ..

Madson, at al (2020) described the Alcohol Use Disorder Identification Test (AUDIT) as a gold standard screening test for alcohol abusers of all ages and gender. Berman, et al (2020) further compared the AUDIT tool with other screening tools but still the AUDIT tool retained its high standard of detecting alcohol abuse.

Demilew et al (2021) reported that the AUDIT composition is of three sections referred to as domains. The first three questions are summarized by the domain of hazardous alcohol use. The hazardous alcohol use domain focuses on the frequency and quantity of alcohol consumed. The second set of questions is numbered 4 to 6 which are referred to as the dependence alcohol use domain. This set of questions explore on signs of alcohol dependency while the last set of questions numbered 7 to 10 are referred to as the harmful alcohol use domain which explore of alcohol related problems of daily living (Demilew, Boru et al. 2021).

Demilew et al (2021) further reported that each questions has a '0' to '4' score range with '0' score showing 'never', '1' showing 'less than monthly' , '2' showing 'monthly', '3' showing 'weekly' while '4' showing 'daily or almost daily'. Questions number nine and ten were assigned three responses with scores of '0', '2' or '4'. The AUDIT tool has a cumulative total score of forty with each domain assigned its own cumulative score within the forty. Thus the hazardous alcohol use domain was assigned a total score of 12, the dependence alcohol use domain was assigned 12 scores while the harmful alcohol use domain was assigned 16 scores (Demilew, Boru et al. 2021).

Crabb, et al (2020) reported that one questionnaire tool can be used to detected abuse of alcohol through self-reporting on the amount consumed. In a study by Aalto, et al (2011) AUDIT test was conducted on participants, results showed that 10% of alcohol consumers were hazardous drinkers; this is after drinking 280g of alcohol per week in men and 168g in women. According to Alto, et al (2011) a heavy drinker is one who consumes greater than 4 drinks in a day and greater than 8 drinks (about 12g) in a week. In the United States a study by Singal, et al (2018) found that 22.8% of alcohol consumers were heavy drinkers. United States defines an alcoholic drink as one that

contain 14g of alcohol equivalent to beer of 5% weight/volume, wine equivalent to 10% weight/volume while hard liquor contain 45% weight/volume (Singal, et al 2018). Similar labelling design of alcohol by volume is found in Kenya and some other Countries.

Pilowsky and Wu (2012) reported that among persons who engage in hazardous alcohol behaviors, 92% of them had an AUDIT score of 8 or greater than 8, while eight percent had an AUDIT score of less than 8. These findings were similar to those of Jenkins, et al (2015) who reported of an AUDIT screening where results of greater than 8 pose a higher risk for future damage of body organs.

According to Stoner, Mikko and Carpenter (2014) AUDIT scoring has an interpretation where 0 to 4 indicating low risk for alcohol use, 5 to 14 indicating risky alcohol use while 15 to 19 indicate harmful alcohol use with possible mild or moderate alcohol use disorder. A score of 20 and above indicate severe alcohol use and a possible moderate or severe alcohol use disorder (Mikko and Carpenter, 2014). In a study by Fujii (2016) 16% of the participants had an AUDIT score of greater than 11, among these participants majority had alcohol consumption of more than four times in a week with more than seven drinks on a typical day (Fujii, et al 2016).

Originally the WHO adopted a standard drink as 10g of alcohol content but other studies done have encouraged that a standard drink be 14 g, this study adopted a standard drink as 14g alcohol content in a drink.

The Alcohol Use Identification Test (AUDIT) during the Covid-19 pandemic aimed at identifying how participants would adapt to the pandemic and adhere to the restrictions despite the alcohol consumption behavior. Persons of hazardous drinking are likely to continue alcohol consumption despite the changes of phenomenon, places or durations

of the year. There restrictions or no restrictions alcohol user will continue drinking unabated. They will continue drinking since hazardous drinking is not life threatening and as such majority do not find it necessary to stop drinking at this level ((Verhoog, Dopmeijer et al. 2020).

A study in japan by Kawaida et al (2021) found that 9.5% of the participants were moderate drinkers, 3.6% were heavy drinkers while 41.6% were binge drinkers (consume about 5 drinks in 2 hours). Moderate drinking is unsafe and is considered an important factor for prevention of Alcohol Use Disorder (AUD) (Kawaida, Yoshimoto et al. 2021).

Eashwar et al (2019) in an AUDIT study found that 15% of the participants were dependent alcohol consumers while 53% were harmful alcohol users. Similarly a study in India on AUDIT found that 67% of the participants were problematic alcohol users, 52% of them reported hazardous or harmful drinking patterns while 14% reported dependent symptoms (Eashwar, Gopalakrishnan et al. 2019).

A study in Ethiopia by Demilew et al (2021) assessed alcohol use pattern using the AUDIT tool and found that 35% of the participants had prevalence of alcoholic liver disorder (Demilew, Boru et al. 2021). A study in Kenya by Harper et al (2021) found that about 76% of the participants had ever been involved in alcohol use with 50% being harmful alcohol users (Harper, Crawford et al. 2021).

Other modalities of alcohol testing and liver evaluations

Alcohol and Nonalcoholic Index (ANI)

Alcohol and nonalcoholic index (ANI) is an analysis method for standard risk factors of ALD. In this analysis method laboratory tests are analysed then stipulated to predict

ALD. These laboratory tests include the AST/ALT ratio, MCV, gender and the Body Index Mass (BMI) (Kamath and Kim 2007).

In an option to avoid a liver biopsy, which is probably the most dependable test for ALD; the ANI scoring tool was formed. The purpose was to help those persons who would otherwise be candidate for liver biopsy and have an alternative to the assessment and diagnosis of the liver status (Cerovic, et al, 2013) The ANI scoring model has gained favor in diagnosis of excess alcohol consumption (Shah, 2015). When using the ANI model logistic regression for MCV, AST/ALT ratio, BMI and gender are used as the variables to distinguish ALD and NAFLD (Jamali, 2013). In this model an ANI index of greater than 0 indicate the likelihood of a diseased liver while an index of below 0 indicate the likelihood of NAFLD (Jamali, 2013).

Jamali, (2013) noted that ANI performance was better than other conventionals either as a single entitle or as combined biomarkers. According to a study by Cerovic, et al. (2013) ANI index results were higher in patients who were chronic alcohol consumers than in non-alcoholics an indication that ANI index is higher in ALD than NAFLD. Cerovic, et al (2013) further reported that MCV and the AST/ALT ratio are higher in persons with ALD while BMI is low. AN index model is regarded as simple and practical easy to use and highly help differentiate the diagnosis of ALD and NAFLD. When in combination with GGT, the ANI model is improved (Wang, et al, 2016).

The ANI model is not a perfect tool to replace histopathologic examination, but despite this the ANI model is reliable for use (Wang, et al, 2016).

Gala and Vatsalya (2020) reported that research on new methods for detecting ALI has been ongoing for decades. Combined clinical scores and liver biomarkers have attracted

relative attention. These modalities provide better options in diagnosis, prognosis and therapeutics in trying to accurately predict them (Gala and Vatsalya 2020).

Discriminant Function index (DFI) which is also known as Maddrey's score is among the widely recognized tool for evaluation of Alcohol hepatitis especially in corticosteroid therapy clients. The tool uses blood tests for prothrombine time index and total bilirubin as its variables for scoring. A range of DF greater than 32 denotes severe liver injury. Patients with such a score if not treated have a mortality rate of 20-50% within a period of 30 days (Gala and Vatsalya, 2020).

The Glasgow Alcoholic Hepatitis Score (GAHS) is a model used to predict the mortality on a patient with end stage liver disease. The model uses age, Blood Urea Nitrogen (BUN), serum bilirubin and prothrombin time as its variables. Thus a score less than 9 predict low mortality rate while a score of greater than 9 predict unlikely benefit from liver treatment (Gala and Vatsalya, 2020).

Gough, et al (2015) reported that questionnaire tools such as the CAGE, AUDIT or patient's own report can be used to assess the alcohol consumption to patients with liver disease. The problem commonly encountered with these tools is that patients will at some point give inaccurate among of alcohol consumed in fear of negatively judged by the clinicians attending to them.

A study in USA reported that majority of the diagnostic models for hepatic disorders are not efficient in diagnosis and prognosis of the ALI aspects and as such more clinical and mechanistic studies may be helpful (Gala and Vatsalya 2020).

Another study in the US reported that total bilirubin of greater than 9mg/dl in alcoholics was highly associated with mortality (Hofmeister, Xing et al. 2021)

2.3 Laboratory Biomarkers' Tests

Transaminase of Aspartate aminotransferase (AST) and Alanine Aminotransferase (ALT) describe the average values of AST as below 10 International Units (IU) to 40 International Units per litre (IU/L) of blood. In comparison, ALT values are below 7 to 56 International units per litre of blood. The mild elevation is between 2 to 3 times higher, while severe elevation is above 4 to 5 times higher but may be elevated to 1000 times higher in selected cases (Flores et al., 2018).

Harris et al. (2013) reported that the aminotransferases test measures the leaked hepatic enzymes into the blood vessels and which are detected through laboratory tests. The aminotransferases usually are less than 30 to 40 IU/l and an elevation of greater than eight times above the upper limit reflects liver injury. They further reported that mild elevation of the aminotransferases results in greater than 250 IU/l. At this level of 250 IU/L elevations, the parameter signifies that liver function is affected and future morbidity or mortality is inevitable (Kwo et al., 2017).

Alanine aminotransferase measurement is usually available in health facilities at a low cost and is utilized to detect liver disease due to alcohol (Nath and Singh, 2016). Clients with elevated liver transaminase levels should be considered for liver injury early before enough damage is done (Niemelä, 2016). Elevation of ALT can effectively identify persons with ongoing liver injury. The Substance Abuse and Mental Health Services Administration (SAMHSA) (2022) committee reported that AST and ALT give the best results when applied to adults between 30 and 60 years. Still, their values can be lowered by the consumption of coffee.

Kwo et al. (2017) reported that essential LFTs are the AST and ALT as their elevations signify liver injury. Kwo et al. (2017) further reported that the majority of the mortality due to liver injury was due to elevated ALT (Kwo et al. 2017)

Kwo et al. (2017) further agreed on the elevated parameters for AST and ALT: that mild elevation is two to five times above Upper Limit of Normal (ULN) moderately elevated be between 5 and 15 ULN and severe elevation as above 15 ULN.

Carbohydrate Deficient Transferrin (CDT) is another laboratory test to rule out alcoholic liver disease. In the liver, transferrin is secreted to aid in the transportation of iron, and Its half-life is 7 to 10 days. The normal range for CDT is; less than 60mg/L, and values between 60 and 100mg/L indicate alcoholism Glycosylation of transferrin is influenced by alcohol consumption leading to increased carbohydrate-deficient transferrin which interferes with the iron transportation. Further CDT has been reported as a helpful liver biomarker than many other available tests for alcohol abuse (Solomons, 2012).

Chronic alcohol consumption interferes with iron availability by inhibiting glycosylation within the Golgi apparatus in the hepatocytes. This results in decreased availability of transferrin increasing its isoforms.

Carbohydrate Deficient transferrin identifies alcohol abusers; it can also be correlated with oral reports of alcohol consumption (Deas, Johnson, and Thomas, 2019). Daily alcohol consumption of upto 80 g in a week may lead to rise of CDT (Muñiz-Hernández et al 2014). In alcohol-dependent patients, CDT is sensitive to detecting relapse and can monitor sobriety. For patients who may not provide accurate data in a questionnaire, the CDT is dependable to accurately provide the status of alcohol consumption when it is elevated (Uljas, 2019).

Carbohydrate Deficient Transferrin is not superior to GGT as a marker for assessing heavy alcohol consumption. When used with other biomarkers such as GGT, it can detect ALI (Arving, 2020).

The CDT investigation has referenced a single test that is more sensitive and more specific. It is an essential detector for moderate to heavy alcohol intake in persons who consume nearly 7 to 10 drinks daily. This test is less expensive than other tests and maintains high standards; it is available in most health facilities (Deas et al., 2019).

The CDT test can be used alone to measure alcohol levels or combined with other tests. If used on its own, it is sensitive enough to be trusted. When combined with other tests, it greatly improves their sensitivity by interfering with its specificity or others (Deas et al., 2019).

Laboratory tests for CDT have been used for excessive alcohol consumption in research, clinical trials, and medico-legal settings, although there is conflicting data on its accuracy, with sensitivity ranging from under 20% up to 100%, specificity maintained at high levels above 70% (Helander et al., 2016)

Another liver biomarker, the Gamma Glutamyl transferase (GGT), is elevated to increase oxidative stress and decrease glutathione levels. Continued exposure to alcohol causes cell inflammation leading to hepatocyte necrosis, further increasing the GGT in serum (Crabb et al. 2020).

A study in the US reported on the normal ranges for transaminase values and other tests for the biomarkers of liver function as AST 0 to 35 IU/L, ALT as 0 to 45 IU/L, GGT as 0 to 30 IU/L, Bilirubin as 2 to 17 micromoles/L, Albumin as 40 to 60 g/L and

Prothrombin time as 10.9 to 12.5 seconds. Lala et al. (2020) reported that AST or ALT, when elevated, rarely exceeds 300 IU/L in ALI (Lala, Goyal et al. 2020).

Elevated liver enzymes should be classified as mild when less than five times UNL, moderate when between 5 and 10 times UNL, and severe when greater than ten times UNL. Malakouti, et al, (2017)

Alkaline Phosphatase

This liver enzyme is found in human tissue; major areas of function include the liver, kidneys, intestines, bones, and placenta. In the gut, it helps protect the intestinal tract against bacteria invasion. Normal values range from 30 to 130 IU/L. High levels of Alkaline Phosphatase (ALP) indicate the presence of disease; due to this, elevated levels in alcohol consumers indicate alcoholic liver injury. Persons who smoke with elevated ALP should stop smoking since it elevates the ALP in the body. Also to note is that coffee reduces the levels of ALP but should be taken with moderation to avoid long-term effects such as hypertension.

2.3.1 Transaminase

Transaminase is the liver enzyme used to evaluate the functionality of the liver. Normal ranges for transaminase values for the biomarkers of liver function are as follows, AST 0 to 35 IU/L, ALT as 0 to 45 IU/L, GGT as 0 to 30 IU/L, Bilirubin as 2 to 17 micromoles/L, Albumin as 40 to 60 g/L, and Prothrombin time as 10.9 to 12.5 seconds. Lala et al. (2020) Both AST or ALT, when elevated, rarely exceed 300 IU/L in ALI. Shreevastva, Pandeya and Mishra (2017)

A study in the US reported that alcoholic liver disease is likely to be present in persons with AST: ALT ratio greater than 2; the study further showed that an AST: ALT ratio

of less than one was suggestive non-alcoholic liver disease. Oh, et al., (2017) (Oh, Hustead et al. 2017).

A study in India on alcoholics consuming alcohol for over 11 years found that AST was elevated in 96%, ALT was elevated in 78%, and ALD was confirmed in 43% of these participants(Chavan and Harshe 2016).

A study in the United Arab Emirates on alcohol liver injury reported that AST: ALT ratio was greater than 2 in 70.27%. The study also showed that AST was about 300 IU/L in 97.29%, and ALT was about 300 in 94.59%. About 3% of the participants had above 300IU/L for AST and ALT. The study further showed that 29.72% of the participants with alcohol liver injury had an AST: ALT ratio of less than 2. In conclusion, the researchers in this study reported that AST and ALT were the determinants of alcoholic liver injury. They were helpful parameters in the hospitalization of patients and their prognosis. Shreevastva et al. (2017). The study further suggested elevated AST and ALT indicated that liver damage has occurred, with the most probable cause cited as alcohol (Shreevastva, Pandeya, et al., 2017).

A study in the United Arab Emirates reported an apparent relationship between alcohol consumption and liver disease. The study suggested alcoholic liver disease and not non-alcoholic liver disease (Shreevastva, Pandeya et al. 2017).

In a study, Hundt et al. (2020) reported that 63.7% of the participants had elevated AST, 63.5% had elevated ALT, and 75.7% had elevated total bilirubin. The results were significant to liver injury before hospitalization. A study in the US found that 46.3% of excessive alcohol users had AST: ALT ratio less than one while 51.5% had a ratio of less than two and only 2% had a ratio greater than 2. This study also showed that 51% of those with ALI had an AST: ALT ratio greater than 2. The study concluded

that the AST: ALT ratio greater than 2 had a statistical significance of liver injury(Gough, Heathers et al. 2015).

A study in China reported that ALT is considered mildly elevated when it is one to two times above the standard limit(Cheng, Wang et al. 2017). The study further reported that 61.8% of the participants had elevated ALT, indicating severe liver injury. A study in India on participants who were alcohol consumers reported that 70.6% had raised AST while 36% had raised ALT; MCV was raised in 54%. Chavan, Birajdar and Pawar (2018)

In a study in India, Jain and Nandy (2018) found that 81% of participants with ALD had AST and ALT elevated. Chaoji and Humaney (2017), in a study on patients admitted to Critical Care Unit (CCU) due to alcoholism, found that AST was raised in 72% while ALT was raised in 33% of participants. Among the participants, 38% were diagnosed with liver cirrhosis, and these participants had a mean of 180ml/day of alcohol consumption. Suthar, Suthar, and Mewada (2013), in a study on alcoholics, found that AST was elevated in 56.1% of the clients while MCV was elevated in 97.6% of the participants. The AST: ALT ratio was 2:11.

A mortality standardization ratio was calculated on the community participants in a study. The results showed that participants with AST of greater than two times the upper limit had a 78% increase in death risk compared with the rest of the average population. Similarly, those with elevated ALT greater than two times had the mortality standardization ratio calculated. The results showed a 21% increased risk of death than the average population (Kunulsor et al., 2014).

Regarding ALT and GGT, Niemela reported that ALT was elevated in 40% of the participants, and GGT was elevated in 92%. Niemela also reported that these two

parameters are dependable indicators of liver injury in any population, both for men and women.

In a prospective study, 31% of participants were with AST/ALT elevate six times ULN. The participants were also found to suffer from severe liver disease; these participants were later found to have developed chronic liver failure (Mookerjee, et al. 2011)

2.3.2 Gamma Glutamyl Transferase (GGT)

GGT is the most reliable liver biomarker to be elevated in alcohol dependence; for GGT 81.5 U/L was considered moderately elevated (Cheng, et al. 2017). Targher and Byrne (2015) reported that an increase of GGT level by over 5 U/L increases mortality risk by 7% among the middle and older-aged participants. They also reported that mildly elevated GGT was an independent predictor of mortality associated with Alcohol consumption.

In a study on heavy drinkers, Chavan, Birajdar, and Pawar (2018) found that 89.1% of participants had GGT levels increased moderately to 2-3 times of ULN. They also observed that some participants had elevated GGT levels of 10 times ULN.

GGT is a biomarker for episodic alcohol consumption. It rises faster in heavy drinking. It continues to rise as a person drink within weeks or months, but it returns to normal levels within 2 to 6 weeks of abstinence. The study reported that the half-life of GGT is 14 to 26 days. Therefore, GGT is a dependable biomarker that can be used for both acute and chronic alcohol consumption (Ghosh, Jain et al. 2019)

Combining different biomarkers provide a dependable opportunity for clinicians to detect liver injury due to chronic alcohol use. (Ghosh, Jain et al. 2019)

A study in China reported that GGT is the biomarker of liver disease. Its decrease signifies improved liver status, while its rise signifies increased liver damage (Wu, Zhang et al. 2021).

Another study in China reported that GGT as a liver enzyme could be used to detect early and to exist alcohol-related liver disease; it can also predict a decrease in liver disease (Zhang, Ma et al. 2021).

In the UK, Newsome et al (2018) reported that when ALP is elevated, it should be tested together with GGT to evaluate the liver function; otherwise, when tested alone, the parameter is a weak test for alcoholic liver disease (Newsome, Cramb et al. 2018).

Ghoshi et al. (2019) reported a positive correlation between GGT and alcohol intake. The study further reported that alcohol consumption of 74g per week is likely to be elevated; the GGT levels and abstinence for a duration of 2 to 6 weeks is likely to return the GGT to normal levels since the half-life is 14 to 26 weeks.

2.4 Correlation of AUDIT screening tool and liver biomarkers.

Alcohol-dependent clients can be followed in rehabilitation centers or hospitals with experienced personnel to screen for alcohol consumption and laboratory for evaluation of ethanol in the body (Savola et al., 2004). Alcohol screening using the self-report depends on memory recall and prevailing attitudes towards alcohol consumption from the interviewee. It is likely to be influenced by willpower or otherwise depending on prevailing circumstances (Niemelä and Maremmani, 2016). Niemela and Maremmani (2016) further reported that the AUDIT screening tool is more reliable than other alcoholic test tools and thus likely to provide dependable results.

Laboratory tests for ethanol can also be used to evaluate toxicity during the acute phase of alcohol consumption. The tests can also be used to evaluate compliance with alcohol rehabilitation therapy. These tests can also be used during follow-up in the out-patient clinics to provide prognostic information about the client (Niemelä, 2007).

Alcohol liver biomarkers can confirm the etiology of liver diseases and help the interactions between the clinician and the client on issues about adverse health outcomes. The adverse outcome can be handled and medically treated before they cause fatal effects. Due to abstinence, a client may be experiencing insomnia for a long. This can be treated medically instead of the client reverting to alcoholism to gain sleep at night (Niemelä and Maremmani, 2016).

Most liver biomarkers have a short half-life preventing clinicians from routinely ordering them. They feel that it may not give an actual picture of intoxication and might be expensive for clients with little added value (Gutierrez et al, 2015) and (Helander, et al, 2008).

Kader, et al, (2012) compared AUDIT score and Ethyl glucuronide (EtG). The positive predictive value for the AUDIT against EtG was 42% which indicated that the laboratory test for it could positively identify those clients who were alcohol consumers. Those who were negative alcohol consumers through the AUDIT test were also negatively identified through EtG at 92 %, indicating that those who tested negative through AUDIT screening were true negatives. Thus the AUDIT screening tool is reliable (Kader, et al., 2012)

Palepu et al. (2008) reported that AUDIT tends to over predict a likelihood of alcohol-related health problems in its score. They further reported that the liver biomarkers are likely to report alcohol use of a shorter duration of time, like in hours, days, or even

weeks. At the same time, the AUDIT is likely to predict alcohol use over months or nearly a year. According to a study by Palepu et al., (2008) AUDIT test is superior to most biomarkers in detecting alcohol use. Palepu et al. (2008) further reported that these biomarkers of everyday use are AST, ALT, AP, GGT, MCV, and CDT.

Agarwal et al. (2015) reported that GGT, compared with AST, demonstrated that alcohol consumption increased the chances of alcoholic liver injury for daily or almost daily consumers. When the two biomarkers were combined with ALP, the results were even more dependable, demonstrating the impact of ALP as a biomarker of the liver. Agarwal et al. (2015) further reported the association between the liver biomarkers and the AUDIT test, which was more promising than the biomarkers alone.

2.4,1 Breath Alcohol Concentration (BAC)

Even though testing breath for alcohol seems like a better alternative for screening interviews and laboratory tests, it has immense challenges. It is easily undetectable from the breath after a few hours. Safety drive officers test a breathalyzer on the roadside in case of suspicion of alcohol use. The breathalyzer can be administered in school to test for alcohol consumption; parents can also use it at home to test on their young ones (DuPont, Skipper, and White, 2013).

Alcoholic breath tests elicit little challenge in use. They are less invasive, less troublesome, and less expensive than the alcoholic biomarkers, but they are less prevalent than many alcoholic tests due to breathalyzers (DuPont, Skipper, and White, 2013). Reading on the breathalyzer is triggered automatically when the client blows the breathalyzer, although some individuals may be unable to blow the device. Clients with severe heart and lung conditions may indeed be sick to blow the breathalyzer. Differentiating actual ability and inability to use a breathalyzer may be a challenge to

many clinicians (DuPont, Skipper, and White, 2013). As such, using a breathalyzer will not formulate an assessment and referral tool for this study.

2.4.2 Combined screening for best results

Neumann et al. (2020) reported that combined tests for either short-term or long-term alcohol use provide the best tests, which are more dependable than any single test. The researchers recommend that clinicians use the combined tests for best results. Simonetto, shah, and Kamath (2020) reported that no single questionnaire or laboratory biomarkers could stand alone as the best test for ALI.

Due to the poor sensitivity in women, CDT is usually combined with GGT to help improve its accuracy. Overall sensitivity and specificity for CDT and GGT are 90 and 100 percent, respectively (Bortolotti, et al. 2020). When combined, the biomarkers of AST and ALT benefit from high sensitivity and specificity, with acceptability among clinicians being high (Litten et al., 2010).

Alcohol biomarkers can be obtained in laboratories with rehabilitation centers or emergency centers. The tests are relatively cheap but require medical professionals to collect blood samples, clinicians to evaluate the results, and an additional clinic fee. Policies governing these blood tests vary depending on the country, county or laboratory, thus to obtain blood tests, it is paramount to transfer the client to a site where blood samples were collected or collect the blood sample and transport it to the laboratory (DuPont, Skipper and White, 2013).

Therefore, biomarkers can measure alcohol abuse, and the outcome provides patients' feedback about the effectiveness of therapy or therapies offered (Kader et al., 2012). In correlation with these tests, one alcoholic liver injury test evaluation tool can be used that will offer equal or near equal results to the desired outcome. The alternative could

be more cost-effective and be acceptable than the previous test method but was expensive and unavailable to the customer.

2.5 Strategies to Develop Assessment and Referral Tool for Alcoholic Liver Injury

In Europe, 9% of persons with alcohol problems report to medical facilities, and 1% are the ones who receive treatment for their condition, a situation they have referred to as 'double treatment gap' (Addolorato et al, 2016). Therefore, clinicians should be able to identify mild, moderate to severe ALD and offer specialized treatment that may include admission in medical facilities.

Addolorato et al (2016) further reported that medical management was superior to behavioral management easy to administer in many alcoholic centers. They further reported better outcomes in a combination of medical and behavioral therapies. Addolorato et al (2016) stated that integrating medical care with addiction treatment increases therapeutic acceptance and efficacy in the majority of the populations.

Combination therapy for medical and psychosocial promotes abstinence, reduces lapse, and prevents relapse, thus being more recommended than psychosocial alone. Medical management trends face challenges due to poor regulatory policies, lack of or low clinician re-education on the new trends, and the high degree of social stigma on alcoholism (O'Toole et al, 2016). O'Toole et al (2017) further compared patients receiving integrated medical and psychosocial therapies with those receiving psychotherapy alone and reported that those for integrated therapy had better outcomes than those for psychotherapy alone.

The Kenya Health Policy for 2014 -2030 prescribes the direction that Kenya should take to attain high health standards to its population commensurate to its status as a middle-income country. The policy focus on attaining the highest standard of Health in

Kenya to be a Country with improved Health. The Kenya Health Sector Strategic Plan (KHSSP) 2018-2023 focuses on transforming health systems to achieve universal health coverage by 2022. It has performance indicators and targets that should minimize health risk exposures and stop or reverse the burden of non-communicable diseases, among them alcoholism. These protocols report poor or less preparedness of medical facilities in Kenya to deal with drug users, among which alcohol is the primary substance. The protocols acknowledge that they are essential guides and that more detailed specialist advice and interventions are needed in the protocol guide. The focus on the alcoholic liver injury was not mentioned in these policy documents; the near focus area is the psychological behavior of alcohol usage.

The protocols prescribe treatment into medical detoxification, management of intoxication, and management of overdose. Other forms of treatment include management of psychiatric disorders, relapse prevention, and psychosocial intervention. Treatment of ALD is given no preference in the different forms of treatments. The protocol reports that delirium tremors account for 5% of the life-threatening conditions due to alcohol but does not report 95% of life-threatening conditions.

Mortality due to alcohol consumption is associated with liver metabolic acidosis and severe central nervous system depression. According to The National Protocol Treatment for Substance Use Disorder (2017), the most commonly used drugs in Kenya are nicotine, alcohol, and cannabis. In the Kenya Health policy 2014-2030 Towards attaining the highest standard of Health and the Kenya Health Sector Strategic Plan (KHSSP) 2018-2023 Transforming Health systems: Achieving Universal Health Coverage, the management of the alcoholic liver disease is not described thus

management of the disease receives low profile. The protocols admit weakness in providing guidelines to the clinicians stating that more information was needed to educate them on the treatment of diseases due to alcohol and substance use.

Crabb et al (2020) reported that the US had formulated guidelines for the general public to consider for alcohol drinkers to mitigate the alcohol use and prevent or detect early ALI. The guidelines also prescribe referral for treatment to the persons with severe liver disease and avoid early death where possible (Crabb, et al 2020)

Mathurin and Bataller (2015) reported that 50% of all persons who had heavy alcohol consumption progressed to liver cirrhosis at age 65, while 50% of heavy alcohol consumers progressed to cirrhosis after 35 years of alcohol intake. Thus strategies to cub the progression to liver cirrhosis should start early and be done by all clinicians of all health facilities.

To assess the state of the client's liver, clinical and biological investigations are required. Previously it has been difficult for a clinician to prescribe some of these therapies since it is expensive to evaluate the clients for liver injury. Many are identified when the liver injury is at a state when reversal of the injury is not possible. At this point, the clients are treated palliative with a poor prognosis. Patients are admitted into health facilities when the liver is damaged, and even abstinence from alcohol consumption or the use of medication cannot reverse the damage.

Strategies to detect liver damage early before irreversible damage set in may be helpful. Such strategies may include evaluating clients at a point of contact and prescribing the most appropriate therapies as soon as possible (Mathurin & Bataller, 2015). Evaluation at a point of contact is good before any therapies are started. The extent of liver injury can be easily detected, and a strategy can help the ailing person.

Dugum & Mc Cullough (2015) reported that strategies to reverse ALI include referral, treatment in outpatient, and admission of clients, among other management modalities. Therefore, it is essential to grade the liver injury at the point of contact and prescribe the modality of management (Dugum & Mc Cullough, 2015). Ursic-Bedoya (2015) had similar findings when they reported that different modalities of management include alcohol abstinence, medication administration, rehabilitation, admission in hospitals, and liver transplant (Ursic-Bedoya, Faure, Donnadieu & Pageaux, 2015)

These different modalities can be achieved by grading the extent of liver injury. Some clients can benefit from one step of modalities without going through all the other modalities. Others may be affected such that they may benefit more from a combination of different modalities where they have to go through all the modalities to get maximum benefit (Dugum, Zein & McCullough, 2015).

Mathurin and Bataller (2015) reported that it is acceptable to combine different parameters to help come up with scores to stratify the liver injury into grades of lower, intermediate, or higher, which will guide the follow-up management for these clients (Mathurin & Bataller, 2015). Combinations of scores are likely to elicit more accurate parameters which are dependable and acceptable.

New methods are needed to strategize on the management of ALI to reduce morbidity and mortality. These methods should detect liver injury early to enable clinician early intervention, eventually reducing morbidity and mortality. Best methods can be non-invasive as invasive methods such as liver biopsy are expensive with higher surgery risks. Non-invasive methods are likely to be acceptable to the clients because the risk is minimal, and they could be cheap with a short wait period for the results to be realized to the clients (Seitz et al 2018). They could be available to the health facilities near the

client compared to others that will require the client to walk long distances to seek the services.

Chen and Pan (2022) reported that non-invasive procedures to evaluate alcohol consumption were recommended, and considerations should be put into place about their affordability, availability, acceptability, sensitivity, and specificity. Decraecker et al (20220 reported that prognostic endpoint evaluation in alcohol liver injury will in the future depend on non-invasive methods. They further reported that the methods would reduce morbidity and mortality due to alcohol consumption is a great deal if acceptable. If ignored, the morbidity and mortality menace due to alcohol consumption is likely to continue over a long duration until the globe adopts better methods to deal with the alcohol consumption problem.

After discharge, constant contact with the client is another area for consideration; the client needs to be followed up and evaluated for alcohol consumption. Cheap and easier methods to evaluate the abstinence or relapse will be of maximum importance to the client, family, and health care of an entire Country. On the contrary, when the services are not available near health facilities, the clients will be discouraged from seeking these services at far health facilities. They may sought for the services only when they feel it is too necessary for life to continue.

Gines et al (2022) reported that it is important to have strategies that can be adopted with the same provision budget but focusing on liver fibrosis evaluation and management.

Therefore, the tool for assessment and referral of persons with alcoholic liver injury will guide to achieving the internationally acceptable evaluation method for alcoholic

liver injury. The tool will aim to achieve affordability, availability, acceptability for alcoholic liver injury evaluation.

2.6 Theoretical Framework; CORE, CARE CURE by Lydia Hall

This study will adopt a nursing theory by Lydia Hall referred to as core care cure theory. The main interest in Hall's theory is the provision of high-quality rehabilitative care for persons with chronic illness offered by nurses. Hall was interested in changing nursing from a task-oriented profession to a profession concerned with managing complex, patient-centered care. She was involved in developing a rehabilitation facility which offered her an opportunity to further her idea and practise in innovation related to the rehabilitation of persons with chronic diseases (Snowden, Donnell, & Duffy, 2014).

Lydia Hall, in her theory, described how nurses should work with patients integrating the biological, pathological, therapeutic, and social sciences in their nursing care. Nurses used this idea to assess the ability of clients to rehabilitate upon their will as the driving motivation. Her interest was also focused on nurturing clients until they understand what they want to achieve and achieve it through the rehabilitation program.

Hall suggested two distinct phases of medical care provided in hospitals and rehabilitation centers. The first phase is a biological crisis, where the primary role is to diagnose the medical condition, while the second phase is the treatment of the medical condition to cure it. Hall further said that when the first phase of crisis subsides, it is time for the nurse to provide a whole-person approach to rehabilitation which she referred to as progressive patient care.

During rehabilitation, Hall emphasizes that clients express their feelings, and the nurse acknowledges these feelings by taking notes and then using them to guide on the rehabilitation care.

She described a rehabilitation center as a halfway house on the road to home. The center should provide an atmosphere similar to that of a home and expose the client to recovery. The client's ideas on modifying the recovery were central to any program at the center. Guided by that, Hall said that clients should receive as much information as possible to develop goals in partnership with the nurse to help recovery and prevent relapse. This ethos (moral code/belief) was different from what doctors prescribed, where the role of the client was only to obey.

Hall's theory received recognition as cost-effective, highly professional, and fit for rehabilitation by nurses, doctors, and other professionals such as psychiatric and sociologists.

Even after Hall died in 1969, her work has continued, particularly in the rehabilitation of persons with chronic diseases, including chronic alcohol use. Clients are now equal partners in their care. Prolonged contact with clients beyond hospital or rehabilitation center stay is therapeutic and emphasized.

Hall described an individual as having three major elements: the person, the body, and the disease. These elements were interlinked and could affect one another, positively or negatively influencing the rehabilitation progress.

Lydia Hall, in 1960 developed a nursing theory that consisted of three independent yet interconnected circles. Each circle represents a component of importance to the health of an individual. The three circles were named core, care, and cure circle. Hall stated

that these three circles vary in size depending on the medical crisis within the client. Sometimes the circles are equal, but on other occasions, they will vary depending on the state of the disease process or healing progress state. She reported that the care circle is most significant at the evaluation and follow-up phase, while during the acute illness period cure circle is largest as it is the primary need for the client then (Kolade, et. al 2014)

CORE

The core is related to social science; it involves using the self as a therapeutic guide to patients. The nurse involves reflective techniques to help the client reflect on their self-motivation and goals towards health. Towards involvement in alcohol intake, whether willingly or otherwise, the nurse develops an interpersonal relationship with the patient that enables them verbally express feelings that regard the disease process and its effects. Through such expressions, the patient can gain self-confidence developing maturing in their discussion.

A discussion should emphasize the social, emotional, and intellectual needs that may push the client into uncontrolled consumption of alcohol. These needs may be peer or family-related. When the discussion reaches maturity level, the nurse listens to the client and verbalizes all they want to share. At this point, the client becomes the core or the focus of attention for the nurse. The core is essential because it is from this circle that others build their foundation. A focused group discussion is thriving based on how much a patient agrees to open up. Core helps the client make an informed decision to sought for medical care due to alcohol consumption and, more importantly, recovery and rehabilitation.

The core circle is shared between psychologists, social workers, psychiatrists, and even the religious clergy.

CARE

Care circle are related to the human body and is exclusive to nursing care by nurses. Care involves the bodily concepts of bathing, toileting, and feeding. When providing care, the nurse aims to comfort the patient by providing that care at the basic needs level. At this level, the patient and the nurse are close to one another, offering an opportunity for the patient to open up even more. At this point, the nurse explores the client's feelings. In alcoholism, this offers the nurse an opportunity to explore more on reasons for alcohol consumption and the client's feelings relating to the action (Bemi, Venkatesan, & Shobana, 2012).

The nurse helps the patient look at and explore these feelings regarding alcohol consumption and their effect on the current status of health. It is in the care circle that the client attempts to change their lifestyle.

CURE

The cure circle is based on the pathologic and therapeutic sciences. The nurse is involved in pathological and therapeutic sciences to cure disease based on knowledge about the disease. Cure involves nursing with the administration of medication and other treatments. The cure aspect is integrated between the patient and the family/society.

The cure is shared with other professionals such as medical practitioners, laboratory personnel, psychologists, physiotherapists, and others (Wilcox, 2017).

According to George (2011), exploring the aspect of a patient is difficult; therefore, someone needs to hold a mirror and invite the patient to look at self on the mirror to examine the concerns of their actions. This will help the patient uncover challenges, problems, or events that threaten their lives. The nurse comes in to hold the mirror for guidance, support, or care during the exploration and healing period.

The three circles of core care cure theory keep changing in size depending on the progress of healing or ailment.

In alcohol liver injury, all the circles are equal in size at the point of contact with the patient. The care circle enlarges as the need for individualized care becomes the center of the patient. The patient is cared for at rehabilitation centers, hospitals, or at home as an outpatient. As time passes, the focus shifts to cure circle when the patient needs to be fixed of the alcohol liver injury and achieve the goal of healing from alcohol liver injury.

Hall described healing as based on two phases. Phase 1 is when the client is in biological crisis and needs intensive medical care, while phase two begins when the client is not in trouble and requires a different form of medical care that is less intense. Hall labeled this second phase as a follow-up-evaluative period and when the nurse is most important to prevent relapse of the disease.

METAPARADIGMS

Nursing

Nursing is considered as participation in the core, care, and cure. The core (patient) is exclusively the responsibility of nurses; the core and cure are the responsibilities of all medical professionals. However, the principal purpose of this collaboration is to cure

the ailment. Therefore, nursing is regarded as participation of patient's care guided by the three aspects of core, care, and cure.

Person

Lydiah Hall viewed a person as one who can change their identity to a patient. A patient is viewed as one who has three aspects of body, pathology and patient. Core care cure theory emphases on the importance of viewing a person as unique, capable of growth and learning. This can be achieved through individualized total patient's approach.

Health

Health in this nursing theory is inferred as a state of self-awareness to life and concerns that can interfere with it, a conscious selection of behaviors that are optimal to positive gains of that life.

Illness in this theory is viewed as feelings-out-of-awareness. These feelings are adjustments to difficult situations experienced by the person. Hall stated that once the patient is connected with the actual reality of illness, they feel motivated to move their healing power for the recovery process. At this point, the patient deals constructively with the disease process, which helps them approach the threat of disease with an informed situation.

The informed situation of good for the clinicians and patient. Both are focused and move together on the path of health care, achieving health goals together.

Environment

This theory has an elaborate emphasis on the environment. It describes it as a space conducive for the patient to live. The theory assumes the hospital's environment is a

better place for treating acute illness. Together with the patient, the nurse has an environment conducive to achieving health goals for the patient.

The environment can also be the society of people who live with the patient. For alcohol liver injury persons, the peers who share with the patient contribute to the conducive environment outside the hospital environment.

Assumption

The three core, care, and cure aspects function interdependently, and none can function alone.

The three circles change size guided by the healing or non-healing situation progress.

Case application; In the acute phase of disease ailment, the cure circle is largest, while the care circle appears largest during the evaluation and follow-up phase. Similarly, during the long-term period, the core circle is the largest.

Phases of illness

Core, care, and cure theory describes three phases of illness in a patient.

The first phase involves the acute period of illness when the patient seeks medical assistance. The second phase requires nursing, medical and other collaborative care. It is non-acute with recovery to illness. It is conducive to learning and rehabilitation. The third stage involves outpatient care with rehabilitation from the illness. The client must stop the earlier behavior; otherwise, they may return to the alcoholic state.

2.7 Theoretical Framework for the Study

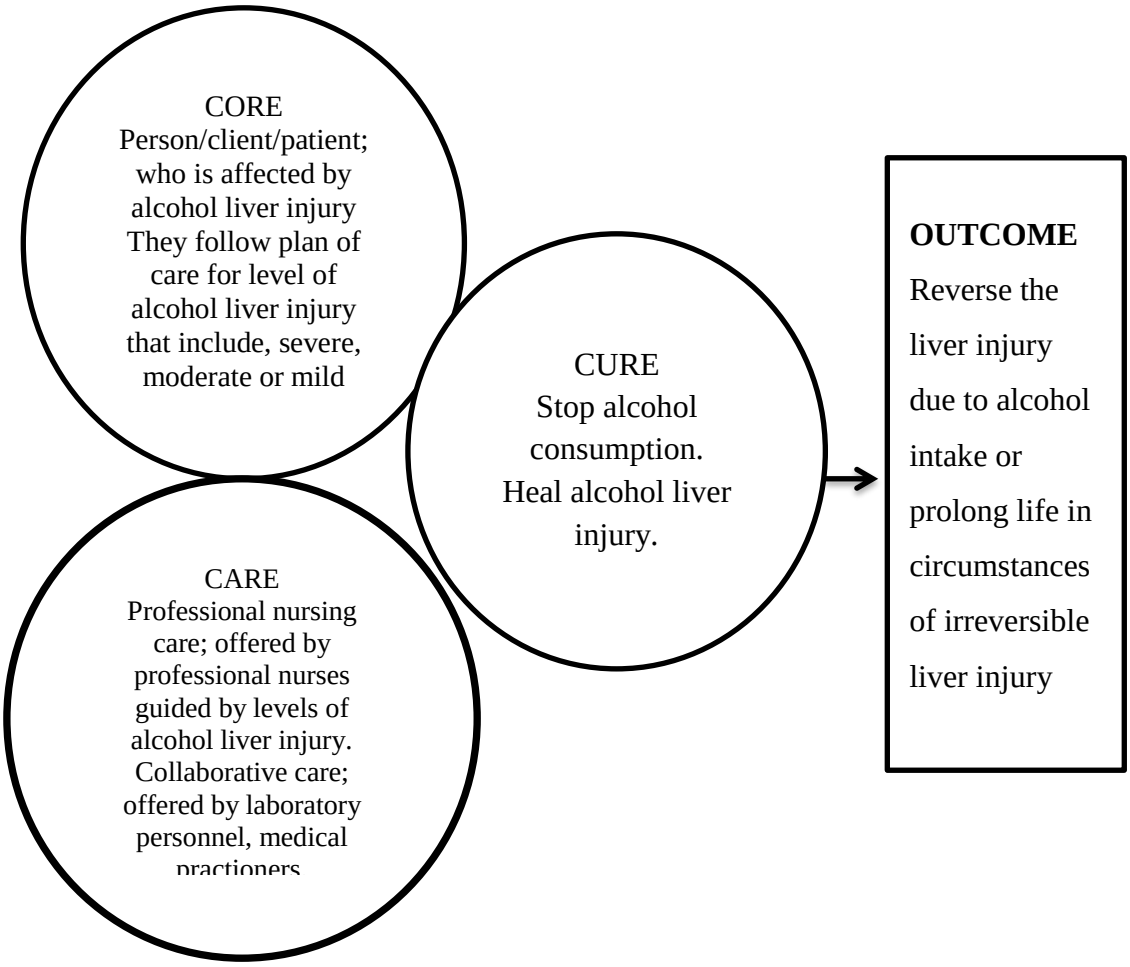


Figure 2.1: Theoretical Framework

2.8 Conceptual Framework

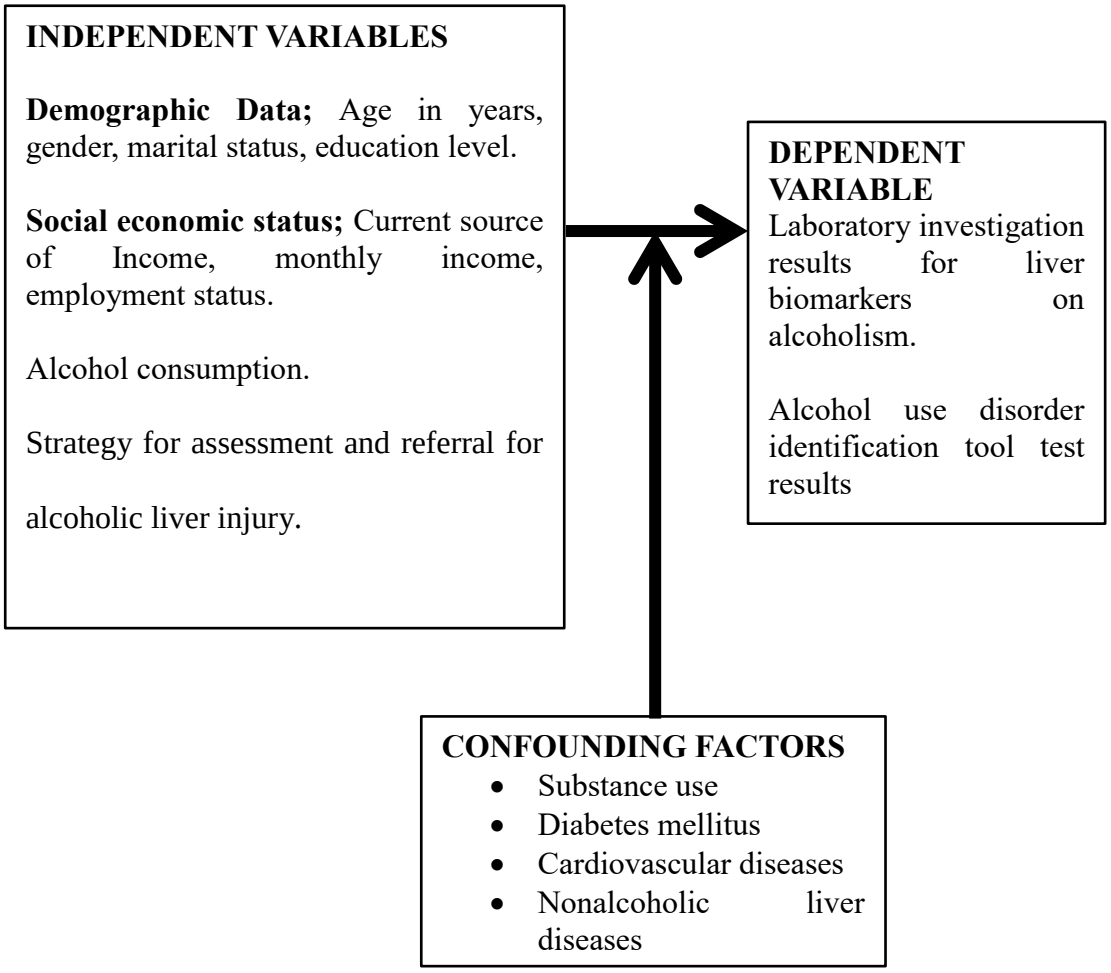


Figure 2.2: Conceptual Framework

Source: Researcher, (2021)

2.8.1 Confounding Factors to Alcoholic Liver Disease

Liver injury can worsen due to alcohol consumption and other nonalcoholic factors such as poor diet, high-fatty foods, metabolic disorders like diabetes mellitus, toxins, and contaminants in some noncommercial alcohol drinks. Some medications, such as pain relievers like acet-aminophen and paracetamol, damage the liver greatly (Ellison, 2007). Other factors that can cause injury to the liver include genetic liver diseases,

limiting the ability to metabolize nutrients and other substances. Autoimmune diseases such as autoimmune hepatitis cause damage to the liver tissue. Chronic hepatitis B and C are also responsible for liver damage (Ellison, 2007). Alcohol is considered a major precipitating factor of liver diseases, but clinicians should be aware of comorbid conditions likely to cause liver injuries (Malakouti, et al, 2017)

2.9 Recap of literature review/gaps identified

Various screening tools are identified for screening alcohol consumption; they include the CAGE tool and AUDIT tool, among many others. These tools have been recommended by multiple committees and health institutions such as the WHO and the European Association for the Study of Liver. These tools help identify different levels of alcohol consumption and establish relationships with other human beings. They act as a guide to emphasize the importance of abstinence. They also help during rehabilitation and can be used to evaluate relapse.

The gap identified in using these tools is that clinicians can not rely on the tools to identify clients with early liver injury. Liver injury is regarded as a major contributor to mortality in most alcohol consumers. These tools have been commonly used to detect behavioral conditions more than detecting system diseases. Behavioral conditions related to alcoholism have reduced mortality compared to systemic

diseases such as liver injury.

Laboratory biomarkers for the liver, commonly referred to as LFTs, have been used to identify liver injury in alcohol consumers and persons with other systemic diseases. The liver biomarkers are expensive and not easily available in many health institutions, especially within sub-Saharan Africa. Despite that, the liver biomarkers are dependable in identifying the liver injury. Their reliability is increased when their specific tests are

combined to evaluate liver injury due to alcohol consumption. The combination of these tests complicates availability and cost factors and, as such, helps cut costs on clients, especially for financially challenged clients.

A gap was identified on how reliable liver biomarkers can be correlated to the screening tools such as the AUDIT to help clinicians detect early liver injury for persons who consume alcohol. There can be a combined score for the liver biomarkers, which can be correlated to a combined score of the AUDIT tool, and both tools complement one another on their score. The AUDIT score can then predict the extent of liver injury. The AUDIT tool informs of a questionnaire that clinicians can use even at remote areas to help detect early liver injury, thereby commencing early therapy of possible referral, which eventually can help reduce morbidity and mortality due to alcohol intake.

CHAPTER THREE: RESEARCH METHODS AND MATERALS

3.1 Introduction

This chapter will explain how the objectives discussed in chapter two were achieved and how the results were shared with the stakeholders. The study involved three phases. In phase one it involved data collection, phase two involved data analysis while phase three was development of the assessment and referral tool. Phase one and two were discussed in this chapter.

3.2 Research Design

The study design was a non-experimental descriptive correlational study design. In non-experimental study design the researcher does not manipulate the situation, experience or circumstances of the participants. Rather the researcher measures the variables in their natural state as they occur or occurred. These variables can be measured in the laboratory or in real life as they occur. In contrast to the experimental study design, the researcher is able to manipulate the variables. Examples are in control and case study where the researcher manipulate the case from the control through provision of medication for certain treatment, then observes the behavior of the case.

There are different types of non-experimental study designs. They include the cross-sectional. Correlational and observational study designs. This study used the correlational design which focuses on statistical relationship between two variables. The researcher does not manipulate the variables rather measure and assesse their relationships.

Descriptive type of research involves a phenomenon, population or situation to try and answer the questions on focus which include ‘what’ ‘where’ ‘when’ and ‘how’ but not ‘why’. There are different types of descriptive designs which include correlational,

comparative and case control study designs. In descriptive correlational design, the researcher describes the variables and their relationships in the naturalistic state as they occur.

3.3 Location of the Study

The study was conducted in Murang'a and Uasin Gishu Counties in Kenya. Various medical health facilities were included within Murang'a County; these facilities were Murang'a County and Referral Hospital, St Martin Rehabilitation centre and Faith based rehabilitation centre. In Uasin Gishu County, the study was carried out in Eldoret Reven rehabilitation center.

3.4 Target Population

All adult Kenyans who consume alcohol and were from the counties of Murang'a and Uasin Gishu County.

3.5 Sampling Procedure and Techniques

3.5.1 Selection Criteria

Inclusion Criteria

1. Clients with voluntary admission to rehabilitation Centres.
2. Clients who consented to be participants in the study within the Murang'a and Uasin Gishu Counties.
3. Kenyan persons aged above 18 years who had been consuming alcohol for a period more than 2 years.

Exclusion Criteria

1. Clients who have been consuming alcohol and have developed systemic conditions with exclusion of Alcoholic liver diseases.

2. Clients who have been consuming alcohol and who may have been started on medication for alcoholic liver disease.

3.5.2 Sampling Method

Due to logistic and resource limitation, purposive sampling method was used to select two counties within Kenya which have high alcohol consumption (NACADA, 2012). The Counties selected were Murang'a and Uasin Gishu. Clients within the two counties were stratified into various medical facilities. The medical facilities were then clustered and sampling done. Those medical facilities that was selected were involved in the study. Alcohol consumer clients form a special population and as such all clients in the selected cluster groups of medical facilities were given equal opportunity. They were all involved in the study upon wellness/consent to participate.

3.5.3 Sample Size Determination

For this study sample size was determined using Cochran equation (Mugenda and Mugenda, 2003).

$n=z^2 pq/e^2$

Where;

n = is the desired sample size when the target population is greater than 10,000

z = is the standard normal distribution set at 95% confidence level or 1.96

p = is the expected population correlation coefficient

q =1-p

e = level of precision which is set at + or – 5% (0.05)

Thus these figures can be substituted for

$$\mathbf{N = \frac{(1.96)^2 (0.5) (0.50}{(0.05)^2}}$$

= 384

The study population was less than 10,000 thus the researcher adjusted the formula using Yamane (1967) formula to determine the sample size.

The study sample size of 150 clients guided by reports on the number of clients who sought for medical help in the two counties between July and Dec 2018.

Since the calculated sample size above was 5% of the study population (N) the formula for Yamane (1967) was applied as follows:

$$nf = \frac{n}{1 + \frac{n-1}{N}}$$

Where

n = is the desired sample size when the population is less than 10,000 which is 384 from the calculation.

N = is the estimate of population which in this case is 150 special population of alcohol use.

Hence, the desired sample size was

$$\text{nf} = \frac{384}{1+\frac{384-1}{150}}$$

nf = 384/1+ 2.55

nf = 384/3.55

nf = 108 clients

To sample the 108 participants in a proportionate way among all the rehabilitation Centres, the researcher divided 150 by 108 to get 1.3, the translation was that all the clients admitted in the Centres was eligible for selection to participate on the study.

3.6 Construction of Research Instruments

Construction of the research instruments form part of phase 1, 2 and 3 of the study. The tables guided the researcher through these two phases regarding selection of the participants, tabulation of the biomarkers results and combing the results to tabulate the severity of liver injury.

Summary of the County referral hospital and Rehabilitation Centers admissions in the selected counties.

Table 3.1: Summary of Hospital and Rehabilitation Centers Admissions

	REHABILITATION CENTRE	COUNTY	ABMISSIONS PER MONTH	ADMISSION IN SIX MONTHS
1	St Martin Rehabilitation Center	Murang'a	6	36
2	Faith based Rehabilitation Center	Murang'a	6	36
3	Murang'a County and Referral Hospital	Murang'a	4	24
4	Haven Recovery Center Eldoret	Uasin Gishu	9	54
	Total		**25**	**150**

Source; County and rehabilitation centers admission data (2021)

Table 3.2: Alcohol Use Disorder Identification Test (AUDIT) screening Tool

Audit Tool Analysis Table			
Domain	**Question number**	**Maximum score awarded**	**Client score attainment**
Hazardous alcohol use	1	4	
	2	4	
	3	4	
		Subtotal 12	Subtotal
Alcohol dependence	4	4	
	5	4	
	6	4	
		Subtotal 12	Subtotal
Harmful alcohol use	7	4	
	8	4	
	9	4	
	10	4	
		Subtotal 16	Subtotal
		Grand total 40	Grand total

Source; field Data (2021)

Laboratory biomarker results was ranked as 1, 2 and 3 for mild, moderate and severe elevations. The following table was used to compute the results for laboratory tests (Table below)

Table 3.3: Selected Liver biomarkers for test

Laboratory test	Normal range	International units (IU)	Results at normal range	Mild elevation	Moderate elevation	Severe elevation	Client's score
			0	1	2	3	
Scores							
AST	10-40	IU/L	10-40	80-120 (2-3 X ULN)	160-200 (4-5 X ULN)	Above 200(>5 X ULN)	
ALT	7-56	(IU/L)	7-56	112-168 (2-3 X ULN)	224-280 (4 -5 X ULN)	Above 280(>5 X ULN)	
ALP	30-130	(IU/L)	30-130	131-150	151-170	>171	
GGT	9-50	mg/L	9-50	50-70	80-90	>100	

Source; Research Data (2021)

Table 3.4: Correlation of AUDIT and biomarkers results

AUDIT SCORE	BIOMARKER SCORE	COMBINED SCORE	OVERALL SCORE
0-10	0	10 and below	Normal liver status
11-20	1	11 to 21	Mild liver injury
21-30	2	22 to 32	Moderate liver injury
31-40	3	33 to 43	Severe liver injury

Source; Research Data (2021)

3.7 Validity and Reliability of Alcohol Screening Tools

The concept of reliability and validity is about the evaluation of research tools and how dependable these tools were in measuring the tests they were formulated to measure. Taherdoost (2016) reported that validity is a measure of what is intended to be measured while reliability is consistency across repetition of the same measurement giving the same results, this describes replication of results obtained. Taherdoost (2016) further said that for a test to be reliable it has to be valid. Reliability is consistency of scores, for instance if retest is taken the subsequent results should be similar or closely similar to the previous results (Pilowsky & Wu, 2012).

Validity of an alcohol screening tool is its ability to measure what was originally intended to measure. Validity of a tool is done by comparing its results with the standardized results for such a tool. Validity shows that the findings of the results were a true reflection of what was measured. Validity is achieved by controlling variables which may otherwise interfere with the results. For this study persons with other systemic diseases apart from Alcohol liver disease, which may include but not limited

to hepatitis, diabetes mellitus and non alcoholic liver disease was excluded. Also clients who have been started on medication for ALD.

Cronbach's alpha was used to test for reliability in this study. Cronbach's alpha test represents the average of all possible split-halves and can be used for dichotomous or continuous score variables. Cronbach's alpha is also described as coefficient alpha. It is an estimate of reliability thus an indicator for consistency. Cronbach's alpha ranges from .00 to 1.0 with .00 signifying that there is no consistency while 1.0 signifying perfect consistency in measurement. A .70 means that 70% of the variance scores is reliable and is acceptable and realistic therefore the error in variance was 30%. The test was tested using SPSS version 24.

The AUDIT screening tool was developed by the WHO in 1982, it was validated as a tool for screening alcohol use in six countries which included Norway, Australia, Kenya, Bulgaria, Mexico and United States of America. This tool is free for use as authorized by the WHO and permission is not therefore a requirement for one to use it (Babor, et al 2020)

3.8 Data Collection Tool

A structured questionnaire was administered in English. The tool was divided into various sections. Section A was demographic information, Section B was information on alcohol AUDIT screening which was an adopted tool. Section C was parameters on BMI.

Laboratory investigations forms for Liver Function Tests (LFT) were used. The tests performed included all the tests prescribed in the LFT with a focus to, AST, ALT, GGT, ALP, Direct bilirubin, indirect bilirubin and proteins

For the in-depth interview the questions were structured to guide the researcher and the research assistants on what question/questions to pose to the participants. This enabled the smooth flow of taped interview.

3.9 Data Collection Method

Data collection was part of phase one in the study. In this phase data was collected through use of questionnaire, collection of blood samples and tape recording through an in-depth interview.

Clients who were involved in the study were identified via a code but not through their names. The clients knew their code for ease of follow up and management. The codes were not known by the other researchers but were only be known by the main researcher.

Questionnaires were administered by the trained nurses and it took the participants approximately 20 minutes for them to complete answering the questions within questionnaire. The interaction was performed in a quiet room with privacy.

Samples of blood were drawn from clients equivalent to 3cc. The samples were drawn by laboratory technologist at the laboratories within the selected medical facilities. After the samples were drawn they were stored in cool boxes with ice packs. The samples were later transported to Mount Kenya University Innovation and Research Laboratories. They were run through a centrifuge to separate the serum from the erythrocytes. From the serum 0.5mls was drawn and stored in a fridge with temperature readings between -8 and +8 degrees centigrade.

The blood samples were then labeled with similar codes to the questionnaire. The samples were within a period of three months transported to Thika level 5 hospital,

laboratory for analysis. They were transported in cool boxes while maintaining the temperature of between -8 and +8 degrees centigrade. The clients' identities were continuously concealed and were only identified only by the researcher.

During the in-depth interview, the voices of the participants were recorded using tape recorders. Trained nurses took the role of moderators during the interview sessions. The tape recorders were secured and safely stored by the researcher awaiting verbatim transcription.

3.10 Pre-test

The study tool was pretested using 8 respondents representing 10% of the sample size in Murang'a County and Referral Hospital and Eldoret Rehabilitation Center. Four participants were selected from each county. The results from the pretesting were excluded from the final results for the study.

3.11 Data Cleaning and Entry

Data was scrutinized at the point of collection for accuracy and completion and entered into a spread sheet using SPSS version 24. The analyzed biomarkers results were tabulated by the machine and hard copies generated, the information was entered in the SPSS spread sheet before analysis.

3.12 Data Analysis Techniques and Procedures

Proposed data analysis for the questionnaires from the AUDIT tool, qualitative data from in-depth interview and laboratory analysis for the blood samples formed the phase two of the study.

Data was entered and analyzed using the SPSS software of version 24. Quantitative data was analyzed using descriptive statistics methods of Mean, Mode, Median and

Standard Deviation. Inferential statistics such as Chi-square was used to show the relationship between variables. Analyzed data was presented as findings in form of frequency graphs, pie charts and tables.

The recorded voices from indepth interviews were transcribed into verbatim using NVivo 12 software. The transcriptions were first read for familiarization and check for accuracy of the collected data. The qualitative data was grouped into different thematic, coding and indexing of similar statements was done. Emerging themes were analyzed and common statements included in the conclusion.

3.13 Ethical Considerations

1) The nature and purpose of this study was explained to its participants and an informed consent obtained

2) Participants experienced minimal discomfort while answering the questions, giving out self for baseline parameters and while giving out blood specimens for biomarkers.

3) Confidentiality was maintained at all stages of the study. The study participants were identified by their codes in the questionnaires and the blood samples were identified by the similar code on both the questionnaire and the blood samples. The information obtained from the data was only to be used for the purpose of obtaining the degree and not be disclosed to unauthorized authorities.

4) The researcher sought approval to use the AUDIT tool from WHO (Approval number 388230)

5) The researcher sought for approval from the following institutions; Institutional Ethical Review Committee of Mount Kenya University (approval number 865) and the

National Commission for science Technology and innovation (NACOSTI) (NACOSTI/P/21/10477).

CHAPTER FOUR: RESEARCH FINDINGS AND DISCUSSIONS

4.1 Introduction

This chapter describes the findings from the study guided by the specific objectives.

4.2 Bio-demographic data characteristic and distribution

Table 4. 1: Bio-demographic data characteristic and distribution

Test Item		**N**	**%**
Age in years	18-27	17	18.3%
	28-37	38	40.9%
	38-47	27	29.0%
	48-57	6	6.5%
	ABOVE 58	5	5.4%
Gender	Male	89	95.7%
	Female	4	4.3%
	Transgender	0	0.0%
Marital status	Single	31	33.3%
	Married	41	44.1%
	Separated	10	10.8%
	Widowed	5	5.4%
	Divorced	6	6.5%
Level of education	No formal education	1	1.1%
	Primary school	18	19.4%
	Secondary school	54	58.1%
	College/University	20	21.5%
Monthly Income	Ksh 1 to 5000	34	36.6%
	Ksh 5001 to 10,000	13	14.0%
	Ksh 10,001 to 15,000	11	11.8%
	Ksh 15,001 to 20000	12	12.9%
	Above Ksh 20,000	23	24.7%

Source; Collected Data, (2021)

Ninety three respondents were involved in the study, this represented 86.11% of the calculated sample size of 108.

4.2.1 Geographical representation.

The study was carried out in two geographic regions referred as counties. The two counties of Uasin Gishu and Murang'a counties were purposefully selected due to their high records of alcohol consumptions. The two regions have rehabilitation centres distributed across the regions with a population of admitted clients which was necessary for the study to proceed.

4.2.2 Age

Participants in the study who were between the ages of 18 and 27 years were represented by 18.3% (n=17), participants aged 28-37 years were represented by 40.9% (n=38), participants aged between 38 to 47 years were represented by 29% (n=27), those between the age of 48-57 years were represented by 6.5% (n=6) while participants aged 58 years and above were represented by 5.4% (n=5).

The study results showed majority of the participants were between the ages of 28-37 years with few participants above the age of 58 years.

The bio-demographic characteristic of the study showed a trend of alcohol consumption with 18.3% between ages 18 to 27 years, there was an increase to 40.9% between ages 28 to 37 years. There was a decrease to 29% between ages 38 to 47 years; there was a further decrease to 6.5% at ages 48 to 57 years and even further decrease to 5.4% above the age of 58 years. The study findings were suggestive of more persons initiated to alcohol consumption after age 27 years. The study findings further suggest that the peak age to alcohol consumption is between the ages of 28 to 37 years. A study in India suggested of the peak age for alcohol consumption as 45 years (Eashwar, Gopalakrishnan et al. 2019).

Beyond the age of 37 years there was a change of trend where the percentage of alcohol consumption decreased with advance in age. The study therefore suggest that the trend would continue on both ends of the curve with few alcohol consumers below the age of 18 years and similarly few alcohol consumers as the age advance beyond 58 years.

A study by Jenkins, et al (2015) in Kenya found a similar trend on age and percentage in alcohol consumption. The study found that below age 30 years participants were represented by 11.3%, between ages 30 to 60 years they were represented by 19.8% while beyond age 60 years they were represented by 6.4% (Jenkins, Othieno et al. 2015).

A study in Kenya by Takahashi et al (2017) had similar trend of age and alcohol consumption. The study found that alcohol consumers at between age 18 and 29 years were represented by 25.7%, at age between 30 and 49 years they were represented by 38.9% while at between age 50 and 65 years they were represented by 35.4% (Takahashi, Wilunda et al. 2017)

On the three studies in the same Country there is a trend of alcohol consumption. Young adults who were beginners of alcohol consumption were few then with advance in age the alcohol consumers increase and get to a peak. The trend then slows down with more advances in age where alcohol consumers were few.

A study in morocco on participants between 15 and 18 years found that 94% were hazardous alcohol users. The study categorized this group as alcohol beginners who should be a focus to medical intervention (Ben El Jilali, Benazzouz et al. 2020).

A study in Germany by Garnett et al (2022) found that alcohol consumption decreased with advancement in older age (Garnett, Kastaun et al. 2022)

A study in India reported that the age initiation to alcohol consumption was 30 years. The study suggested that focus should be put to young persons of alcohol beginners as the intervention may salvage the burden of alcohol consumption and after effect to the globe (Eashwar, Gopalakrishnan et al. 2019)

Male in the study were more than female. The study found skewness on gender with a high percentage (95.7%) of the participants being men. The findings were similar to those from a study by Jenkins, et al (2015) in the same Country where more men represented by 87% were alcohol consumers as compared to women at 13% (Jenkins, Othieno et al. 2015).

The findings of our study had contrary results from a study done in Kenya on alcohol consumers where more than half of the participants were female (Takahashi, Wilunda et al. 2017). A study in Brazil reported nearly equal percentage of male and female who were involved in alcohol consumption (Machado, Campelo et al. 2021)

Marital status

Majority of the participants in our study were married with an annual income of U$5000, similar to findings in Thailand and Nepal where most of the responded with alcohol problem were of the married group (Assanangkornchai, Nontarak et al. 2020).

A study in India reported similar findings with our study where majority of the participants who were alcoholic were married (Rathod, Luitel et al. 2018).

Another study in USA found that 77% of the participants were married with an annual income of more than U$150,000 (Boschuetz, Cheng et al. 2020).

4.2.3 Gender

Regarding gender, participants who were of the male gender were represented by 95.7% while the female gender was represented by 4.3%.

Male in the study were more than female at 95.7% (n=89) and 4.3% (n=4) respectively. A study in Iran had similar findings where it was reported that more men were involved in alcohol consumption than female (Noorbakhsh, Shams et al. 2018)

A study by Daly et al (2021) in Ireland had contrary findings on alcohol consumption, the study showed equal representation of gender where male were equal to female at 50 percent respectively (Daly and Robinson 2021).

The high percentage of men involved in alcohol consumption and presenting themselves at the rehabilitation centres shows that there were more men involved in alcohol drinking than women. It also shows that there were more men than women willing to seek medical assistance due to alcohol than women.

The study had male gender over represented than the female gender. Other studies done outside the country and within Kenya had similar findings. Despite that equal or near equal representation can eliminate biasness of over-representation of one gender.

4.2.4 Marital status

On marital status, participants who were married were represented by 44.1% (n=41), participants who were single were represented by 33.3%, (n=31), participants who were separated were represented by10.8% (n=10), windowed participants were represented by 5.4% (n=5) while participants who were divorced were represented by 6.5% (n=6). The study showed that majority of the participants were married represented by 44.1% while few participants were windowed represented by 6.5%.

The findings of this study were similar to findings in a study in Ethiopia by Demilew et al (2021) on alcohol use disorder which found that majority of the participants represented by 55.5% were married. They were followed by participants who were single represented by 28.7% (Demilew, Boru et al. 2021).

A study in US by Ngo et al (2021) on hazardous alcohol use had similar findings to our study, the study found that 49% of the participants were married and living with their spouses (Ngo, Liebschutz et al. 2021).

This study had similar findings with a study in Kenya by Jenkins et al (2015) on alcohol consumption that showed majority of the participants were married, they were represented by 66%, they were followed by those who were single represented by 22% (Jenkins, Othieno et al. 2015).

4.2.5 Income

Participants in the study with a monthly income of between Ksh. 1 and Ksh 5000 were represented by 36.6% (n=34), participants with an income of between Ksh 5001 and 10,000 were represented by 14% (n=13), participants with an income between Ksh 10,001 and Ksh 15,000 were represented by 11.8% (n=11), participants who had an income of between Ksh15,001 and Ksh 20,000 were represented by 12.9% (n=12) while participants with an income above Ksh 20,000 were represented by 24.7% (n=23).

The study showed that majority of the participants had a monthly income of between Ksh 1 and Ksh5000 represented by 36.6%, while few participants had an income between Ksh 15,001 and Ksh 20,000.

A study in Australa by clwere et al (2021) reported that availability of money to buy alcohol was a key factor for the participants continued alcohol consumption. The findings of the study were similar to the findings in India by Ahmed (2021) who reported that participants with more money tend to buy alcohol more frequently than those with little money (Ahmad, 2021).

A study in South Africa by Belus et al (2021) reported that more money was spent to buy alcohol thus the alcohol consumer had more money in their reserve to facilitate the buying. The study further reported that more money from the participants income was spent on alcohol than on any other goal may be family or self- development.

4.2.6 Education level

Regarding level of education, participants with no formal education were represented by 1.1% (n=1), participants with primary school education were represented by 19.4% (n=18), secondary school education were represented by 58.1% (n=54) while participants with college or university education were represented by 21.5% (n=20). This study showed that participants with secondary school education or above were majority represented by 79.6%. A study done in Kenya by Jenkins et al (2015) on alcohol consumers showed similar findings where more than half of the participants had secondary school education or college/university(Jenkins, Othieno et al. 2015).

A study in Ethiopia by Demilew et al (2021) on Alcohol use disorder found that participants who had attained secondary school education or more were represented by 33% (Demilew, Boru et al. 2021).

More than half of the participants had education level equivalent to or above secondary school. Thus alcohol drinking was not influenced by low level of education. These

results were compared to a study in Netherlands where university students had a high rate of hazardous alcohol use (Verhoog, Dopmeijer et al. 2020).

The results on the level of education were contrary to the findings in Thailand where it was found that high education level influenced the consumption of alcohol, there were more harmful alcohol users with secondary and university education than those of the primary school levels. A study showed that college persons had a 160 times more likely to consume alcohol, thus education level had influence on alcohol consumption (Assanangkornchai, Nontarak et al. 2020).

4.2.7 Employment status

Regarding the employment status, nearly half of the participants were employed while slightly more than half were unemployed. Thus employment status was not a major factor to influence the drinking pattern of the participants. There was no major difference on the employment status for participants in a different study from the same country (Jenkins, Othieno et al. 2015). A study in India found that majority of the participants represented by 76% were employed and employment was the major contributor to alcohol consumption (Jenkins, Othieno et al. 2015)

A study in Germany by Garnett et al (2022) found there was an association between monthly income and alcohol consumption with persons of high income more likely to drink more (Garnett, Kastaun et al. 2022).

4.2.8 Alcohol consumption then relapsed

Majority (60.2%) of the participants reported to have never experienced relapse, they were represented by 60.2% (n=56) while participants who 39.8% reported of relapse cases were represented by 39,8% (n=37). There was a statistical significant ($\chi 2 = 16.567, \mathrm{df} = 8, \mathrm{p} = 0.035$) relationship between stopped alcohol consumption then

relapsed and alcohol dependence. Those who reported to have stopped alcohol consumption then relapsed were likely to attain alcohol dependence AUDIT score above 10 from a maximum score of 12. (Figure below)

A study in Australia by Manning et al (2021) showed that 50% of the participants experienced relapse which was described as expensive for the family (Manning, Garfield et al. 2021).

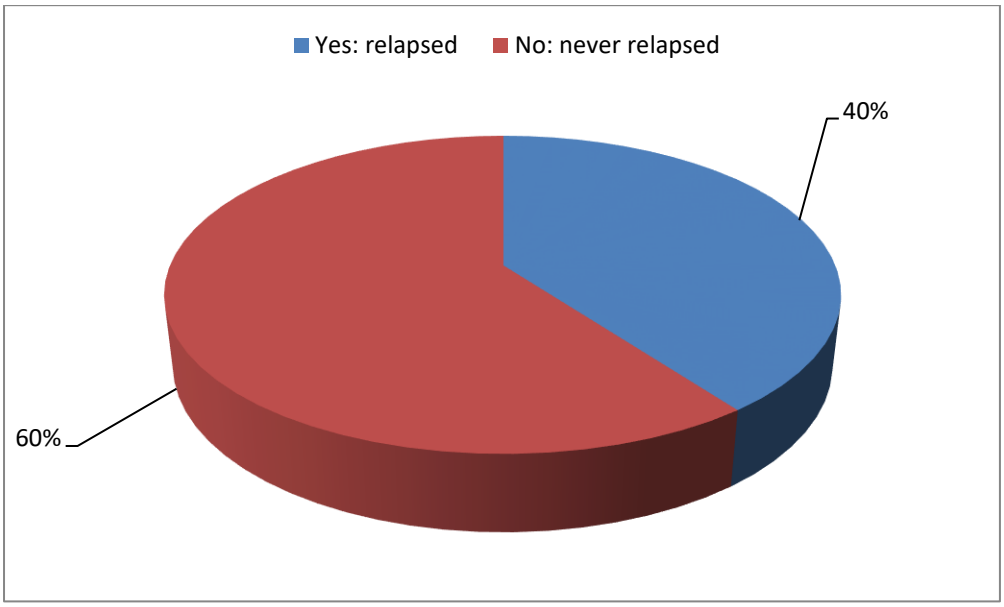


Figure 4. 1: Alcohol Relapsed

Majority of the participants represented by 60.2 %,(n=56) reported to have never experienced relapse, while 39.8% (n=37) reported of relapse cases.

A study in Australia by Manning et al (2021) reported that relapse is common with alcohol users. Treatment modalities for relapse vary but psychosocial intervention with motivational interviews have little significance to prevent relapse (Manning, Garfield et al. 2021).

Therefore, a combination of psychotherapy and medication were recommended to prevent alcohol use relapse for majority of the previous alcohol users.

After deciding not to drink again the alcohol users were at great risk of being lured to drinking again. It is worth mentioning that majority of persons who go through rehabilitation of alcohol drinking later go back to the drinking behavior. Our study had slightly more than half of the participants reporting that they had relapse before. Other studies showed higher percentages of relapse cases. A study in Australia by Manning et al (2021) reported that 85% of alcohol users who withdraw from drinking experience relapse. The study further found that persons who relapse will consume their first alcohol drink within a period of two weeks post rehabilitation (Manning, Garfield et al. 2021).

Relapse should be avoided through continuous recovery of participants. There should be continuous engagement of previous alcohol users and there should be no time regardless of the duration they have remain abstinence that clinicians should classify the previous alcohol users as persons who have completely recovered.

A study by Manning et al (2021) reported that exposure to certain cues such as images of alcohol drinks or persons drinking, smell of alcohol or physical or social context of alcohol may trigger the mental urge to drink and should therefore be strongly prevented (Manning, Garfield et al. 2021). Therefore the use of billbonds adverstments, radio and television advertisements of alcohol should be stopped as they could be such triggers that encourage alcohol drinking.

4.2.9 Drinking pattern during the Covid-19 restrictions.

Regarding alcohol drinking pattern during the Covid-19 period, participants who reported to agree that the covid-19 restrictions affected their alcohol drinking pattern were represented by 44%, (n=41) participants who reported to disagree that covid-19 restrictions affected their alcohol drinking pattern were represented by 46% (n=43)

while participants who reported that covid-19 restrictions partially affected their alcohol drinking pattern were represented by 9.7% (n=9)

The findings on this study showed that nearly half of the participants disagreed that covid-19 restrictions affected their alcohol drinking pattern while nearly half of participant agreed that covid-19 restrictions affected their alcohol drinking pattern.

A study in America during the covid 19 restriction duration found that there was increase in alcohol consumptions at home across all ages and gender(Barbosa, Cowell et al. 2021).

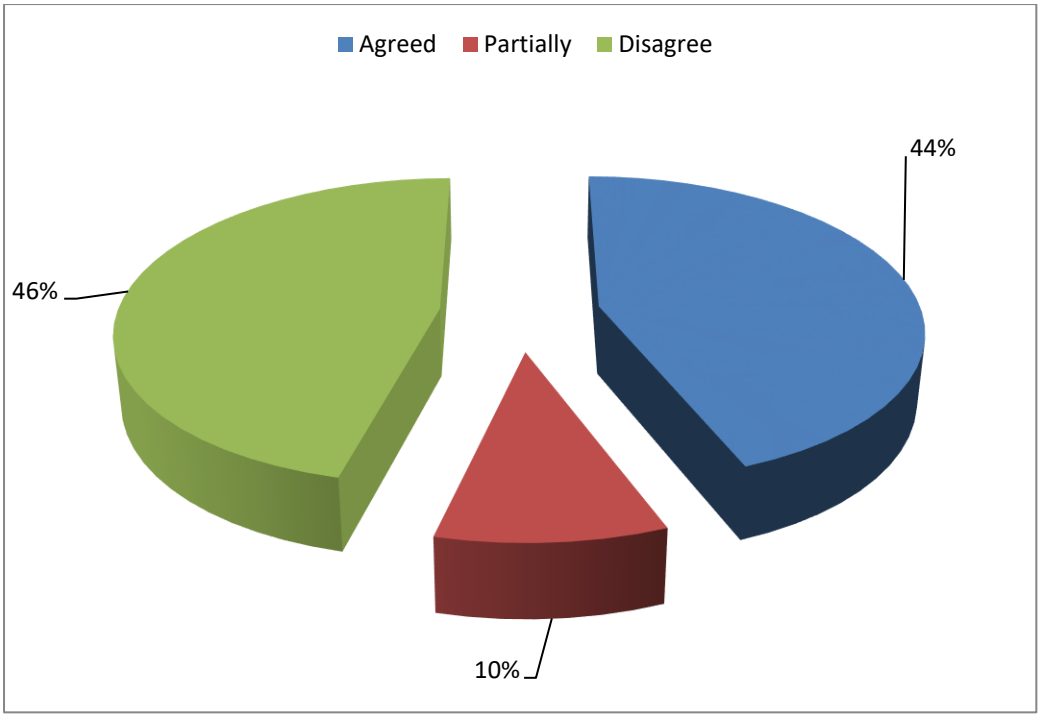


Figure 4. 2: Drinking pattern during the Covid-19 restrictions

4.2.10 Duration of consumption of Alcohol

Regarding duration participants had consumed alcohol, participants who had consumed alcohol for a duration between 1 and 5 years were represented by 16.1% (n=15), participants who had consumed alcohol for a duration between 6 and 10 years were

represented by 26.9% (n=25), participants who had consumed alcohol for 11 to 15 years were represented by 20.45 (n=19), participants who had consumed alcohol for a duration between 16 and 20 years were represented by 22.6% (n=21) while participants who had consumed alcohol for a duration above 25 years were represented by 5.4% (n=5)

The mean for duration on consumption of alcohol was 6 to 10 years while the median was 11 to 15 years. With the mode being 6 to 10 years, with a standard deviation of 1.410. The findings of the study showed that majority of the participants had consumed alcohol for a duration of 6 to 10 years and were represented by 25% while few participants represented by 5.4% had consumed alcohol for a duration above 25 years.

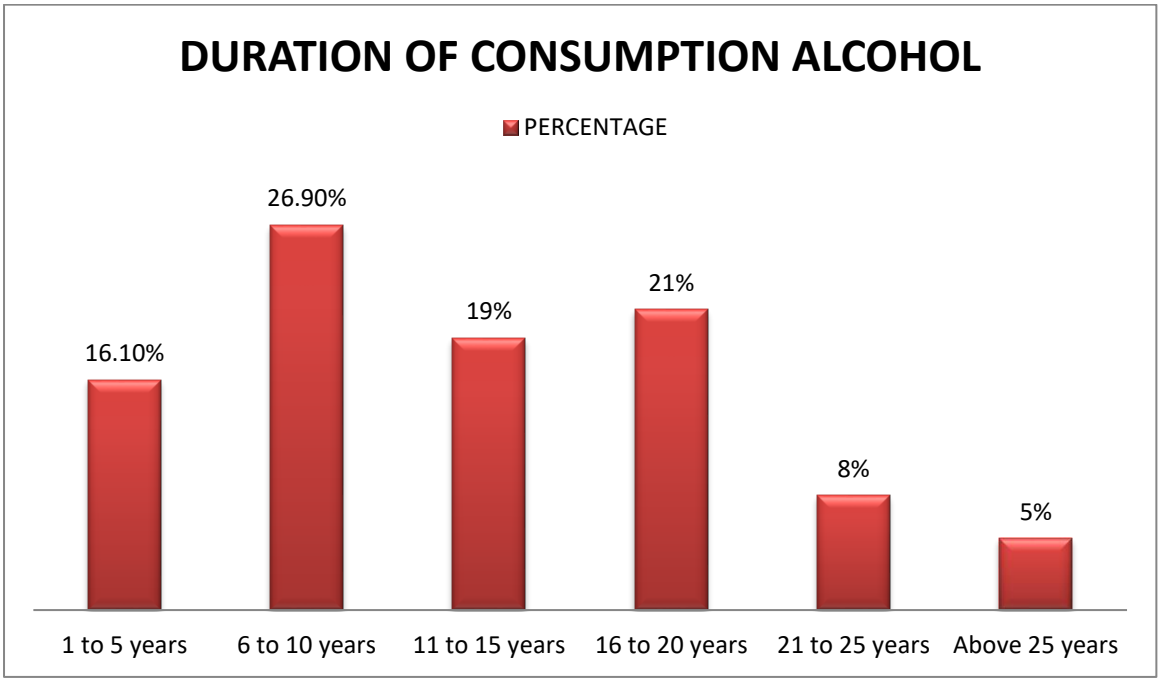


Figure 4. 3: Alcohol drinking pattern in the covid-19 pandemic period

Table 4. 2: Duration of consumption alcohol

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 to 5 years	15	16.1	16.1	16.1
	6 to 10 years	25	26.9	26.9	43.0
	11 to 15 years	19	20.4	20.4	63.4
	16 to 20 years	21	22.6	22.6	86.0
	21 to 25 years	8	8.6	8.6	94.6
	Above 25 years	5	5.4	5.4	100.0
	Total	93	100.0	100.0	

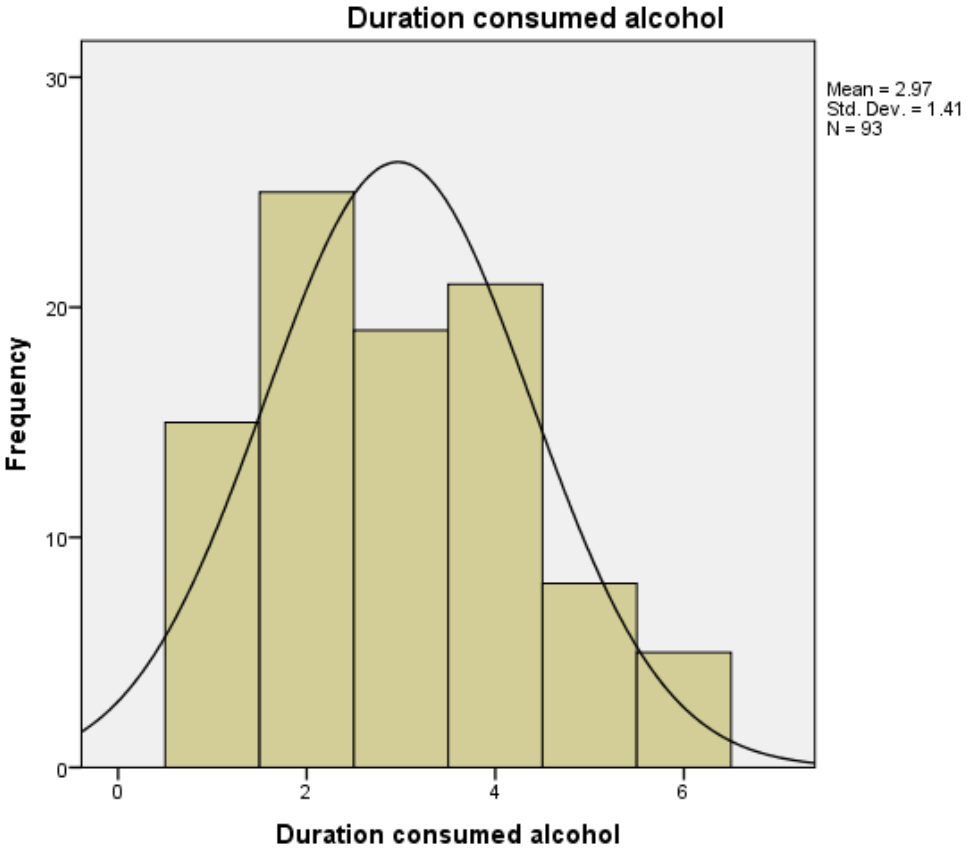


Figure 4. 4: Duration consumed alcohol

A study in US by Aguinis and bakker (2021) reported that participants had consumed alcohol for more than 10 years prior to the study. Our study reported that most participants had consumed alcohol for a duration of 6 to 10 years. A study in Denmark by Lindvig (2021) reported that participants had consumed alcohol for an average

duration of 11 to 20 years before admission to the hospital with severe liver diseases. In that study 52% of the participants were still drinking despite diagnosis of the liver disease (Lindvig, Hansen et al. 2021).

4.2.9 Relapse of participants

Regarding alcohol drinking relapse, participants who reported to have experienced relapse to alcohol consumption were represented by 60.2% (n=56), while participants who reported to have never experienced relapse were represented by 39.8% (n=37). This study showed that majority of the participants represented by 60.2% had experienced alcohol consumption relapse. A study in US by Shen et al (2021) found that 70% of alcohol consumers had relapses (Shen, Kaplan et al. 2021).

Table 4. 3: Relapse due to alcohol consumption

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes; relapsed	37	39.8	39.8	39.8
	No; never relapsed	56	60.2	60.2	100.0
	Total	93	100.0	100.0	

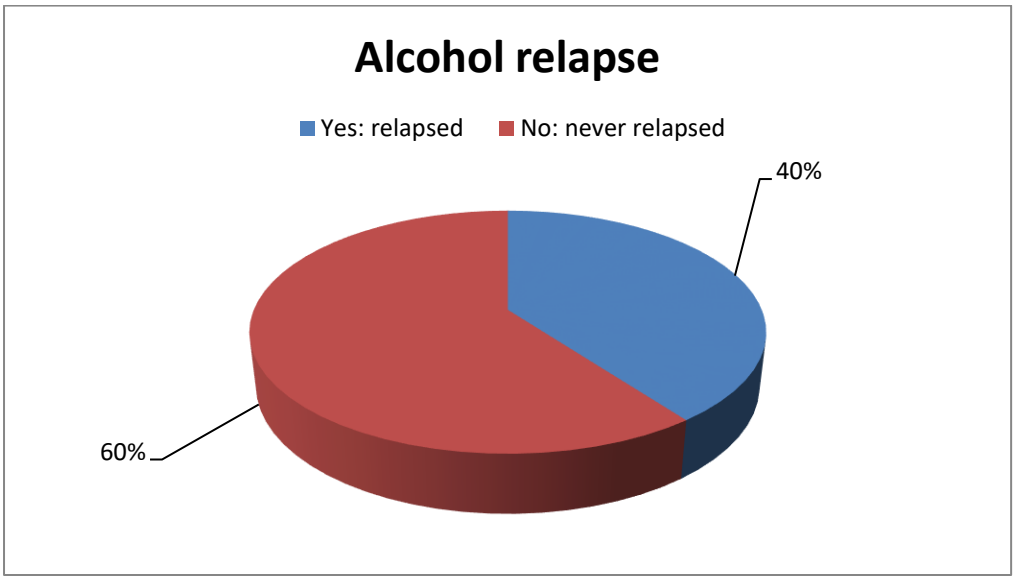


Figure 4. 5: Relapse due to alcohol consumption

4.2.10 Admission criteria

Regarding the admission criteria to rehabilitation centres, participants who reported that they could not know their admission criteria were represented by 36.6% (n=34). Participants who reported that their admission criteria was through a referral to the rehabilitation centre were represented by 34.4% (n=32) while participants who reported that their admission to the rehabilitation centre was not through a referral were represented by 29% (n=27). The mean was ‘yes’ while the median was ‘no’

Our study showed a near equal response to the question of admission criteria. The three responses of ‘yes’ ‘I do not know’ and ‘no’ showed nearly a third portion for each response. The findings were different from other studies. A study in Lebanon by Mahboub et al (2021) reported that all admissions were voluntary and the persons eligible for admission were required to fill acceptance and detoxification forms (Mahboub, Honein-AbouHaidar et al. 2021).

A study in Australia by James et al (2020) reported that admission criteria to a rehabilitation facility was by consent through relatives call the institution to request for the admission. The study further reported that the family has to accept to the requirements of the facility and occasionally accept to be on the waiting list for suitable admission date. During the waiting period the family is guided on home aware (Mahboub, Honein-AbouHaidar et al. 2021).

Most of the participants represented by 36.6 %,(n=34) reported that they could not describe their admission criteria, they were represented by 34.4% (n=32), participants who reported that their admission to the facility was a referral were 34.4% (n=32) while 29.0% (n=27) reported that their admission was not a referral.

4.2.11 Admission to the facility a referral

Table 4. 4: Was your admission to the facility a referral

		Frequency	Percent (%)	Valid Percent	Cumulative Percent
Valid	Yes	32	34.4	34.4	34.4
	I did not known	34	36.6	36.6	71.0
	No	27	29.0	29.0	100.0
	Total	93	100.0	100.0	

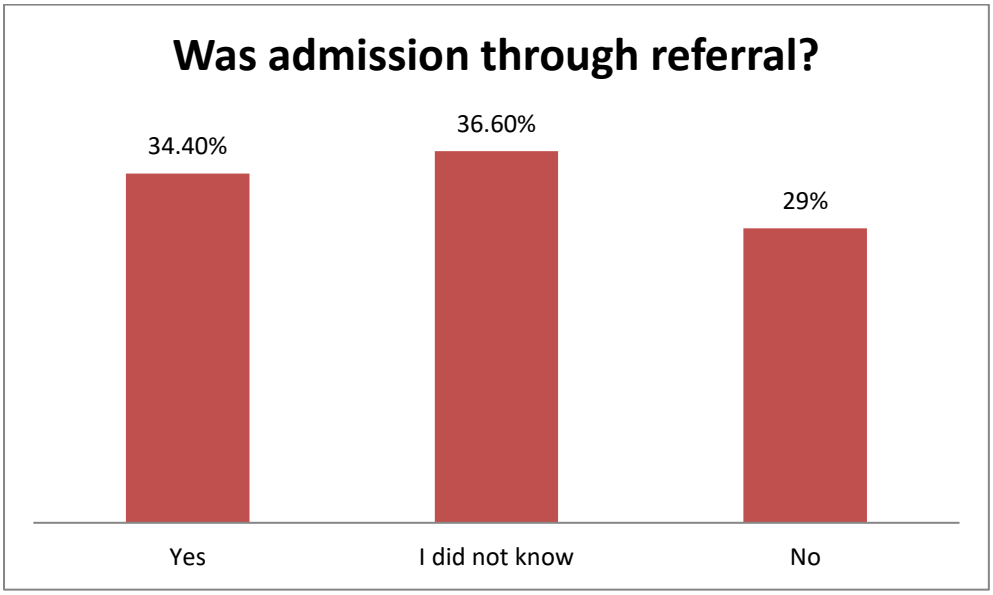


Figure 4. 6: Was your admission to the facility a referral

Table 4. 5: Influence to Alcohol Consumption

Item	Frequency	Percent
Stressful situations	9	9.7
Desire to remain in groups of friends	39	41.9
Afraid to be early at home with spouse	6	6.5
Availability of money	39	41.9
Total	93	100.0

Regarding the influence to alcohol consumption, participants who reported that it was due to stressful situations were represented by9.7% (n=9), participants who reported that their alcohol consumption was influenced by desire to remain in groups of friends were represented by 41.9% (n=39). Participants who reported that they were afraid to be early at home with the spouse as an influenced to alcohol consumption were represented by 6.5% (n=6) while participants who were influenced by availability of money as their main influence to alcohol consumption were 41.9% (n=39).The mean, median and mode was 'desire to remain in group' with a standard deviation of 1.096 was established.

According to a study by Atkinson et al (2021) on a content analysis of marketing alcohol brands in UK during the Covid-19 pandemic, it was noted that the period offered an opportunity to regulate alcohol intake but it was manipulated to offer an opportunity of more alcohol consumption.

It was said that 'we were in it all together' alcohol public community partnership were started where corporate institutions offered monitory donations to support Covid-19 challenges.

Atkinson et al (2021) further reported that the corporate institutions sooner than later realized that this donations strategy provided an opportunity to communicate about the

use of alcohol at homes and encouraged on home delivery for its customers to continue drinking. Their consumers were encourage to stay at home to slow down the spread of the virus but also continue drinking while at home. This approach was interpreted as ethical action which reinforced positive image of their brand possibly even encouraging new loyal consumers (Atkinson, Sumnall et al. 2021).

A study in China by Xu et al (2021) during the Covid-19 pandemic reported that the pandemic had drastic changes in lives and activities of daily living, the situation was stressful for most people which led to restrictive lifestyle change. The change in persons with addiction had more impact than the near normal or normal persons (Xu, Park et al. 2021).

Xu, Park et al (2021) further reported that alcohol consumption and online gaming were regarded as positives since they could keep the persons busy and time would run fast. People had more time to consume alcohol than to work, the end results were more alcohol consumption than abstinence (Xu, Park et al. 2021).

A study in China by Sun et al (2020) found that one out of 6 alcohol abstinence persons relapsed during the covid-19 period. This was related to stressful situations during the period with unrestricted available of alcohol at homes (Xu, Park et al. 2021).

A study in Italy by Messina et al (2021) reported most of the alcohol drinkers were motivated by social affiliation to their peer colleagues. A further search found that participants who were involved in alcohol drinking had not attended alcohol education courses. Thus it was imperative to enroll alcohol users to educational courses at the tertiary teaching institutions or at work related institutions (Messina, D'Angelo et al. 2021).

Desire to remain in groups of friends and availability of money were common influence to consumption of alcohol, both were rated at 41.9% (n=39)

The mean, median and mode was ‘desire to remain in group’ with a standard deviation of 1.096 was established.

The findings in this study were similar to findings in a study in Kenya where participation in social environment gatherings was identified as the main influencer to alcohol consumption (Takahashi, Wilunda et al. 2017).

4.3 AUDIT screening results for alcoholic liver injury among adults of alcohol consumption

The AUDIT tool had 10 item questions subdivided into three domains of hazardous alcohol use, dependence alcohol use and harmful alcohol use. The hazardous alcohol use domain had 3 item questions, the dependence alcohol use had 3 item questions while the harmful alcohol use had 4 item questions.

4.3.1 Descriptive Statistics on AUDIT screening results for alcoholic liver injury among adults of alcohol consumption

4.3.1.1 Hazardous alcohol use

Item 1: Sequence of drinking alcohol

Table 4. 6: Sequence of drinking alcohol

	Frequency	Percent (%)	Mean	Standard deviation
Never	0	0%		
Monthly or less	2	2.2		
2 to 4 times a month	6	6.5	3.60	
2 to 3 times a week	19	20.4		
4 or more times a week	66	71.0		0.709
Total	93	100.0		

Source Field Data (2021)

Regarding the sequence of alcohol consumption, none of the participants reported never to consume alcohol, they were represented by 0% (n=0). Participants who reported to consume alcohol monthly or less than monthly were represented by 2.2% (n=2). Participants who reported to consume alcohol 2 to 4 times in a month were represented by 6.5% (n=6), those who reported to consume alcohol 2 to 3 times in a week were represented by 20.4% (n=19) while majority of the participants reported to consume alcohol 4 or more times in week and were represented by 71%, (n=66) (Table 3)

The findings in our study showed that majority (71%) of the participants consumed 4 or more drinks of alcohol in a week while few (6%) participants consumed a drink of alcohol less than monthly. These findings had a negative relationship to findings using the AUDIT tool in Brazil, the study found that few (3%) participants consumed alcohol 4 or more times in a week. Further the study in Brazil had findings negative to our study where nearly half of the participants consumed alcohol 2 to 4 times a month (Machado, Campelo et al. 2021).

A study in Ireland by Daly et al (2021) during the Covid-19 period reported of a 108% increase in alcohol consumption with more alcohol users drinking greater than 4 times in a week (Daly and Robinson 2021).

Item 2: Amount of drinks on a typical day

Regarding amount of alcohol consumed on a typical day, participants who reported to consume 1 to 2 drinks of alcohol were represented by 2.2% (n=2), participants who reported to consumed 3 to 4 drinks of alcohol were represented by 11.8% (n=11), those who reported to consumed 5 to 6 drinks of alcohol in a typical day were represented by 14% (n=13) while participants who reported to consumed 7 to 9 drinks of alcohol were represented by 17.2% (n=16). Majority of the participants reported to consumed 10 or

more drinks of alcohol on a typical day, they were represented by 54.8% (n=51) (Figure 4.7 below)

The findings of this study showed that few (2.2%) participants consumed 1 or 2 drinks of alcohol in a typical day while majority (54.8%) of the participants consumed 10 or more drinks of alcohol on a typical day. The findings in our study were contrary to findings in Brazil where majority (32%) of the participants consumed 1 or 2 drinks of alcohol in a typical day while participants who consumed 10 or more drinks of alcohol in a typical day were represented by 26% (Machado, Campelo et al. 2021).

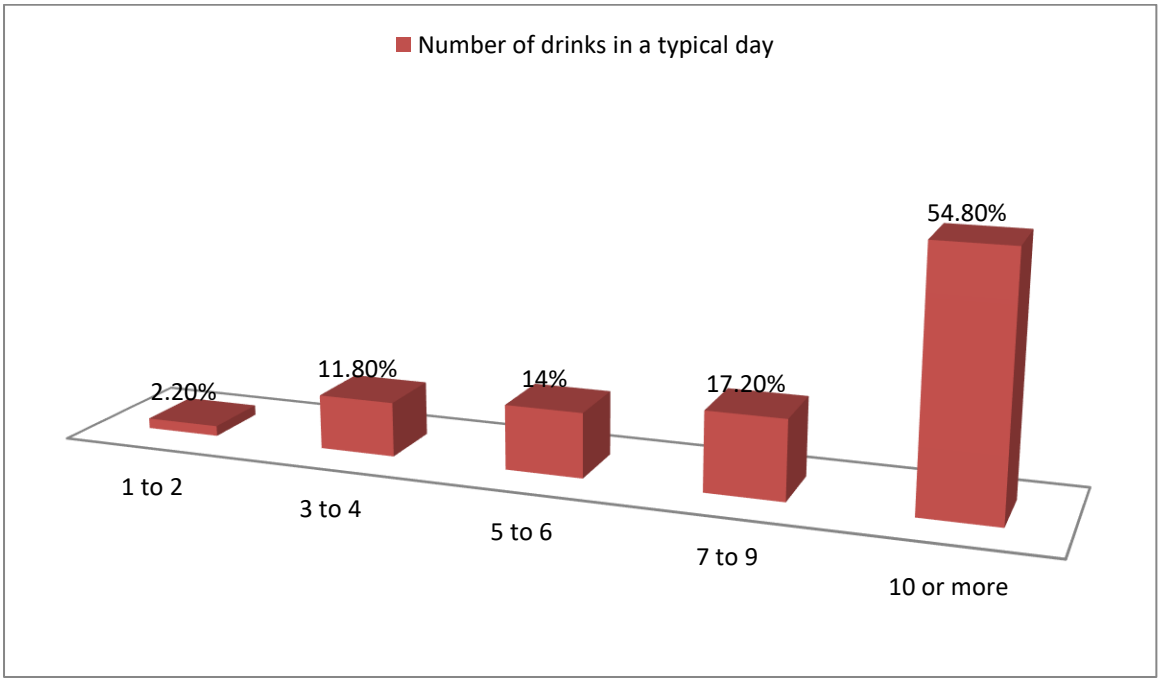


Figure 4. 7: Number of drinks in a typical day

Item 3: Consumed 6 or more drinks on an occasion.

Table 4. 7: When one drink 6 or more drink

	Frequency	Percent	Mean	Standard deviation
Never	1	1.1		
Monthly	5	5.4		
Weekly	22	23.7		
Daily or almost daily	65	69.9		
Total	93	100.0		

Source Field Data (2021)

Regarding consumption of 6 or more drinks of alcohol in an occasion, the study found that participants who never consumed 6 or more drinks of alcohol in an occasion were represented by 1.1% (n=1), participants who reported of monthly consumption of 6 or more drinks of alcohol in an occasion were represented by 5.4% (n=5), participants who reported of weekly consumption of 6 or more drinks of alcohol in an occasion were represented by 23.7% (n=22), participants who reported of daily or almost daily consumption of 6 or more drinks of alcohol in an occasion were represented by 69.9% (n=65) (Table above)

A study in morocco had contrary findings where the study found that 92% of the participants consumed 6 or more drinks of alcohol in an occasion(Ben El Jilali, Benazzouz et al. 2020).

A study in Brazil reported of few (2.2%) participants who consumed 6 or more drinks of alcohol in an occasion (Machado, Campelo et al. 2021).

4.3.1.2 Hazardous drinking

Table 4. 8: Hazardous drinking

Item	Test item	Frequency	Percentage
Sequence of alcohol consumption	Never	0	0.0%
	Monthly or less	2	2.2%
	2 to 4 times a month	6	6.5%
	2 to 3 times a week	19	20.4%
	4 or more times a week	66	71.0%
Number of drinks in a typical day	1 to 2	2	2.2%
	3 to 4	11	11.8%
	5 to 6	13	14.0%
	7 to 9	16	17.2%
	10 or more	51	54.8%
Occasion consumed 5 or more drinks	Never	1	1.1%
	Less than monthly	0	0.0%
	Monthly	5	5.4%
	Weekly	22	23.7%
	Daily or almost daily	65	69.9%

Source Field Data (2021)

From the table above it indicates that the sequence of alcohol consumption was high at 4 or more times a week with a total respondents of 71.0% followed by 2 to 3 times a week with a total respondents of 20.4% (n=19). This was followed by participants who reported to consume 2 to 4 times a month represented by 6.5% (n=6), monthly or less was represented by 2.2% (2) while never was represented by no participant (0%).

On the number of drinks in a typical day; More than half percentage indicated by 10 or more number of drinks in a typical day with 54.8% respondents, while 7 to 9 with a total respondents of 17.2%, for the case of 5 to 6, 3 to 4 and 1 to 2 drinks in a typical day, were respondents of 14.0%, 11.8% and 2.2% respectively. On the occasion consumed 5 or more drinks, participants who reported on daily or almost daily drinking were represented by 69.9%, the respondents who were assessed to drink weekly had an

average of 23.7% of total respondents while 5.4% of respondents indicated that they drunk once in a month while none of the respondents drunk in less than a month.

On hazardous alcohol use, the study found that more participants drink alcohol 4 or more times in a week. The number of drinks in a typical day was 10 or more for most of the participants while on the occasion the participants consumed 5 or more drinks, majority reported this as a daily or almost daily occurrence.

A study in US found that majority of the participants were hazardous alcohol users represented by 53%**.** A study in India suggested that more than half (52.5%) of the participants were hazardous alcohol users(Eashwar, Gopalakrishnan et al. 2019). A study in Kenya by Takahashi et al (2017) found that 60% of the participants were hazardous alcohol users (Takahashi, Wilunda et al. 2017)

Domain: Dependence alcohol use

Item 4: Unable to stop drinking alcohol once started

Regarding the response to when participants were unable to stop drinking alcohol once started during the past duration of one year, participants who reported 'never' denoting that they never had problem to stop drinking once started were represented by 7.5% (n=7), those who reported unable to stop drinking alcohol once started in less than monthly were represented by 4.3% (n=4) while those who reported that they were unable to stop drinking once started, as a monthly occurrence were represented by 18.3% (n=17). Similarly participants who reported of weekly unable to stop drinking alcohol once started were represented by 18.3% (n=17) while those who reported unable to stop drinking once started, as a daily or almost daily occurrence were majority represented by 51.6% (n=48). Table below)

The findings in this study showed that majority (51.6%) of the participants were unable to stop drinking alcohol once they started daily or almost daily while few (4%) were unable to stop drinking alcohol once started in less than monthly. A study in Brazil had contrary but equally similar findings where the study found that few (0.7%) of the participants were unable to stop drinking alcohol once started in daily or almost daily while a similar percentage (4%) of participants reported that they were unable to stop drinking alcohol once started in less than monthly (Machado, Campelo et al. 2021).

Table 4. 9: Unable to stop drinking alcohol once started

		Frequency	Percent	Mean	Standard deviation
Valid	Never	7	7.5		
	Less than monthly	4	4.3		
	Monthly	17	18.3		
	Weekly	17	18.3		
	Daily or almost daily	48	51.6		
	Total	93	100.0	100.0	

Source Field Data (2021)

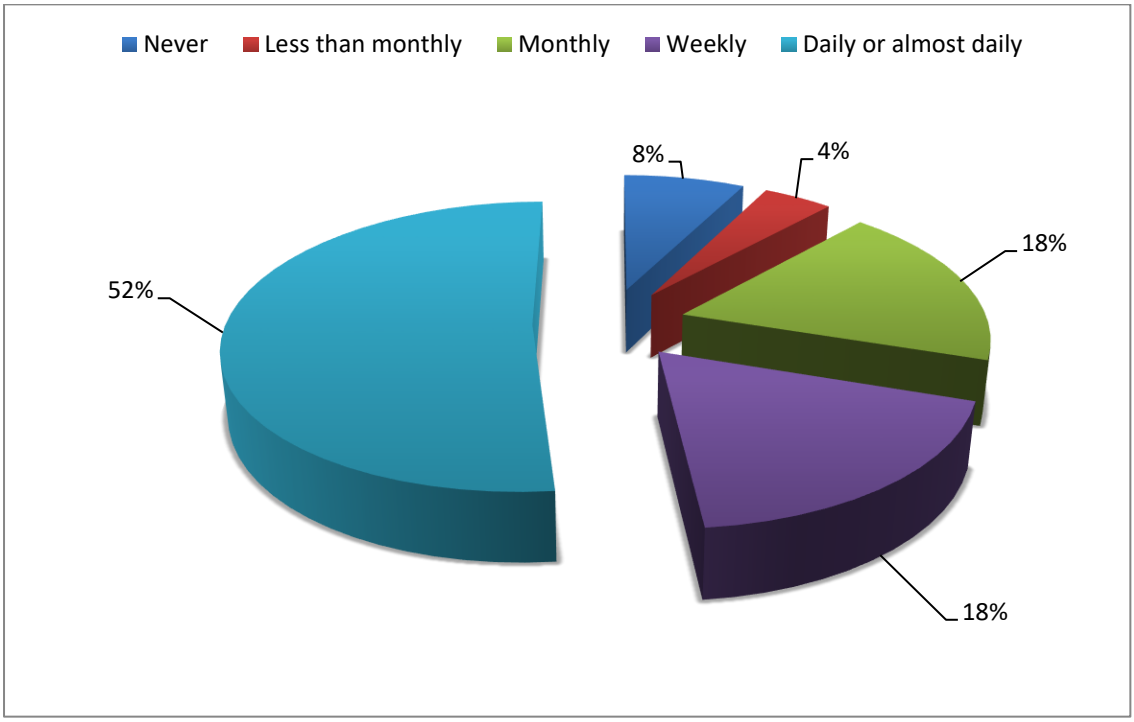


Figure 4. 8: unable to stop drinking

Item 5: Unable to fulfil tasks expected to undertake due to drinking alcohol

Regarding unable to fulfil tasks expected to undertake due to drinking alcohol, participants who reported that they never missed to fulfil tasks expected to fulfil due to drinking alcohol were represented by 3.2% (n=3). Participants who reported that they were unable to fulfil tasks expected to fulfil due to drinking alcohol in less than monthly were represented by 8.6% (n=8), participants who reported that they were unable to fulfil tasks expected to fulfil due to drinking alcohol in monthly were represented by 9.7% (n=9) while participants who reported unable to fulfil tasks expected to fulfil due to drinking alcohol were represented by 26.9% (n=25). Participants who reported that they were unable to fulfil tasks expected to fulfil due to drinking alcohol on daily or almost daily were represented by 51.6% (n=48) (table below)

This study showed majority (51.6%) of the participants were unable to fulfil tasks expected to fulfil due to drinking alcohol on daily or almost daily bases. Findings from a study in Brazil showed contrary findings where few (0.4%) of the participants were unable to fulfil tasks expected of them due to drinking alcohol(Machado, Campelo et al. 2021).

Table 4. 10: Unable to fulfil tasks expectations due to drinking alcohol

		Frequency	Percent	Mean
Valid	Never	3	3.2	
	Less than monthly	8	8.6	
	Monthly	9	9.7	
	Weekly	25	26.9	
	Daily or almost daily	48	51.6	
	Total	93	100.0	

Source Field Data (2021)

Item 6: Need for a drink in the morning to get started

Regarding need for a drink in the morning to get started, participants who reported never in need of a drink in the morning to get started were represented by 5.4% (n=5), similarly participants who reported need of a drink in the morning to get started in less than monthly were represented by 5.4% (n=5). Participants who reported need for a drink in the morning to get started in monthly were represented by 5.4% (n=5), those that reported the need for a drink in the morning to get started in weekly were represented by 17.2% (n=16) while participants who reported need for a drink of alcohol to get started in daily or almost daily were represented by 66.7% (n=62) (table below)

Findings of this study showed that few (5%) participants needed a drink in the morning to get started in less than monthly, a study in India reported that majority of the participants needed a drink in the morning to get started in less than monthly, they were represented by 79% (Eashwar, Gopalakrishnan et al. 2019)

Table 4. 11: Need for a first drink in the morning

Need for a drink to get started	Frequency	Percent	Mean	Standard deviation
Never	5	5.4		1.147
Less than monthly	5	5.4		
Monthly	5	5.4		
Weekly	16	17.2		
Daily or almost daily	62	66.7		
Total	93	100.0		

Source Field Data (2021)

Alcohol dependence

Table 4. 12: Alcohol dependence

	Never		Less than monthly		Monthly		Weekly		Daily or almost daily	
	N	%	N	%	N	%	N	%	N	%
Unable to stop drinking alcohol once started	7	7.5%	4	4.3%	17	18.3%	17	18.3%	48	51.6%
Unable to meet expectations due to drinking	3	3.2%	8	8.6%	9	9.7%	25	26.9%	48	51.6%
Need for first drink in the morning after a heavy drinking session	5	5.4%	5	5.4%	5	5.4%	16	17.2%	62	66.7%

Source Field Data (2021)

To estimate the alcohol dependence; was measured using the following parameters and the following results were achieved. ‘Unable to stop drinking alcohol once started’ which was measured using the Likert scale where most of the respondents were found on ‘daily or almost daily’ category with a total respondent of 51.6%(48), a total of 18.3% indicated for the case of both ‘weekly’ and ‘monthly’ with a total of 17 respondents each. For the case of ‘less than monthly’; had the lowest tally indicated by 4.3% and ‘never’ was indicated by 7.5% of total respondents. To measure the alcohol dependency on ‘unable to meet expectations due to drinking’, most respondents were found in ‘daily or almost daily’ with an average of 51.6% of total respondents. 26.9% (25) respondents indicated that ‘weekly’ as their expectation to ‘unable to meet expectations due to drinking’ with fewer respondents indicating for ‘monthly’, ‘less

than a monthly' and 'never' case with 9.7%, 8.6% and 3.2% respectively. For the 'need for first drink in the morning after a heavy drinking session' most of respondents indicated by over half of the respondents with a total of 66.7%, however 'weekly' and 'monthly' was indicated by 17.2% and 5.2% respectively similarly to 'less a monthly' and 'never' with 5.2% each. This was represented by the table above.

Domain: Harmful alcohol use

Item 7: Feeling remorseful after drinking alcohol

Regarding 'feeling remorseful after drinking alcohol', only one participant who reported never to feel remorseful after drinking alcohol represented by 1.1%. Participants who reported 'feeling remorseful after drinking alcohol less than monthly' were represented by 6.5% (n=6), those participants who reported of 'feeling remorseful after drinking alcohol in monthly' were represented by 15.1% (n=14), participants who reported of 'feeling remorseful after drinking alcohol weekly' were represented by 26.9% (n=25) while participants who reported 'feeling remorseful after drinking alcohol daily or almost daily' were 50.5% (n=47) (table below).

The findings of this study showed that majority of the participants represented by 50.5% were remorseful after drinking alcohol daily or almost daily. A study in India had similar results where majority of the participants represented by 69% reported that they felt remorseful after drinking alcohol daily or almost daily(Eashwar, Gopalakrishnan et al. 2019).

Table 4. 13: Feeling remorseful after drinking alcohol

	Frequency	Percent
Never	1	1.1
Less than monthly	6	6.5
Monthly	14	15.1
Weekly	25	26.9
Daily or almost daily	47	50.5
Total	93	100.0

Source Field Data (2021)

Item 8: Unable to remember what happened the night before due to drinking

Regarding 'unable to remember events after night of drinking alcohol', participants who reported that they never experienced the forgetfulness were represented by 2.2% (n=2). Participants who reported 'unable to remember events after night of drinking alcohol in less than monthly' were represented by 3.2% (n=3), participants who reported 'unable to remember events after night of drinking alcohol in monthly' were represented by 14% (n=13) while participants who reported 'unable to remember events after night of drinking alcohol in weekly' were represented by 29% (n=27). Participants who reported 'unable to remember events after night of drinking alcohol in daily or almost daily' were represented by 51.6% (n=48).

The findings of this study showed that majority of the participants were unable to remember events after a night of drinking alcohol in daily or almost daily and were represented by 51.6%. A study in India had similar results where participants who were alcohol consumers reported unable to remember events after a night of drinking alcohol in daily or almost daily and were represented by 60% (Eashwar, Gopalakrishnan et al. 2019).

Table 4. 14: Unable to remember events after night of drinking

		Frequency	Percent	Mean	Standard deviation
Valid	Never	2	2.2		
	Less than monthly	3	3.2		
	Monthly	13	14.0		
	Weekly	27	29.0		
	Daily or almost daily	48	51.6		
	Total	93	100.0		

Source Field Data (2021)

Item 9: Someone injured due to alcohol drinking

Regarding injury arising from drinking alcohol, participants who reported that nobody was injured due to their alcohol drinking were represented by 20.4% (n=19), participants who reported that injury happened due to their alcohol drinking, but not in the last one year were represented by 11.8% (n=11) while participants who reported that injury happened due to their alcohol drinking within the last one year and were represented by 67.7% (n=63) (Table below).

Table 4. 15: Injury arising from drinking alcohol

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	19	20.4	20.4	20.4
	Yes; but not in the last year	11	11.8	11.8	32.3
	Yes; during the last year	63	67.7	67.7	100.0
	Total	93	100.0	100.0	

Source Field Data (2021)

Item 10: Concern to cut down on drinking.

Regarding ‘concerns by relatives, friends or health care giver to cut down on drinking alcohol’, participants who reported that they were concerned to cut down on drinking

alcohol but not in the last one year were represented by 11.8% (n=11) while participants reported that they were concerned to cut down on drinking alcohol in the last one year and were represented by 88.2% (n=82) (Table below). The results of this study showed that majority of the participants represented by 88.2% were concerned to cut down on drinking alcohol in the last one year. A study in India had similar results where majority of the participants represented by 71% reported that relatives, friends or health care workers were concerned that they cut down on drinking alcohol in the last one year (Eashwar, Gopalakrishnan et al. 2019).

Table 4. 16: Concerns to cut down on drinking

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes; but not in the last year	11	11.8	11.8	11.8
	Yes; during the last year	82	88.2	88.2	100.0
	Total	93	100.0	100.0	

Source Field Data (2021)

Harmful alcohol use

To test for the harmful effects of alcohol use was tabulated in the table 21 below;

Table 4. 17: Harmful alcohol use

Item	Test item	Frequency	Percentage
Feeling remorseful after drinking	Never	1	1.1%
	Less than monthly	6	6.5%
	Monthly	14	15.1%
	Weekly	25	26.9%
	Daily or almost daily	47	50.5%
Unable to remember events after night of drinking	Never	2	2.2%
	Less than monthly	3	3.2%
	Monthly	13	14.0%
	Weekly	27	29.0%
	Daily or almost daily	48	51.6%
Injury arising from drinking alcohol	No	19	20.4%
	Yes; but not in the last year	11	11.8%
	Yes; during the last year	63	67.7%
Concerns to cut down on drinking	No	0	0.0%
	Yes; but not in the last year	11	11.8%
	Yes; during the last year	82	88.2%

Source Field Data (2021)

Most of the respondents indicated that ‘daily or almost daily’ they felt about feeling remorseful after drinking with 50.5%. ‘Weekly’, ‘monthly’, ‘less than a month’ and ‘Never’ were represented by 26.9%, 15.1%, 6.5% and 1.1% respectively. When assessing on the ‘unable to remember events after night of drinking’ was measured by use of Likert scale were most of the respondents indicated that 51.6% ‘almost daily or daily’ they were unable to remember events after night of drinking, 29.0% of respondents indicated that ‘weekly’ they were unable to remember events after night of drinking, for cases of ‘monthly’, ‘less than monthly’ and ‘never’, they were at 14.0%, 3.2% and 2.2% respectively. Most of respondents had injuries within the last year after having heavy drinking with a total percentage of 67.7% while 11.8% indicated that they didn’t have any injury within the last year and 20.4% had no injury arising due to drinking alcohol. Concerns to ‘cut down on drinking’ was presented where most of the respondents indicated that they were concerned to cut down on drinking over the last

one year with 88.2% of total respondents while 11.8% the concerned to cut down on drinking but not in the last year.

4.3.2 Inferential statistics on the AUDIT screening results for alcoholic liver injury among adults of alcohol consumption

Paired T-test for Alcohol Use Disorder Identification Test (AUDIT) screening Tool

Table 4. 18: Alcohol Use Disorder Identification Test (AUDIT) screening Tool

Paired Samples Correlations				
		N	**Correlation**	**Sig.**
Pair 1	HT & DT	93	.523	.000
Pair 2	HT & HTT	93	.350	.001
Pair 3	DT & HTT	93	.478	.000

Source Field Data (2021)

Paired samples t-tests; HT-Hazardous T-test, DT-Dependence T-test, HTT-Harmful T-test.

There was significance between the audit tools since the significance was less than 0.05 for each pair under test. This was shown by the table below;

Table 4. 19: Paired Samples Test

		Mean	**Std. Deviation**	**Std. Error Mean**	**t**	**Df**	**Sig. (2-tailed)**
Pair 1	HT - DT	.80645	2.20798	.22896	3.522	92	.001
Pair 2	HT-HTT	-2.82796	2.68904	.27884	-10.142	92	.000
Pair 3	DT - HTT	-3.63441	2.57406	.26692	-13.616	92	.000

Source Field Data (2021)

From the table 5 above it indicated that there was a no correlation between those individuals who had hazardous drinking and alcohol dependence with a t-value of

3.522 at 95% confidence interval which is less than table value 1.962 at 95% level of significance. For the hazardous drinking and harmful alcohol use had a positive correlation since t-value obtained was less than the t table value at 95% confidence interval (-10.142 ≤ 3.522). The sample paired t-test between harmful alcohol use and alcohol dependence had a positive correlation (-13.616 ≤ 3.522) at 92 degree of freedom hence obtained t test value is being less than the table value.

The AUDIT tool had 10 item questions subdivided into three domains of hazardous alcohol use, dependence alcohol use and harmful alcohol use. The hazardous alcohol use domain had 3 item questions, the dependence alcohol use had 3 item questions while the harmful alcohol use had 4 item questions.

4.3.3 Inferential statistics use on the AUDIT screening results for alcoholic liver injury among adults of alcohol consumption

Item 1: Sequence of drinking alcohol

Hazardous alcohol

Regarding the sequence of alcohol consumption, none of the participants reported never to consume alcohol, participants who reported to consume alcohol monthly or less than monthly were represented by 2.2% (n=2). Participants who reported to consume alcohol 2 to 4 times in a month were represented by 6.5% (n=6), those who reported to consume alcohol 2 to 3 times in a week were represented by 20.4% (n=19) while majority of the participants represented by 71%, (n=66) reported to consume 4 or more times in week.

The findings in our study showed that majority (71%) of the participants consumed 4 or more drinks of alcohol in a week while few (6%) participants consumed a drink of

alcohol less than monthly. These findings had a negative relationship to findings using the AUDIT tool in Brazil, the study found that few (3%) participants consumed alcohol 4 or more times in a week. Further the study in Brazil had findings negative to our study where nearly half of the participants consumed alcohol 2 to 4 times a month(Machado, Campelo et al. 2021).

Item 2: Amount of drinks on a typical day

Regarding amount of alcohol consumed on a typical day, participants who reported to consume 1 to 2 drinks were represented by 2.2% (n=2), participants who consumed 3 to 4 drink were represented by 11.8% (n=11), those who consumed 5 to 6 drinks in a typical day were represented by 14% (n=13) while those who consumed 7 to 9 drinks were represented by 17.2% (n=16). Majority of the participants represented by 54.8% (n=51) consumed 10 or more drinks on a typical day (Figure 3)

Item 3: Consumed 6 or more drinks on an occasion.

A study in morocco found that 92% of the participants consumed 6 or more drinks every day of the week (Ben El Jilali, Benazzouz et al. 2020).

Discussion of the hazardous alcohol use domain

The findings of this study found that majority of the participants drunk alcohol 4 or more times in a week, the number of drinks in a typical day were 10 or more while on the occasion the participants consumed 5 or more drinks; it was a daily or almost daily occurrence. The

Participants were represented by 71%, 54.8% and 69.9% respectively. On average these three items of the domain had the highest representation of 65.2%. A study in Kenya by Takhashi et al (2017) regarded hazardous alcohol use as high risk to predisposition of morbidities in the human body(Takahashi, Wilunda et al. 2017).

A study by Lachenmeier et al (2021) in Germany reported that hazardous alcohol use was associated with disproportionate harm of alcohol toxicity due to unrecorded use of ethanol and methanol constituents in alcohol products(Lachenmeier, Neufeld et al. 2021).

A study by Lawler et al (2021) in Australia found that majority of the young persons who were involved in alcohol consumption were at the hazardous group progressing fast to more dangerous state due to vigor in alcohol use(Lawler, Stapinski et al. 2021).

A study by Paulus et al (2021) in USA found that there were positive and negative emotions involved in alcohol consumption with hazardous alcohol users. The study reported of difficulties in regulating both emotions with majority of the participants applying minimal or no mechanisms in coping with the emotions(Paulus, Heggeness et al. 2021).

A study by Ngo et al (2021) in USA found that hazardous alcohol users experience pain on their body suggestive of more alcohol consumption inorder to get the body be used of the circumstance to endure the pain(Ngo, Liebschutz et al. 2021).

Another study by kola et al (2021) in UK found that hazardous alcohol use was associated with insomnia when the drinkers were on the rest mode, upon return to drinking they reported of normal sleep pattern(Kolla, Biernacka et al. 2021).

This study suggest that there were various factors that encourage hazardous alcohol users to continue drinking. They may or may not be knowledgeable of the damage caused by continuous alcohol use but the motivator could be strong to resist. Without intervention on hazardous alcohol use the persons were more likely to progress to dependence use than they were likely to downgrade to abstinence. Medical intervention should focus effort on hazardous alcohol users in early diagnosis and intervention on alcoholic liver injury.

Alcohol consumers at the domain were likely to progress with liver injury without their knowledge due to the harm subjected to the body.

Domain: Dependence alcohol use

Item 4: Unable to stop drinking alcohol once started

Regarding the response to when participants were unable to stop drinking alcohol once started during the past period of one year, participants who reported never denoting that they never had problem to stop drinking once started were represented by 7.5% (n=7), those who reported unable to stop drinking alcohol once started in less than monthly were represented by 4.3% (n=4) while those who reported this as a monthly occurrence were represented by 18.3% (n=17). Similarly participants who reported of weekly unable to stop drinking alcohol once started were represented by 18.3% (n=17) while those who reported this as a daily or almost daily occurrence were majority represented by 51.6% (n=48).

A study in Ireland by Daly et al (2021) during the Covid-19 period reported of more alcohol users reporting unable to stop drinking once started but rather opted to continue drinking alcohol for longer hours(Daly and Robinson 2021).

A study by Niclasen et al (2021) in Greenland on AUDIT test reported that nearly half of the participants were unable to stop drinking once started(Niclasen, Flyger et al. 2021).

Item 5: Unable to meet expectations due to drinking

Niclasen et al (2021) reported that over 30% of alcohol users were unable to meet their expectations either at the family level or at work due to alcohol consumption on weekly bases or more(Niclasen, Flyger et al. 2021).

Item 6: Need for a drink in the morning to get started

After a heavy drinking session, participants who reported never in need of a drink in the morning to get started were represented by 5.4% (n=5), similarly those in need of a drink to get started in less than monthly were represented by 5.4% (n=5). Participants who reported that they need a drink to get started in monthly were represented by 5.4% (n=5), those that need a drink to get started weekly were represented by 17.2% (n=16) while majority of the participants represented by 66.7% (n=62) reported that they need a drink to get started daily or almost daily (table 4 below)

A study in India reported of similar findings where 68% of the participants reported of a need for a drink in the morning to get started(Eashwar, Gopalakrishnan et al. 2019). Niclasen et al (2021) reported that over 30% of alcohol users needed a drink of alcohol in the morning to get started on weekly bases or more(Niclasen, Flyger et al. 2021).

The test on dependence alcohol use found high percentages on daily or almost daily occurrence of unable to stop drinking alcohol once started, unable to meet expectations due to drinking and need for first drink in the morning after a heavy drinking session. Participants were unable to stop drinking probably because they were drinking from home or the take-away quantity was still available. The other parameters of unable to meet expectations and need for first drink could have been due to unable to stop consumption once started. The test on harmful alcohol use found that near half of the participants experienced feelings of remorsefulness after drinking on daily or almost daily occasion. The results were compared with a study from Sau Luis where majority of the participants were not remorseful of drinking alcohol(Machado, Campelo et al. 2021).

Summary of the dependence alcohol use domain

A study by Niclasen et al (2021) in Greenland on AUDIT test found that 60% of the participants were dependence alcohol users(Niclasen, Flyger et al. 2021).

Callinan at al (2021) in a study in Australia found that during the Covid-19 period there was decrease in dependence alcohol use(Callinan, Smit et al. 2021).

Domain: Harmful alcohol use

Item 7: Feeling remorseful after drinking alcohol

A study in India reported similar findings where majority of the participants who were alcohol consumers represented by 69% reported that they felt remorseful of alcohol drinking(Eashwar, Gopalakrishnan et al. 2019)

Item 8: Unable to remember what happened the night before due to drinking

A study in India reported similar findings with our study where 63% of the participants who were regular alcohol consumers reported of unable to remember what happened on the night before because they had a blackout (Eashwar et al, 2019)

Item 9: Someone injured due to alcohol drinking

Regarding injury arising from drinking, participants who reported that it did not happened were represented by 20.4% (n=19), those that reported that injury happened but not in the last one year were represented by 11.8% (n=11) while majority reported that yes injury happened within the last one year were represented by 67.7% (n=63)

Item 10: Concern to cut down on drinking.

Regarding concerns by relatives, friends or health care giver on cut down to drinking alcohol, participants who reported yes but not in the last year were represented by 11.8% (n=11) while majority of the participants represented by 88.2% (n=82) reported yes concerns to cut down on drinking during the last year

Nearly half of the participants reported unable to remember events after a night of drinking on daily or almost daily drink. The significant of this was that participants were likely to suffer from alcohol use disorder or other comorbidities and as such further diagnostic studies can improve the diagnostic evaluation. A study in India reported similar findings with our study where 71% of the participants who were alcohol drinkers reported that they had been adviced either by relatives, friends or health workers to cut down on drinking alcohol. Niclasen et al (2021) reported that two thirds of alcohol users were concerned of cutting down on drinking

Callinan et al (2021) in a study during the Covid-19 period reported that there was decrease in harmful alcohol use due to the measures of social distancing and closure of licensed premises.

4.4 Biomarkers of liver

Each participant was requested to provide 5 mls of venous whole blood that was collected into vacutainer tubes. Before blood collection the veni-puncture site was swabbed thrice with methylated spirit swab. The solution was left to evaporate before skin and venous penetration into the vein to collect blood.

The collected blood was put in a vacutainer tube which was labelled using identification code for each participants.

The vacutainer was stored inside a cool box with ice packs and transported to Mount Kenya University research and Innovation laboratories. Upon reaching the laboratories the blood samples were prepared for centrifuging.

A study in Tanzania by Francis et al (2015) reported that when blood samples for biomarker test were collected they were transported in cool boxes to a storage

laboratory within a period of 6 hours. The samples were stored at -8 centigrade until the day of analysis of tests(Francis, Weiss et al. 2015).

4.4.1 Descriptive statistics on the levels of alcoholic liver biomarkers among adults of alcohol consumption

Table 4. 20: Descriptive Statistics for Aspartate aminotransferase.

Alanine aminotransferase diagnostic results

Item description in IU/L		N	%
Alanine Aminotransferase	0-40	0	0.0%
	41-80	91	97.8%
	81-120	2	2.2%
	Above 120	0	0.0%

Source Field Data (2021)

When alanine aminotransferase assay was done, findings from blood samples were as follows. Participants with 0 to 40 IU/L were represented by 0%, those with 41 to 80 IU/L were represented by 97.8% (n=91) while those with 81 to 120 IU/L were represented by 2.2% (n=2). None of the participant blood had findings above 120 IU/L.

Table 4. 21: Descriptive statistics for alanine aminotransferase

Aspartate aminotransferase diagnostic results

Item description in IU/L		N	%
Aspartate aminotransferase	0-34	7	7.5%
	35-68	82	88.2%
	69-102	3	3.2%
	Above 102	1	1.1%

Source Field Data (2021)

Regarding aspartate aminotransferase results, blood samples with 0 to 34 IU/L were represented by 7.5% (n=7), blood samples with 35 to 68 IU/L were represented by 88.2% (n=82), blood samples with 69 to 102 IU/L were represented by 3.2% (n=3) while samples with results above 102 IU/L were represented by 1.1% (n=1)

Table 4. 22: Descriptive statistics for Gamma Glutamyl aminotransferase

Gamma glutamyl aminotransferase diagnostic results

Item description in IU/L		N	%
Gamma Glutamyl aminotransferase	0-50	0	0.0%
	51-100	67	72.0%
	101-150	26	28.0%
	Above 150	0	0.0%

Source Field Data (2021)

Regarding Gamma Glutamyl aminotransferase, blood sample results with 0 to 50 IU/L were represented by zero percent. At 51 to 100 IU/L were 72% (n=67), those with 101 to 150 IU/L were represented by 28% (n=26) while none had sample results above 150 IU/L.

Table 4. 23: Descriptive statistics for alkaline phosphatase

Alkaline phosphatase diagnostic results

Item description in IU/L		N	%
Alkaline phosphatase	0-150	1	1.1%
	151-300	86	92.5%
	301-600	6	6.5%
	above 600	0	0.0%

Source Field Data (2021)

Blood sample results for alkaline phosphatase found that 0 to 150 IU/L were represented by 1.1% (n=1), those with 151 to 300 IU/L were represented by 92.5% (n=86), those with 301 to 600 IU/L were represented by 6.5% (n=6) while none of the blood samples had above 600 IU/L.

A study in Uganda found that 78.4% had less than 2.5 times Upper Limit of the Normal (ULN), 15.9% had between 2.5 and 5 times ULN, 4.9% had 5 to 10 times ULN while about 1% had equal to or above 10 times ULN (Freiman, Fatch et al. 2021)

A study in US by Lala at al (2020) reported on the normal ranges for liver transaminase values for the biomarkers as, aspartate aminotransferase at 0 to 35 IU/L, with alanine aminotransferase at 0 to 45 IU/L, while gamma glutamyl transferase was reported at GGT as 0 to 30 IU/L. Bilirubin was at 2 to 17 micromoles/L with albumin at 40 to 60 g/L and Prothrombin time at 10.9 to 12.5 seconds (Lala, Goyal et al. 2020). Shreevastva, Pandeya and Mishra (2017) reported that AST or ALT when elevated rarely exceed 300 IU/L in ALI (Lala et al, 2020).

Lala et al (2020) described the normal range for alkaline phosphatase as 30 to 130 IU/L, bilirubin as 2 to 17 Micromoles/L while albumin was described at 40 to 60 g/L. Due to its presence in bone diseases alkaline phosphatase should be tested with other

biomarkers to make a conclusive diagnosis and should not be used alone as a liver biomarker (Lala, et al 2020)

Since different laboratories can have different machine readings as per the manufacturer's instructions, our machine was set to ALP normal values as 0 to 150 IU/L

A study in USA showed that in all the participants ALT and AST were elevated which was significant for AUD.

There was a high ratio (AST/ALT >1) in 86% of the participants with presence of liver cirrhosis in 63%.

A study in Turkey reported that elevated AST, ALT albumin and bilirubin had high mortality rate especially with liver fibrosis(Salık, Uzundere et al. 2021).

4.4.2 Regression Results on the AUDIT screening results for alcoholic liver injury among adults of alcohol consumption

Table 4. 24: Model summary

Model Summary				
Model	**R**	**R Square**	**Adjusted R Square**	**Std. Error of the Estimate**
1	.946[a]	.896	.896	.419

a. Predictors: (Constant), Alkaline phosphatase, Aspartate aminotransferase, Gamma Glutamyl aminotransferase, Alanine Aminotransferase

Source; Collected Data, (2020)

The model summary was fitted for the various levels of alcoholic liver biomarkers among adults of alcohol consumption it was found out that the value of R^2 on the relationship between the studied parameters of measuring various level of alcohol consumption was 0.896 showing a goodness of fit of the model. This implied that

holding the other factors that were affecting the alcohol consumption constant showed Alkaline phosphatase, Aspartate aminotransferase, Gamma Glutamyl aminotransferase and Alanine Aminotransferase were main factors would contribute by 89.6%.

Table 4. 25: ANOVA Fitting model

ANOVA[a]						
Model		**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
1	Regression	3.042	4	.760	2.303	.000[b]
	Residual	.000	88	.033		
	Total	3.042	92			

Source; Collected Data, (2020)

From the four factor which were Alkaline phosphatase, Aspartate aminotransferase, Gamma Glutamyl aminotransferase and Alanine Aminotransferase used to determine the levels of alcoholic liver biomarkers among adults of alcohol consumption it indicated an f-value of 2.303 which was less than the f table value at 4 degree of freedom which was 6.39 hence there was a statistical significance between biomarkers and alcohol consumption. A significance of 0.000 was less than p-value of 0.05 hence showing goodness of fit model.

Regression analysis

Table 4. 26: Regression analysis

Model		Unstandardized Coefficients		
		B	Std. Error	Sig.
1	(Constant)	4.268	.000	1.000
	Alanine Aminotransferase	.201	.000	.000
	Aspartate aminotransferase	.536	.000	.000
	Gamma Glutamyl aminotransferase	.620	.000	.000
	Alkaline phosphatase	.372	.000	.000

Source; Collected Data, (2020)

The table above shows the regression model on the biomarkers and their corresponding coefficient of each parameter. It was found out that Gamma Glutamyl aminotransferase had the highest influence compwere to other factors of 0.620, followed closely by Aspartate aminotransferase with 0.536 correlation rate, Alkaline phosphatase had a correlation of 0.372 and finally Alanine Aminotransferase had a correlation 0.201. We can observe that none of the biomarkers measures had a negative correlation hence positive correlation of biomarkers towards determination of the level of alcoholic liver biomarkers among adults of alcohol consumption.

The following was a linear regression equation of biomarkers towards the level of alcoholic liver biomarkers among adults of alcohol consumption.

$$y = 4.268 + 0.201x_1 + 0.563x_2 + 0.620x_3 + 0.372x_4 + \varepsilon$$

Where $x_1 =$ Alanine Aminotransferase

$x_2 =$ Aspartate aminotransferase

$x_3 =$ Gamma Glutamyl aminotransferase

$x_4 =$ Alkaline phosphatase

4.4.3 Inferential statistics on the AUDIT screening results for alcoholic liver injury among adults of alcohol consumption

Table 4. 27: Paired T-test for Total Bilirubin and Direct Bilirubin

Paired Samples Correlations				
		N	Correlation	Sig.
Pair 1	TBIL & DBIL	93	.712	.000

Source; Collected Data, (2020)

There was a strong correlation between the total bilirubin and the direct bilirubin since there was a high correlation of 71.2% hence can be used to determine the levels of alcoholic liver biomarkers among adults of alcohol consumption. A significance of 0.000 was less than p-value of 0.05 hence showing goodness of fit model.

Table 4. 28: Paired T-test for Total Bilirubin and Direct Bilirubin

Paired Samples Test									
		Paired Differences							
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	Sig. (2-tailed)
Pair 1	TBIL - DBIL	18.7269	5.9619	.6182	17.4990	19.9547	30.291	92	.000

Source; Collected Data, (2020)

A T-value of 30 was obtained from the correlation between the total bilirubin and the direct bilirubin this indicated a strong correlation when compared with the t-table value at 92 degree of freedom which is 1.965 at 95% level of significance.

Total protein and ALB

Paired sample correlation was carried out and the following results were obtained.

Table 4. 29: Paired T-test for Total protein and ALB

Paired Samples Correlations				
		N	Correlation	Sig.
Pair 1	TP & ALB	93	.56	.000

Source; Collected Data, (2020)

There was half of correlation between the total protein and the ALB with a correlation of 56.0% hence indicating there was a relationship between the total protein and the ALB. A significance of 0.000 was obtained which is less than 0.05 this indicating that goodness of fit in the model.

Paired Samples Test								
	Paired Differences							
				95% Confidence Interval of the Difference				
	Mean	**Std. Deviation**	**Std. Error Mean**	**Lower**	**Upper**	**T**	**df**	**Sig. (2-tailed)**
Pair 1 TP - ALB	29.077	9.787	1.015	27.062	31.093	28.652	92	.000

Source; Collected Data, (2020)

Paired T-test between the total protein and the ALB obtained a t value of 28.652 which is greater than T-table value which is 1.965 at 95% level of significance at 92 degree of freedom. This indicated that there was an association between the total protein and the ALB in estimating the levels of alcoholic liver biomarkers among adults of alcohol consumption.

The European Association for the study of the liver in 2021 stated that elevation of bilirubin, ALT and ALP provide definitive damage and dysfunction of hepatocellular.

The association recommends this pattern as a reliable diagnostic tool(Salık, Uzundere et al. 2021).

A study in Denmark reported that albumin and bilirubin were reliable just like the other biomarkers in diagnosis of alcoholic liver injury(Lindvig, Hansen et al. 2021)

The European Association for the study of the liver in 2021 reported that ALP combined with GGT provides evidence that ALP elevation is from the hepatic origin (Brennan, Cartlidge et al. 2021).

A study in Spain found that elevated levels of transaminase and bilirubin were highly dependable in drug induced liver injury (Andrade and Robles-Díaz 2020).

A study in Spain reported that ALT/AST ratio, ALP and Total Bilirubin (TBL) as the pillars for liver injury detection and qualifications (Andrade and Robles-Díaz 2020). A study in Rwanda by Rutayisire (2017) reported that total protein range was between 68 and 88 IU/L, albumin was between 40 and 55 IU/L while total bilirubin was between 5 and 22 IU/L.

It is reported that in advanced liver disorder, the liver functions deteriorate a suggestion well evaluated through serum bilirubin. Liver biopsy has lost its importance in evaluating alcoholic liver disease(Seitz and Neuman 2021).

A study in Denmark reported that routine liver function tests were diagnose fibrotic liver disease if combine with other parameters such as albumin and bilirubin(Lindvig, Hansen et al. 2021).

Correlation of the Total protein, Alanine Aminotransferase, Aspartate aminotransferase Gamma Glutamyl aminotransferase and Alkaline phosphatase

The table below indicates the results of the correlation between where Total protein was compared with the Alanine Aminotransferase, Aspartate aminotransferase Gamma Glutamyl aminotransferase and Alkaline phosphatase.

Table 4. 30: Correlation of the Total protein, Alanine Aminotransferase, Aspartate aminotransferase Gamma Glutamyl aminotransferase and Alkaline phosphatase

Paired Samples Correlations				
		N	**Correlation**	**Sig.**
Pair 1	TP & ALT	93	-.062	.000
Pair 2	TP & AST	93	-.050	.000
Pair 3	TP & ALP	93	-.043	.000
Pair 4	TP & GGT	93	.071	.000

Source; Collected Data, (2020)

The paired value correlation between the total protein and the Alanine Aminotransferase was -0.062 indicating a negative correlation relationship between the Total protein and ALT. The relationship between the Total protein and the Aspartate aminotransferase had a negative correlation of -0.050 hence contributing levels of alcoholic liver biomarkers among adults of alcohol consumption. Correlation of -0.043 was drawn between the relationship between the total protein and Alkaline phosphatase similarly indicating a correlation hence negative impacts towards the influence towards contributing levels of alcoholic liver biomarkers among adults of alcohol consumption. The correlation between the total protein and the Gamma Glutamyl aminotransferase was very high with 0.071 hence indicating a statistical relationship between them hence influence towards contributing levels of alcoholic liver biomarkers among adults of

alcohol consumption. A significance of 0.000 indicated the goodness in fit of the model in paired t-test.

Paired T-test for the Total protein, Alanine Aminotransferase, Aspartate aminotransferase Gamma Glutamyl aminotransferase and Alkaline phosphatase

The table below indicates the results of the paired T-test between where Total protein was compared with the Alanine Aminotransferase, Aspartate aminotransferase Gamma Glutamyl aminotransferase and Alkaline phosphatase.

Table 4. 31: Paired T-test for the Total protein, Alanine Aminotransferase, Aspartate aminotransferase Gamma Glutamyl aminotransferase and Alkaline phosphatase

Paired Samples Test									
		Paired Differences							
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper	T	df	Sig. (2-tailed)
Pair 1	TP - ALT	19.7978	14.9111	1.5462	16.7269	22.8688	12.804	92	.000
Pair 2	TP - AST	22.7968	17.5399	1.8188	19.1845	26.4091	12.534	92	.000
Pair 3	TP - ALP	-163.9129	84.3811	8.7499	-181.2910	-146.5348	-18.733	92	.000
Pair 4	TP - GGT	-21.9226	26.0247	2.6986	-27.2823	-16.5628	-8.124	92	.000

Source; Collected Data, (2020)

A t-value of 12.804 was obtained between the pair of the total protein and the Alanine Aminotransferase, this indicated a strong correlation between them since the table value is 1.66 at 92 degree of freedom at 95% confidence interval. The paired value between the Total protein and the Aspartate aminotransferase was 12.534 which indicating a relationship between the two variables hence influence towards contributing levels of

alcoholic liver biomarkers among adults of alcohol consumption at 95% confidence interval with a t-value of 1.66.

The statistical relationship between the total protein and Alkaline phosphatase was 18.733 this indicated a relationship between the total protein and Alkaline phosphatase towards the influence towards contributing levels of alcoholic liver biomarkers among adults of alcohol consumption at 95% confidence interval. A t-value of -8.124 was generated between the total protein and the Gamma Glutamyl aminotransferase this is less than the t-table value at 92 degree of freedom at 95% confidence hence we reject the null hypothesis that there was a relationship between them towards determining influence towards contributing levels of alcoholic liver biomarkers among adults of alcohol consumption.

A study in Czech Republic by Anders et al (2021) reported that there was an association between AUDIT results and liver biomarkers. An increase in AUDIT score was associated with an increase in severity of the liver biomarkers when GGT, ALT, AST and Albumin were tested(Anders, Kitzlerová et al. 2021).

Alanine aminotransferase

Our study found that all the participants had elevated levels of alanine aminotransferase. A study in Denmark by Abero et al (2021) had similar findings when they reported that alanine aminotransferase was highly regarded when predicting liver fibrosis. Elevation of the parameter signified liver Injury with high elevation likely to lead to immediate or later day hospitalization with predictable mortality(Åberg, Danford et al. 2021).

A study in US by Urbano et al (2021) reported that high levels of ALT correlated with the severity of liver injury and that the biomarker was dependable in diagnosis of alcoholic liver injury(Urbano, Filippini et al. 2021).

Our study found that nearly all the participants had elevated ALT. Moriles and Azer (2021) had similar findings when they reported that ALT alone affects 8.9% of the US population. They further reported that 1 to 2.2 fold higher than normal limit was an indication of reversible alcoholic liver injury.

Aspartate aminotransferase

According to Ndrepepa (2021) the aspartate aminotransferase to alanine aminotransferase ratio has a lot of significance on liver injury due to alcohol (Ndrepepa 2021).

A study in China by Kang et al (2021) reported that AST elevation is used to evaluate alcoholic liver injury. The researchers further stated that elevated AST levels above the normal upper limit was significant of alcoholic liver injury but the severity of the injury depends on the level of elevation(Kang, Sun et al. 2021).

A study in US by Cusi et al (2021) reported that alcohol consumption of more than 10 g daily or 14 g per week was adequate to elevate the AST above the normal upper limit(Cusi, Alkhouri et al. 2021).

Gamma glutamyl aminotransferase

A study in US by Bijnens et al (2021) reported that GGT had a cellular role to degrade extracellular glutathione into amino acids that can be used in synthesis of intracellular glutathione, GGT is therefore a marker for oxidative stress. Bijnens et al (2021) further reported that the number of alcohol consumed in a week was positively correlated with

GGT. A study in US by Harris et al (2021) reported that GGT was a widely trusted liver biomarker for excess alcohol consumption. Heavy alcohol intake elevates the GGT in most alcohol consumers. A study by NIvukoski et al (2021) reported that alcohol users have prolonged inflammatory mileu that is needed in development of endotoxemia that increases gastrointestinal permeability which increases the risk of mortality in alcoholic liver injury patients. A study in Japan by Hamada et al (2021) reported that GGT was a useful liver biomarker which has moderate accuracy for habitual alcohol drinking to evaluate liver injury.

Alkaline phosphatase

Akinloye et al (2021) reported that excess alcohol consumption causes imbalance within the tissue damaging the liver as shown by elevation of liver biomarkers

Li et al (2022) reported that alkaline phosphatase regulate intracellular metabolism. So it is a diagnostic study for many clinical illnesses that include alcoholic liver injury.

Shalata et al (2022) reported that when alkaline phosphatase mildly or moderately elevated the clinician can ascertain liver disease due to alcohol by combining the tests with other biomarker tests such as GGT.

A study in Canada by Neuman et al (2021) reported that inflammation of the liver causes failure when combined with heavy chronic alcohol consumption. Neuman et al (2021) further reported that ALT, AST, GGT and ALP were all elevated in chronic alcohol users.

Albumin

A study in China by Sheng et al (2021) reported that albumin and alkaline phosphatase were important biomarkers of liver that was decreased and elevated respectively in liver damage. Sheng et al (2021) further reported that albumin helps to maintain the colloidal osmotic pressure and storage of substances. Albumin is involved in regulation of the body immune response and inflammation. Alkaline phosphatase has anti-inflammatory response that inhibit inflammation. A study in China by Cao et al (2021) reported that participants had serum albumin higher than the upper limit and that albumin was significantly associated with alcohol consumption. Cao et al (2021) further reported that serum albumin is essential in the transportation of fatty acids in the body. Low levels were associated with depressive states while high levels were associated with malnutrition and alcohol consumption. Malnutrition and alcohol consumption were damaging to the liver hepatocytes.

4.5 Correlate AUDIT test results with liver biomarkers among adults of alcohol consumption

4.5.1 Descriptive statistics on the Biomarker Tools and audit tools in measure in levels of alcoholic liver biomarkers.

Table 4. 32: Descriptive statistics on the Biomarker Tools and audit tools in measure in levels of alcoholic liver biomarkers among adults of alcohol consumption

Paired Samples Statistics					
		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Biomarkers	73.36	93	12.794	1.327
	audit	3.30	93	.564	.058

Source; Collected Data, (2020)

Biomarkers tools had high standard deviation compared to the audit tools due to their scale with each the sample size of 93 samples used in the study.

4.5.2 Inferential statistics on the Biomarker Tools and audit tools in measure in levels of alcoholic liver biomarkers among adults of alcohol consumption

Table 4. 33: Correlation between the Biomarker Tools and audit tools in measure in levels of alcoholic liver biomarkers among adults of alcohol consumption

Paired Samples Correlations				
Correlation		N	Correlation	Sig.
Pair 1	Biomarkers & audit	93	.732	.000

Source; Collected Data, (2020)

From the paired T-test between the biomarker and Audit tools there was 73.2% hence indicating both tools were good measure in levels of alcoholic liver biomarkers among adults of alcohol consumption. A significance of 0.000 indicated the goodness in fit of the model in paired t-test.

Table 4. 34: Paired T-test on the Biomarker Tools and audit tools in measure in levels of alcoholic liver biomarkers among adults of alcohol consumption

Paired Samples Test									
		Paired Differences							
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	Sig. (2-tailed)
Pair 1	Biomarkers - audit	70.059	12.788	1.326	67.425	72.693	52.833	92	.000

Source; Collected Data, (2020)

A paired T test was 52.833 which is greater than the t-table value at 92 degree of freedom which is 1.662 since the t value obtained is greater than the table value at 95% level of significance we accept that there was a statistical significance between the biomarker's tools and the audit tools.

Table 4.35: Chi-Square test on the Biomarker Tools in measure in levels of alcoholic liver biomarkers among adults of alcohol consumption

Chi-Square test on the Biomarker Tools

Chi-Square Tests			
	Value	Df	Asymptotic Significance (2-sided)
Pearson Chi-Square	6.718	93	.364
Likelihood Ratio	3.317	93	1.000
Linear-by-Linear Association	.094	1	.759
N of Valid Cases	93		

Source; Collected Data, (2020)

Table 4.36: Chi-Square test on the audit Tools in measure in levels of alcoholic liver biomarkers among adults of alcohol consumption

Chi-Square Tests			
	Value	Df	Asymptotic Significance (2-sided)
Pearson Chi-Square	5.961	93	.000
Likelihood Ratio	3.317	93	1.000
Linear-by-Linear Association	.094	1	.759
N of Valid Cases	93		

Source; Collected Data, (2020)

In testing on alcohol consumption based on the Biomarker tool the value of the chi Square statistic is 6.718. The p-value appears in the same row in the "Asymptotic Significance (2-sided)" 0.010. The result is significant if this value is equal to or less than the designated alpha level 0.05. While compared the chi –Square value of the audit tools which is 5.961 which is slightly lower indicating that this audit tool can be used to test for alcoholic liver among adults of alcohol consumption.

Moriles and Azer (2021) reported that the activity of ALT in hepatocytes is increased when the cells were injured or dying. Alanine Aminotransferase when combined with Aspartate aminotransferase have been reported as the most dependable biomarkers of liver due to alcohol. A study in US by Vatsalya et al (2021) reported that when both ALT and AST were elevated there was statistical significant of liver dysfunction with suggested liver injury, fibrosis of cirrhosis depending on the range of elevation.

A study in US by Vatsalya et al (2021) reported an association between alcoholic liver injury with elevated AST. The study further reported that elevated values were observed in participants with acute alcohol disorders. A study in Bangladeshi by Molla et al (2021) showed positive and significant correlation between serum ALT and GGT

in evaluation of alcoholic liver injury. The study further reported that the elevation of these biomarkers is commonly found in alcohol consumers than in patients with cardiac diseases. A study in Italy by Gerussi et al (2021) reported of a correlation between serum GGT and ALP in determination of alcoholic liver injury. The study further reported that GGT can be used at primary health facilities to determine alcoholic liver injury. A study by Nivukoski et al (2021) reported that quantitative alcohol estimates self-reported were vulnerable to memory-dependent biasness and therefore biomarkers assays to compare the results were helpful. Further Nivukoski et al (2021) reported that liver biomarkers have also been used as predictor to mortality due to alcoholic liver injury and their combination with other tests like the AUDIT can enhance the predictability for mortality or prognosis.

The Audit tool was enough to differentiate the at risk persons for hazardous alcohol use, dependence symptoms and harmful alcohol use for the respondents from rehabilitation centres. Majority of the respondents in the study reported high percentages on hazardous alcohol use, dependent symptoms and harmful alcohol use. These results were consistent with other studies which reported high alcohol use on the participants (Blair, Pearce et al. 2017, Niclasen, Flyger et al. 2021)

The results were inconsistent with the findings in a study in Nepal where a low percentage of participants had hazardous alcohol use, dependence symptoms and harmful alcohol use (Rathod, Luitel et al. 2018).

A study done in Kenya on a different cohort from a different County found low percentages of hazardous alcohol use, dependence use and harmful use (Long, Richardson et al. 2020). A high percentage of the participants reported concerns to cut down on drinking alcohol over the past one year. The findings show that the

participants were not positively motivated by the behavior of drinking and this may have been the driving force for them to sought medical help at the rehabilitation centres.

A study in Switzerland by Surial et al (2021) reported among its participants who were alcohol consumers hazardous alcohol use was represented by 57.9%, dependence use was represented by 22.9% while harmful alcohol use was represented by 15.3%(Surial, Bertholet et al. 2021). A study in Switzerland showed of follow-up for the three domain of Audit, the study reported that harmful alcohol use domain was highly associated with mortality while hazardous alcohol use domain was associated with the risk of liver injury(Surial, Bertholet et al. 2021). A study showed that 28% of all participants who were ranked as harmful alcohol users had liver cirrhosis (Pearson, Kim et al. 2021).

4.6 To develop a strategy for assessment and referral of alcoholic liver injury among adults of alcohol consumption in selected counties in Kenya.

4.6.1 In-depth interview

	REHABILITATION CENTRE	COUNTY	ABMISSIONS PER MONTH	ADMISSION IN SIX MONTHS
1	St Martin Rehabilitation Center	Murang'a	6	36
2	Fanikisha Rehabilitation Center	Murang'a	6	36
3	Murang'a County and Referral Hospital	Murang'a	4	24
4	Haven Recovery Center Eldoret	Uasin Gishu	9	54
	Total		25	150

For the purpose of this study and ease of discussion, the referral hospital is group as a rehabilitation centre. The indepth interview was conducted on residential nurses from the selected rehabilitation centres. This was done through tape recording with the researcher or research assistants as moderators for the interviews.

Question1--Describe the effects of alcohol on liver injury.

"Alcohol is known to destroy the liver cells, especially the one brewed at home or unlicensed premises where a lot of illicit chemical are added to make it stronger" (Nurse 1 rehabilitation Centre 1)

"Alcohol that is sold around this locality which is home brewed does a lot of damage to the liver, we hear that they like one that is strong enough to make them drunk quickly with less money to use" (Nurse 2 rehabilitation Centre 2)

"When the liver is burned beyond repair the person affected come to see us in the rehabilitation centre for treatment, but I think at that stage the liver is completely destroyed by this alcohol. Even with abstinence this liver is destroyed and we can not help the person" (Nurse 3 rehabilitation Centre 3)

"Alcohol has damaging effects to the liver, the damage is so bad that it kills over time" Nurse 4 rehabilitation centre 3

"We all know alcohol burn the liver and so when one takes a lot of alcohol it continue with the burning effect. I don't know what happens to the burnt piece but people say that when the whole liver is burnt it falls down and the person dies" (Nurse 5 rehabilitation centre 5)

A study in Seoul Korea by Kim et al (2021) reported that prolonged contact with alcohol damages the liver, thereby causing alcoholic liver disease(Kim, Ko et al. 2021).

Question2--Describe the effects of alcohol abstinence on the liver?

"When alcohol drinkers stop drinking their drink they change to the better, they look admirable and can eat better. You see, when the liver stops receiving the strong toxins it is happier and similarly the whole body is happy" (Nurse 1 rehabilitation Centre 1)

"Alcohol abstinence has effects on the liver, the burning process, I mean the destruction process that had been started is stopped and rejuvenation process starts. The liver starts recovery process, it may be slow recovery is the toxins had done more destruction or it may be a fast recovery if the persons had not taken alcohol for long duration, I mean for many years" (Nurse 2 rehabilitation Centre 2)

Abstinence to alcohol has benefits in that the dying liver is rejuvenated upon no more alcohol (Nurse 3 rehabilitation 3)

"Abstinence means stop taking the alcohol and that is why we have these persons here in the rehabilitation Centre. When you look at them they are different from how they looked when they came. Their bodies can tell it all, they are happy and also the liver is happy because it is now free from the strong alcohol that destroys it. That is it abstinence help the liver to be free of strong alcohol" (Nurse 4 rehabilitation centre 3)

"Abstinence is about avoiding to take alcohol, for a specified period of time. During the abstinence period the liver is like on a resting mode after fighting a battle of destruction from the stronger effects of alcohol. During this resting phase the liver is building up for the next battle which may be stronger or less tough. In that case abstinence makes the liver continuously recover to become better and better everyday. This is good for the body" (Nurse 5 rehabilitation centre 4)

Question3--What are the institutional considerations for admission of Alcoholic Liver Injury clients?

"Persons who are admitted here must be accompanied by their relatives who must be willing to adhere to the institutional rules and regulations. During this period of covid-

19 we do not allow relatives to visit them, only one person who is registered at the office is allowed to come here once per week to know the progress of the person admitted. We fear covid-19 sprending to our clients here" (Nurse 1 rehabilitation centre 1)

"There are considerations here that the person due for admission should be one who has been consuming alcohol and is willing to be helped to stop taking alcohol. While here the person can not leave to go and look for alcohol out there. They should confess to stop alcohol and not go back to it again" Nurse 2 rehabilitation centre 2)

"We are a referral hospital and so we receive patients through referral from rehabilitation centres or the patients can come direct from the community. We consider that they are alcoholic who have decided to stop drinking and willingfully ready for admission" Nurse 3 rehabilitation centre 3)

"Institutional requirement to admission for rehabilitation is that someone should be in a stable state of mind, be a consumer of alcohol among others. A patients can be referred from a rehabilitation centre to a referral hospital" (Nurse 4 rehabilitation centre 3)

"Here we admit persons who are alcoholics who can be able to talk and are of sound mind, you see we can not admit a person who is so sick that they are about to die and then we say because it is because of alcohol then we shall admit them, no it is only those of sound mind and sound body that we admit here, the relative have to be supportive as well" Nurse 5 rehabilitation centre 4)

Question4--What is your grading system for clients with Alcoholic Liver Injury during the admission period?

"To be sincere we do not have any specific grading system, what we do here is to assess the general status of the client and if we feel the person is so sick we do not

admit them here, we refer them to our referral general hospital" (Nurse 1 rehabilitation centre 1)

"Clients who are admitted here and we suspect that they have liver problem we observe them to see whether they are improving or not. Incase they are not improving then we refer them for further management" (Nurse 2 rehabilitation centre 2)

"During admission we do a focused head to toe assessment for the liver, we are guided by pain scale of 1 to 10 then we divide the scale into 3, we rank the pain as mild moderate or severe to equate to mild, moderate or severe liver injury" (Nurse 3 rehabilitation centre 3)

"We grade the patient general condition where some patients are graded to be taken for psychiatric treatment than alcohol rehabilitation, so the mental status assessment is done for purposes of differential diagnosis" (Nurse 4 rehabilitation centre 3)

"Grading system? Eh eh here we do not have a clear grading system for liver problem. May be we introduce a new one, but what we do to those sick clients with liver problem we admit them for observation as we await to refer them." Nurse 5 rehabilitation centre 4)

A study in Canada reported that persons of alcoholic liver disease should be properly examined and graded to avoid premature mortality that is untimely and unjustified. Roberts, S. B., Hansen, B. E., Shin, S., Abrahamyan, L., Lapointe-Shaw, L., Janssen, H. L., ... & Hirschfield, G. M. (2021). Internal medicine hospitalisations and liver disease: a comparative disease burden analysis of a multicentre cohort. *Alimentary Pharmacology & Therapeutics*, *54*(5), 689-698.

Question5--What guidelines are in place to evaluate Alcoholic Liver Injury?

"We do not have guidelines for evaluating liver disease, may be you give us one. Is there any from the ministry, I have never heard of guideline on liver disease" (Nurse 1 rehabilitation centre 1)

" Our rehabilitation centre does not use guidelines to evaluate liver injury, but incase someone has liver disease we assess them through physical examination then we embark to start alcohol rehabilitation therapy" (Nurse 2 rehabilitation centre 2)

Guidelines to evaluate liver disease, here we do not have them, those are probably found in the ministry headquarters but here we don't have them. (Nurse 3 rehabilitation centre 3)

"You said guidelines, eh eh guidelines are not here we don't have guidelines here, no no none" (Nurse 4 rehabilitation centre 3)

"Here we are guided by the morals of Christianity where we value those persons who drink alcohol but we do not condem them, we love them despite their status, we are a Christian institution" (Nurse 5 rehabilitation 4)

Berzigotti et al (2021) reported of the European Association on the Study of Liver (EASL) clinical practise guidelines that help to evaluate the severity and prognosis of liver disease across Europe and the world(Berzigotti, Tsochatzis et al. 2021).

Mendez-Sanchez et al (2021) reported of the Latin America Association for the study of the liver (ALEH) has provided guideline on the prevention and treatment of alcoholic liver disease. Further they have provided criteria on diagnosis and evaluation of persons in alcoholic states(Mendez-Sanchez, Arrese et al. 2021).

Patel and Mueller (2021) reported that during physical examination a client of alcohol use may present with Jaundice, hepatomegaly of fever(Patel and Mueller 2021).

The researcher did not find the Africa or East Africa association on the study of liver disease.

Question6--What are the institutional considerations for referral for Alcoholic Liver Injury to other tertiary institutions?

"Thank you, we refer our clients when we realize that someone is more sick and needs greater attention, that is when we refer them, we inform the relative who organize for the ambulances to come for the patient, we also call the hospital to inform them that we have a patient that we want to refer to them. So when the patient becomes more sick we refer" (Nurse 1 rehabilitation centre 1)

"Eh eh here when we see that a client is not improving on the general status we inform the relatives that there is need to sought help from a hospital so we write a referral letter and we tell relatives to book for an ambulance for referral" (Nurse 2 rehabilitation centre 2)

"We receive referrals from the rehabilitation centres around us when they are unable to manage their clients and they feel that they are better placed here than at those centres, sometimes they bring the patients here when these people are too sick and we wonder why couldn't they refer them when they realise that they did not have the capacity to treat them, so even us sometimes we feel like they bring them to die here, it is sad" (Nurse 3 rehabilitation centre 3)

"Sometimes we look at the person and we realize he is not well, then we refer, referral sometimes is tricky because relatives refuse to pay for the stay before we refer so even us sometimes it is not so good, it can be a mess" (Nurse 5 rehabilitation centre 4)

Question7--For clients with relapse how do you evaluate the Alcoholic Liver Injury?

"Clients with relapse we ask them, what happened and then they tell us their story, we ask them whether they have pain on the liver site and when they say yes, we grade the pain and grade the liver severity aswell, incase we feel is serious meaning severe we

refer them to the referral hospital for further management" (Nurse 1 rehabilitation centre 1)

"Alcohol relapse is really emotional to the staff and the clients, upon re-admission we ask the client what are the chief complains then we do liver span examination then blood toxicology test and biomarkers test" (Nurse 2 rehabilitation centre 2)

"Relapse cases are many here, you have a client here then you discharge them then afterwards you find them coming back, it is not good. To check on their liver we do liver assessment to see whether it is enlarged and if so we realize that this someone with liver disease. then we send them for scan and liver function tests which they usually complain that they are expensive" (Nurse 3 rehabilitation centre 3)

"Relapse is common here, you find that we work on these people and by the time they are leaving here to go back home they are good, I don't know what happens that they relapse when out there, but when they come we feel they liver on the right side of the abdomen to feel if it is enlarged, incase we feel it is too much then we refer them to general hospital" (Nurse 5 rehabilitation centre 4)

Question8--What is the importance of having a grading system for Alcoholic Liver Injury?

"It is through grading system that we shall know when we should refer them or when we should retain them here for now we refer when we think it is right then when we get to the hospital there they complain to us that we refer when it is too late. I think this will help us alot" (Nurse 1 rehabilitation centre 1)

"To grade means that you will know who is more sick to refer than to admit because sometimes you find that we admit all clients and sometimes you think that we are

guided by monitory incentive than the status of the client" (Nurse 2 rehabilitation centre 2)

"The grading system will help evaluate persons suitable for admission here, you see some relatives bring their persons here yet these are people who can benefit from psychiatric hospitals or in referral hospitals, so if we have a grading system we shall only admit persons who are suitable for admission here" (Nurse 3 rehabilitation 3)

"I feel the grading system will help those people in the rehabilitation centres who refer clients here because we feel they wait when it is too late that is when they refer here why can't they refer early, so the grading system will help them do early referral rather than wait when it is too late" (Nurse 4 rehabilitation centre 3)

"The grading system can help our facility to know what kind of a person are we admitting here, very sick or mildly sick" (Nurse 5 rehabilitation centre 4)

4.6.2 Development of an Assessment and Referral Model

A table was developed, on one column was the AUDIT result and on another was the biomarker results. The total scores were distributed among the domains. The biomarkers with the highest impact were picked and awarded scores on a range of 1 o 4 for the three biomarkers. The biomarkers were correlated with the AUDIT score where the biomarkers were later drop and the AUDIT results picked to relate with liver injury. A step by step strategy was developed guided by the AUDIT domains on care for alcoholic liver injury

SUMMARY OF AUDIT	
DOMAIN	SCORE
HAZADOUS ALCOHOL USE	1-12
DEPENDENCE ALCOHOL USE	13-24
HARMFUL ALCOHOL USE	25-40

SUMMARY OF BIOMARKERS		
LFT	SCORE	TOTAL SCORE-16
AST	1-4	
ALT	1-4	
GGT	1-4	
ALP	1-4	

ASSESSMENT MODEL		
AUDIT	BIOMARKER	ALI
1-12	1-5	MILD
13-24	6-10	MODERATE
25-40	11-16	SEVERE

Alcohol Assessment		**A step by step draft to attainment of recovery from alcoholic liver disease.**			
Audit Domain	Total Audit Score Scale				
Hazardous Alcohol Use	1-13	Abstinence and Counseling	Recovery	Recovery	Recovery
Dependence Alcohol Use	14-27	Abstinence and Counseling	Rehabilitation	Recovery	Recovery
Harmful Alcohol Use	28-40	Abstinence and Counseling	Rehabilitation	Refer	Recovery

MODEL FOR ASSESSMENT AND REFERRAL OF ALCOHOLIC LIVER INJURY

Alcohol assessment		**Phases of the assessment and referral model**			
Audit domain	AUDIT SCORE				
Hazardous alcohol use	1-13	ABSTINENCE	RECOVERY	RECOVERY	RECOVER
Dependence alcohol use	14-27	ABSTINENCE	REHABILITATION	RECOVERY	RECOVERY
Harmful alcohol use	28-40	ABSTINENCE	REHABILITATION	REFER	RECOVERY

KEY

ABSTINENCE AND COUNSELING -Avoid alcohol consumption and undergo training on human behavior and self awareness.

REHABILITATE- Avoid alcohol consumption, continue counselling and admit client or follow up at a rehabilitation centre

REFER- Avoid alcohol consumption, continue counselling and admit to a hospital for medical management of alcoholic liver disease

RECOVERY- Avoid alcohol consumption, continue counseling and followed-up by a health care provider for recovery from alcoholic liver injury

Description of the assessment and referral model for alcoholic liver injury.

This model focuses on early detection of persons with alcoholic liver injury. Asrani et al (2021) reported that easy to use screening tools that link early detection and treatment interventions for ALI are needed (Asrani, Mellinger et al. 2021).

It is postulated that the model will reduce cost for assessment of alcoholic liver injury that is high and may be strenuous for the clients to afford. The basic requirements for the model will be a 10 questions AUDIT tool that could be available as a soft copy to the clinician, the availability of the client and the formulated model for the diagnosis to be made. The cost will be minimal since the soft copy can be availed to the clinician mobile phone and then the data from the client can be transferred to a data base within the institution.

According to the WHO report on global strategy to reduce harmful use of alcohol (2010) some of the guiding principles on alcoholics and their families should be

affordability of preventive and curative health care services. The health services should be sustainable by both the governments and the individual alcoholics (WHO, 2010)

The model will require the AUDIT test completed and then the results from the client incorporate into the client's score within the model. The clinician will require a quiet room with profound privacy for confidentiality. The room should be conducive for both the client and the interviewer.

4.6.3 Abstinence and counselling

Alcohol caseation usually reverses the damage done on the liver. During the abstinence duration the Golgi apparatus are restored to normal within 10 days of caseation. After alcohol withdrawal in abstinence the hepatic triglycerides are reduced while the liver biomarkers were restored to normal. Three weeks to one month of abstinence from alcohol induces a recovery duration known as bacterial beneficial duration where the bacterial toxins population decreases leading to decrease in potential toxins and increase in beneficial microbial metabolites (WHO, 2010)

Majority of persons presenting with elevated liver enzymes are asymptomatic ignoring the need for assessment and management of livery injury (Malakouti, Kataria et al. 2017). They find no need to present themselves for early detection and possible referral for alcoholic liver injury. They may have minor body dysfunctions on various organs but they opt to ignore the problem at the expense of drinking alcohol. A study showed that persons who sought medical assistance with abstinence increase their survival rate in 1 year from 63% to 95% and in 5 years from 36% to 61% (Andresen-Streichert, Müller et al. 2018).

There is hope for persons who accept abstinence from alcohol since this is likely to prolong their life. A study in France reported of 10 years survival rate for patients with alcoholic liver injury who accepted to abstinence (Singal and Mathurin 2021).

A study in US by Bloom et al (2021) reported that 69% of the participants had elevated ALT on admission and on abstinence the biomarker decreased over time. A study by Nivukoski et al (2021) reported that there was a significant correlation of alcohol consumption on admission and one month past admission in serum GGT. The GGT levels had significantly reduced. Further Nivukoski reported that a combination of liver biomarkers and AUDIT can be used in long term follow-up of clients and also as a predictor to the outcome of liver rejuvenation in heavy alcohol consumption A study in Canada by Neuman et al (2021) reported that AST, ALT, GGT and AP levels were all decreased in alcohol abstinence within a duration of 2 weeks.

4.6.3 Future trends on alcoholic liver injury

Alcohol abstinence even for one year does not reverse the liver function fully, the liver biomarkers were still elevated signifying prolonged liver injury (Seitz and Neuman 2021). Therefore there is a need to combine the abstinence therapeutic sessions with counselling for a deeper meaning of the actions the abstaining clients are taking. Abstinence is the bases for healing the liver but counselling brings in the synergy for both to be effective.

Counselling sessions will be progressive during the client's stay at the rehabilitation centre. The sessions should blend the therapies with feedback from the clients about abstinence and counseling.

Rehabilitation

Rehabilitation for alcoholic liver injury will involve availability at a medical facility through which therapeutic sessions will be offered by medical professionals. The sessions may be regular, daily or on altered days depending with the institutional programme and the priority needs for the client. Persons involved in increased use of alcohol with negative consequences accompanied with unsuccessful attempt to stop drinking should be presented to the rehabilitation cenres for therapy (Asrani, Mellinger et al. 2021) .

Alcoholic liver injury is usually detected at a late stage when the liver is at a state of decompensated cirrhosis and occasional little or no effort can help salvage the situation (Asrani, Mellinger et al. 2021). This model will help early detection especially during feedback sessions at the rehabilitation centres where clients will be offered chances to express their reasons for continued alcohol consumption. Therapeutic sessions will involve many areas of concern that the medical personnel will deem necessary.

Referral

Clients who may show little or no improvement have the option for referral to medical facilities of a higher tier. They may be referred to referral hospitals for can be referred to other rehabilitation centres of their choice. Upon referral the clinician at the referring health centre will indicate reasons for referral whether it was a family's choice or referral for further management. Countries such as Japan and Egypt have put measures in place and it is estimated that morbidity and mortality due to alcoholic liver injury in these countries will reduce (Liu, Xu et al. 2021).

Clients with severe alcoholic liver injury may need referral for further evaluation of the damage to the liver and intense therapeutic to prevent early mortality. A rehabilitation centre may feel inadequate to help the client on the evaluation and thus can be a good reason to refer. With strong interventions it is expected that the world peak for deaths related to alcohol will in 2040 be decrease by 7% (Julien, Ayer et al. 2020)

Recovery

The clients of alcoholic liver injury will be on continuous recovery since they can relapse to alcohol consumption. The model describes the recovery phase for all clients inorder for them to stop alcohol use forever. They are at no time provided with space for relapse or getting back to alcohol use. This phase is provided as an importance one and should be held with utmost importance since it helps in maintaining the abstinence state.

The model is on trial at the faith based rehabilitation centre in Murang'a for adoption.

Majority of persons presenting with elevated liver enzymes are asymptomatic ignoring the need for assessment and management of livery injury(Malakouti, Kataria et al. 2017).

A study showed that persons who sought medical assistance with abstinence increase their survival rate in 1 year from 63% to 95% and in 5 years from 36% to 61% (Andresen-Streichert, Müller et al. 2018).

In the US strategies have been formed such that any person suspected to be an alcohol consumer should be in close contact with clinician with continuous tests and check-up for the purpose of early detection for ALI(Lindvig, Hansen et al. 2021).

It is estimated that asymptomatic alcohol disease progression takes about 15 years and it is at the duration that the candidates of alcoholic liver disease should be follow-up by clinicians (Lindvig, Hansen et al. 2021).

During the asymptomatic period clinician should do a minimum of 5 tests per year for the suitable candidates (Lindvig, Hansen et al. 2021).

If untreated and unfollowed 75% of the alcohol liver cirrhosis patients are diagnosed late when abstinence has little value and treatment is palliative(Lindvig, Hansen et al. 2021).

There is unexplored potential in early detection of alcoholic liver injury that is helpful if given due attention by all sectors of human health, lots of life can be salvaged if full efforts are used on this area(Lindvig, Hansen et al. 2021). Lindvig et al (2021) reported of simple strategy methods that can optimize early disease detection as paramount to the fight against alcohol liver cirrhosis, further they mentioned of clear pathway for referral and follow-up when disease is diagnosed (Lindvig, Hansen et al. 2021)

Definitive treatment of ALD still does not exist thus prevention and early detection of the disease is paramount (Seitz and Neuman 2021). Alcohol dependence is difficult to completely treat; it has a 60% relapse rate even with liver transplantation.

Alcohol abstinence even for one year does not reverse the liver function fully, the liver biomarkers are still elevated signifying prolonged liver injury (Wu and Shah 2021). A study in France reported of 10 years survival rate for patients with alcoholic liver injury who accepted to abstinence (Singal and Mathurin 2021). A study in France reported that corticosteroid therapy was associated with improvement in patients with severe alcoholic liver injury(Singal and Mathurin 2021).

Alcoholic liver injury is usually detected at a late stage when the liver is at a state of decompensated cirrhosis and occasional little or no effort can help salvage the situation(Asrani, Mellinger et al. 2021). Easy to use screening tools that link early detection and treatment interventions are needed.

Medication on relapse

Alcohol dependence is difficult to completely treat; it has a 60% relapse rate even with liver transplantation (Seitz and Neuman 2021). Froehlich et al (2015) reported that injection prazosin hydrochloride 0.5mg/ml/kg body weight 6 hourly for 4 to 5 weeks reduces alcohol intake in situations of expected increased alcohol intake, after a spell of alcohol deprivation. The study further suggested that prazosin is effective in reducing relapse during the period of permanent alcohol abstinence for hazardous, dependence and harmful alcohol users (Froehlich, Hausauer et al. 2015).

A study in England by Donoghue (2021) reported that naltrexone medication was important to prevent relapse. Ehrie et al (2020) reported that 3 medications have been

approved by the Food and Drug Administration (FDA) for treatment of alcohol use, they include disulfiram, naltrexone and acamprosate. Both disulfifiram and naltrexone are oral and injectable formulations. Other approved medication for treatment of alcoholism that are approved in US include topiramate, gabapentin and baclofen (Ehrie, Hartwell et al. 2020).

A study in Australia by Manning et al (2021) reported medication such as naltrexone and acamprosate will reduce alcohol relapse by 5 % to 8 % for a period of up to 1 year of treatment(Manning, Garfield et al. 2021).

Ehrie et al (2020) reported that in 2015 the Substance Abuse and Mental Health Services Administration (SAMHSA) recommended that clinicians use medication together with psychotherapy as treatment modalities for persons of alcohol use.

A miss in early detection and under referral of alcoholic liver injury may lead to late diagnosis, high numbers of patients with cirrhosis and collapsed health system to deal with alcoholic liver disease

A study by Arab et al (2020) reported that more than 50% of population aged 15 to 19 years reported to have consumed alcohol in the last one month. More than 50% of the population in latin America are current drinkers.

A study in Australia by Manning et al (2021) reported that a standard treatment for alcoholic liver injury should involve abstinence, counselling, peer support and pharmacotherapy.

A study in Australia by James et al (2020) reported that upon discharge from the rehabilitation Centre, the client should be follow up and even assigned to a community based facility for monitoring and continuous psychotherapy.

Abstinence

Alcohol caseation usually reverse the damage done on the liver. During the abstinence period the golgi apparatus are restored to normal within 10 days of ceseation. After alcohol withdrawal in abstinence the hepatic triglycerides are reduced while the liver biomarkers are restored to normal. Three weeks to one month of abstinence from alcohol induces a recovery period known as bacterial beneficial period where the bacterial toxins population increases leading to decrease in potential toxins and increase in beneficial microbial metabolites.

The extent of liver damage guide the recovery because in cirrhosis the liver may not be completely recovered. Pearson et al (2021) follow up patients for a period of 4.9 years and found that 21.4% of all harmful alcohol users developed cirrhosis

Cargili et al (2021) reported that in UK the number of admission due to alcohol consumption had doubled in June 2020 at 28% compared to June 2019 which was at 48.5%. There are many factors that may have influenced the admission but the researcher prediction was low figures of admission due to the fear of covid-19 in hospitals in the UK.

There have been long calls for government support to access of treatment by all persons who desire to seek treatment in all medical facilities.

Recovery from alcohol consumption is a long complex process, one should be aware of their limitations and vulnerability. Recovery should be client centered with an aim of achieving maximum benefit to the client. Recovery should have different domains that involve post rehabilitation treatment modalities, work etiquettes and social-life

program. There should be community based program that will help them understand and respect the community morals and its values.

During recovery the clients should be equipped skills and knowledge on planning and implementing individual goals that will stimulate and facilitate their re-admission to the community for everyday life. These activities should earn them respect from the community and also acceptability. If they are employed then it is at the recovery stage that they can retain their employment or lose it.

Alcohol care teams

United Nations Sustainable Development Goals with its 193 member states aimed to achieve reduced harmful alcohol use by year 2030. Among the key focal points was to develop alcohol care teams.the areas of interest was to reduce acute admissions to hospitals that related to alcohol, reduce mortality and improve on quality alcohol care. It is agreed that clinician's multidisciplinary teams should be include to integrate alcohol related treatments across all primary, secondary and tertiary health institutions. The team should formulate and coordinate alcohol related policies in their countries. It is agreed that alcohol specialist nurses should be available in health care set-up for seven days a week. Alcohol outreach assertive services should be available in the countries. Consultants' hepatologists and gastroenterologists should collaborate for alcohol centered expertise services.

The government of UK has established health care teams to support general hospital settings for alcohol use.

The health care team is mandated with the responsibilities of assessment and treatment of alcohol use disorders and its related complications. The team is advised to quickly

develop therapeutics for the affected persons, their relatives and communities involved. A core component on the team is effective leadership that should steer policy development and implementation across regions and countries.

Training and re-training of hospital and institutional staff was paramount. The training should incorporate attitudes and values that will impact change of lifestyle and life practises among different groups of alcohol consumers and care givers.

A study in UK reported that the UK states in 2019 reduced public funding on drugs and alcohol by 162 million pounds that translated to 18% reduction. The end results for the cut in funding was a 26% rise in drug related deaths. The study reported that private run health institutions are left on their own after the cut in funding. The government continued saying that the services are free at health institutions.

Smartphone application intervention

There should be smartphone applications that will help detect alcohol relapse. Upon the persons getting into an alcohol premises, they should activate the application that should send alarm to the relatives and clinicians that the person is within an alcohol drinking premises. Relatives should in return find out the actual premises and withdraw the person from the area. Such applications should be given to alcohol selling personnel who should report persons of abstinence to relevant authorities. It should be a comprehensive approach to prevent relapse which should not be left to a single cohort to handle but all should be involved.

Manning et al (2020) reported that the use of smartphone app intervention may be helpful to prevent alcohol relapses.

Another approach was to program all the drinking premises and using an application on the smartphone the alarm was triggered when the holder of the smartphone is available on the zone. This trigger will again notify relevant authorities and relatives that the person is within certain prohibitive areas.

A study in Japan by Takano and Matsumoto (2021) reported of a web based smartphone relapse prevention program.

Takano and Masumoto (2021) reported that smartphone app usage had an 83.7% acceptability in japan when used on a study that monitored alcohol relapse.

Schaub et al (2021)mreported that there should be electronic alcohol (e-alcohol) programs to all affected persons, after completion of the program the partcipants should be issued with certificate of completion and other awards should be offered. This will encourage the participants to greater achievements on this field thereby remaining alcohol free for long.

In Brazil Reichenheim et al (2021) developed a model for evaluation of alcohol misuse guided by the AUDIT tool. The model applied the AUDIT domains with scores to categorize alcohol misuse, it was found to be helpful especially to the young adults.

Regulation of alcohol consumption and selling

Persons who procure alcohol from any selling premises should be holders of secret code which should be coded with their status of alcohol procurement allowances from the regulatory bodies. Upon reaching the maximum allowance the seller should not sell more alcohol to prevent overdose thus liver injury.

Discussion on in-depth interview

Interview question 1 was about the effects of alcohol on liver injury. Respondents nurse 1 at rehabilitation centre 1 described the damage of liver cells by alcohol focusing on the illicit type that has added chemical into the solution. The respondents mentioned about the destruction of the liver parenchyma which is important in the normal functioning of the liver.

Another respondents (Nurse 2) from rehabilitation centre 2 pointed that within the locality there is home brewed alcohol, which is strong to make the customer get drunk quickly. This statement signified that the generation of alcohol brewed within this area could have damaging effects to the liver yet minimal or no evalution has been done on the process of manufacturing. The respondent mentioned of added chemicals which are probably unknown and which could have serious effects on the liver. Evaluation on the process of brewing this alcohol was of help. The samples of the brewed alcohol can be taken to the government chemist for evaluation.

Another respondents (Nurse 3) from rehabilitation centre 3 reported that the liver can be burned beyond repair. The respondent signified that the liver could be diseased to the stage of cirrhosis where there is total none function of the liver. The respondent said that at this stage even abstinence will not help recovery of the liver. The respondent focus was how the alcohol destroys the liver to a level beyond salvage.

The other respondent was nurse 4 from the same centre as nurse 3 who reported that over time the alcohol effect on the liver is total destruction denoted by “it kills over time”.

The last respondent on this question was nurse 5 who said that alcohol burns the liver signifying that the liver will not function normally due to the effects of alcohol. The respondent described progressive destruction of the liver parenchyma eventually the whole liver cells will be destroyed and can not function.

From the responses the researcher found that alcohol users could be consuming sub standard home brewed alcohol solution that has ingredients of unknown effects which could lead to quick progression into liver injury.

When the liver is damaged the alcohol users may not be aware of the injury for early diagnosis and treatment rather they continue with the consumption to a point of total none function of the liver when mortality could be inevitable.

Petersen (2021) said that the liver can be categorized as the principal organ that is affected by alcohol. Other organs include the pancreas. The process upon which alcohol damages the liver is by an oxidative process that is catalyzed by alcohol dehydrogenase the pathway for alcohol metabolism. Buchanan and Sinclair (2021) reported that this pathway leads to formation of acetaldehyde which is toxic to the cells

A study in Japan by Ochiai et al (2021) reported that the greater the volume of daily alcohol intake the greater the risk of development into alcoholic liver disease.

A study in Spain by Liamosas-Falcon et al (2021) reported that daily alcohol consumption increased the risk of liver cirrhosis by 11%, the percentage is even higher in unregulated alcohol solutions.

Another study in US by Balachandran et al (2021) similarly reported of the concomitant drug-drug interaction on different additives added on the illicit alcohol and

their effect on the body. They further reported that there is a growing popularity to the solution with growing effects on the body.

The global information system on alcohol and health (GISAH) reported that in 2018 illicit alcohol accounted for 26% of the world total alcohol consumption. The WHO global strategy to reduce harmful use of alcohol (2010) report cautioned about too strict orders for availability of illicit alcohol that may be a source of parallel secret markets for availability of more illicit alcohol drinks. The report recommended strategies that will acceptable by all with lesser restrictive regulations on the days and hours of alcohol sale.

The second question on the in-depth interview was about the effects of abstinence on the liver. Respondents mentioned of positive impact realized upon abstinence, such are responses from nurse 1 who mentioned of changing to the better upon cessation to strong toxins reception. The respondent said that the whole body is receptive about abstinence. Another respondent said that the destruction effect that had been started is stopped during abstinence. The respondent mentioned of a recovery process that is initiated.

Another respondent mentioned about the liver rejuvenating from the hostility subject to it during alcohol consumption. Another respondent said that when they stop alcohol consumption they look different from the way they are during admission. They look happy due to freedom from alcohol. Another respondent mentioned about resting the liver from the battle of destruction of alcohol.

All the respondents mentioned of positive effects of abstinence on the liver when abstinence is initiated, denoting that upon maintenance of the abstinence the recovery

process was continuous. A study in UK by Buchanan and Sinclair (2021) reported that abstinence of alcohol improves outcome of the liver disease at all stages.

A study in US by Mellinger et al (2021) found contrary opinion where it was pointed that reducing the amount of alcohol intake was beneficial rather than total abstinence which may results in withdrawal syndrome. To support the practise of reduced alcohol intake against total abstinence Kirouac et al (2019) did a study in US and reported that total abstinence was not favorable as compared to gradual abstinence. The researchers further reported that this practise received numerous critiques on the treatment model.

The third question of the in-depth interview was about the institutional considerations before admission for client with alcoholic liver injury. Respondents mentioned about support from relatives. The relatives are to abide to the rules and regulations of Covid-19 pandemic restrictions which was paramount to protecting other patients and the staff within the institution. Another consideration was about alcohol use cessation while in the rehabilitation centre, Clients are forbidden from leaving the institution to sought for alcohol outside, this denoted total abstinence during the stay at the institution.

One respondent mentioned about a client having a stable state of mind. The significance of this was that the client was able to follow the institutional rules and regulations for the desired outcome of alcohol cessation. These responses from the rehabilitation centres did not subject clients to unattainable regulations about admission, rather they are strict to protect the other patients and staff from Covid-19 and still maintain their focused goal of rehabilitating the clients.

Other studies reported about institutional considerations before admission especially during the covid-19 pandemic.

A study in UK by De Biase et al (2020) reported that any rehabilitation facility must consider both the covid 19 specific needs and the needs of rehabilitation for its clients during admission and in-stay period.

A study in US by Kapuria et al (2021) mentioned about minimizing the risks of exposure to Covid-19 to the clinical practise personnel and also the clients on admission. The study described of a broad roadmap for care of alcoholic liver injury patients during the pandemic.

A study in UK by Rose et al (2021) reported that restricting relatives to the medical facilities during the covid-19 pandemic had negative impact in that there was negative influence on information transfer from both the clinical side and the family side. A family centered care was unattainable during the covid 19 pandemic.

The fourth question of the in-depth interview was about the eligibility criteria for admission to the rehabilitation centre. Respondents mentioned knowledge deficit on the grading system for admission to the rehabilitation centre. Other respondents said that they are guided by head to toe examination to evaluate the health status of the client. There was a mention of the pain scale of 1 to 10 that guided the clinicians to evaluate pain as a significance of the general condition of the patient for eligibility to admission.

There was a mention of the mental health status assessment criteria to evaluate for psychiatric condition than alcoholic liver injury. Another respondent said that they may appreciate introduction of a new grading criteria because they did not have one. The summary of this response was that there was no clear grading system for admission criteria for persons of alcoholic liver injury in the rehabilitation system. The clinicians used other methods of evaluation such as the pain scale, the mental health status or no

grade at all but rather would admit the patient then observe on their status. There is need to have a standardized system of grading for admission to the rehabilitation centres.

Studies have been done to elaborate on the eligibility criteria for admission in the rehabilitation centres. Such studies have guided on this issue. A study in US by Kim et al (2021) reported that mortality due to alcoholic liver injury was increased due to biased selection criteria.

A study in Argentina by mendizabal et al (2021) reported that the eligibility criteria for admission to treatment of end stage liver disease was by use of a model referred to as Child-Turcotte-Pugh (CTP) score model. The model is famous for its ability to predict mortality and as such one can remove the client from a waiting list of admission to priotize for immediate admission. In using the model mortality has been reduced in many centres.

A study in US by (Kapuria, Bollipo et al. 2021)mentioned about following the public health policies for testing and re-testing for Covid 19 during the pandemic.

The fifth question was about use of guideline for management of alcohol liver injury in the rehabilitation centres. Responses included verbalization that there are no guidelines used and a request was put to the researcher to provide one. Another response was that they do physical examination which guide on condition of the patient. Another respondent mentioned that guidelines are probably at the ministry headquarters denoting that at the rehabilitation centre they are unavailable for use. Another response was that of moral Christian virtues of value for humanity since this was a Christian rehabilitation institution.

From the responses it was found that the rehabilitation centres did not have clear guidelines that are followed for management of alcoholic liver injury patients. Various institutions used various modalities to care for their patients. There seems a disorganized way of care for these patients. The government through the ministry of health may have not guided the institutions on what is required for management of alcoholic liver injury. This was supported by lack of no single response that mentioned of the ministry guideline for care of these patients.

Various studies have mentioned about guidelines on management of alcoholic liver injury patients. Such guidelines include the European Association for the Study of Liver (EASL) clinical practise guidelines. (Panel, Berzigotti et al. 2021) mentioned that these guidelines should guide for management and evaluation of severity and prognosis for alcoholic liver injury. They encourage the use of these guidelines in all set-ups of care for these patient since they are comprehensive and detailed.

Another set of guidelines are provided by the Asian Pacific Association for the Study of Liver (APASL), the guidelines are similar to those provided by the European association for the study of liver diseases, but Ando and Joy (2021) said that the difference between the two is that the Asian Association for the study of liver diseases advocate for liver biopsy as the best test despite its risks(Ando and Jou 2021).

From the Latin America there is the Latin America Association for the study of liver (ALEH) clinical guidelines. These guidelines are similar to the other two with emphasis that alcohol exclusion takes a key evaluation factor than other etiologies in their evaluation criteria. Mendez-Sanchez et al (2021) said that in the guidelines alcohol has be considered to have far reaching implications than any other substance on the liver(Arab, Dirchwolf et al. 2020).

After a detailed search by the researcher there are no African or Kenya Guidelines on the management of liver diseases.

The sixth question on the in-depth interview was about the institutional considerations for referral of clients with alcoholic liver injury to tertiary institutions. Respondents mentioned that more sick clients was referred to tertiary institutions after consultation with the relatives. Another respondent said that when the client is not improving to the management then they refer. Another response was that when rehabilitation centres feel that their clients are better placed at the referral hospital rehabilitation centre than at the community rehabilitation centre. Another respondent mentioned about the negative aspect of referral where relatives refuse to pay for the bills.

The statement of 'more sick' was not qualified by any supporting statement and the researcher comment was that the statement was ambiguous. The aspect of relatives refusal to pay the bills was misplaced but had an impact that may influence early referral. All the respondents did not mention of common institutional considerations for referral. Thus the relevant institutions such as the ministry of health should aid with referral policy and guidelines. The research arguably deduce that with lack of guidelines on admission there could be lack of policies or guidelines for referral.

Other studies done on the referral of alcoholic liver disease mentioned that clear policies and guidelines for referral are paramount. A study in US on global online alliance for liver studies (GOAL) by Kapuria et al (2021) mentioned that it was important to have local policies on referral for alcoholic liver injury(Kapuria, Bollipo et al. 2021).

A study in US by Im et al (2021) reported that 60% of their referral was for behavioral therapy than alcoholic liver injury(Mellinger, Im et al. 2020).

Another study in the US by (Chen, Ting et al. 2021)reported that there was an escalation of referral during the covid 19 pandemic period for alcoholic liver injury The study was done on 459 institutions and no clear referral principals are observed on the referral system.

A study in Australia reported that late referral is a contributor to missed opportunity to improve on alcohol liver injury. The study commended to reduce on late referral and encourage of early referral(Chen, Johnston et al. 2021).

The researcher in this study denotes a deficient clear referral system for alcoholic liver injury for alcohol users.

The seventh question from the in-depth interview was about relapsed cases. The question sought to know how clinicians evaluate relapsed persons who report back to the centres. Respondents mentioned that they ask clients ‘what happened ?’ .The respondent did not offer an answer to the question posed on the client. Another respondent mentioned that it was emotional to the staff, but they admit and do a liver span for the size of the liver. Another respondent said that they do not know what happens after discharge that they relapse. It was mentioned that relapse is common.

The researcher expectation was to find out whether there are tests done to evaluate for advance damage to the liver compared to the last day of discharge. This was not clearly mentioned otherwise emotions for relapse are commonly elicited than the expected. Other studies done on relapse mentioned about the importance of improved care for relapse cases. A study in France by Singal and Mathurin (2021) reported of ten years

survival rate for alcohol liver injury. They reported 88% for those with total alcohol abstinence and 73% for persons with alcohol relapses(Singal and Mathurin 2021).

Another study in UK by Herrick-Reynolds et al (2021) reported that abstinence was reassessed and evaluation concluded. Incase of relapses a client is considered with lots of serious intense therapies to prevent more relapses(Herrick-Reynolds, Punchhi et al. 2021).

A study in US by Shen at al (2021) reported that most predictors of alcohol relapses are not quantifiable. This may prevent objective analysis for relapse risk that can target intervention improvement for better clinical improvement(Shen, Kaplan et al. 2021).

The eighth and last question of the in-depth interview was about the importance of have a grading system for alcoholic liver disease. Respondents said that it was important since it will offer an opportunity for the care giver to know when to refer or retain clients at the centre. Another respondent mentioned about more sick clients verses less sick ones and refer when appropriate than too late. Another respondent mentioned about the suitability of admission criteria than admit all clients presented at the rehabilitation centres.

The question was a self evaluation for the practise at the rehabilitation centres where the participants had realized gaps in the management of alcoholic liver injury persons. The gap was lack of clear policies and guidelines on the management of these clients. The rehabilitation centres are at a risk of admitting all clients presented for admission without restriction because the guiding principles are not in place. When to refer or otherwise has been left to the institution to do or not to do so. It is a confusing state of ambiguity with no clear direction.

A study in Seoul Korea by Jang et al (2021) reported that ambiguity about the management of alcoholic liver disease patient led to seeking information from the television programmes and sometimes use of food supplements in their management of the disease(Jang, Lee et al. 2021).

Another study in US by Tiacopa et al (2021) reported that tailoring treatment for alcoholic liver injury aided the uptake and maintenance in the first line therapies(Tincopa, Wong et al. 2021).

CHAPTER FIVE: SUMMARY, CONCLUSION AND RECOMMENDATION.

5.1 Summary of the Study

5.1.1 Demographic Factors

Geographical representation

The study had participants from two counties with high alcohol consumption. This representation could not lead to a generalized finding in the Country. A wider geographical representation could have helped in the generalization of the findings.

Gender

The male gender was over-represented in the study, while the female gender had few participants. This could affect the generalization of the study, with biasness of one gender being a factor of importance.

Age

The study had an equal representation of the age. There are young participants, with old ones represented as well. The study realized that young participants at around 18 years would consume less alcohol, but increased alcohol consumption was noticed with an increase in age. Beyond 58 years, the number of alcohol consumers decreases as the age advances. The researcher suggests that few alcohol consumers at age 18 could be due to the government regulations in Kenya. Some regulations state that alcohol should not be sold to persons below 18 years. Upon attaining this age, many persons who would wish to consume alcohol may feel that upon getting to age 18, they can freely consume alcohol without major restrictions. It is common knowledge that at age 18 years, persons could be joining tertiary institutions of education or otherwise.

Therefore, having few young persons present with alcohol challenges at rehabilitation centers indicates a starting to use alcohol trend with few challenges. As age progresses, many persons may be drinking more with new adventurous alcohol and its many brands. This study, therefore, noticed age to be an important consideration in targeting alcohol management.

Marital status

Effects of alcohol consumption affected participants almost on equal capacity, whether married, single, divorced, separated, or widowed. Therefore, persons who consumed alcohol suffered the consequences of alcoholism; equally, the magnitude of the effects of alcohol was not lesser to those disadvantaged or advantaged by marital status.

Income

The income for our participants was adequate to facilitate them buying third-generation alcohol daily. Third-generation alcohol is cheap and can be available with little money. The first-generation type of alcohol is expensive and may not be available with daily subdivision of the monthly income for our participants.

Level of education

Our study had participants with a basic education level or above. They could read and write in English and the national language (Swahili). This was an important component of the study that could translate to the participant's ability to read instructions available to them that have been put on the alcohol containers by the government. Availability of internet services provided a provision for alcohol consumers to search for important materials about the alcohol they consumed.

Employment status

Employment was not the major factor in alcohol consumption in our study.

Duration participants had consumed alcohol.

There was an almost equal distribution on the range of alcohol consumption for our participants. No skewness was identified on the duration participants had consumed alcohol.

Alcohol relapse.

Our study found that relapses are common among the participants, with a representation of near half of the participants reporting relapses. This is a high percentage that needs focus by the management at the rehabilitation centers. Therapies should include mitigations on relapses.

Admission criteria

The responses for 'yes,' 'No' and 'I don't know' showed almost equal percentages. The response was trying to establish the catchment for rehabilitation centers. The caregivers discussed this near similar question at length on the area for an in-depth interview. Thus, the regulatory body must describe admission criteria to rehabilitation centers for alcoholic liver injury persons.

Influence to alcohol consumption

This question was trying to establish the major contributing factors to alcohol consumption. It was found that the desire to remain in the peer groups and availability of money contributed a great deal. Again, these are areas of focus during therapies that should be discussed with clients and better ways to handle the situation established. It

was clear from our study that stressful situations and spouse challenges had a lesser impact on drinking alcohol. The low percentage on the response regarding spouse can be related to the bio-demographic characteristic on a marital status where nearly half of the participants are married, showing that they valued being in family setups.

Again, the question can be compared with the AUDIT question on failure to do responsibilities due to alcohol. The majority of the respondents acknowledged that this happened daily or almost daily. The researcher connects the AUDIT question to be influenced by family responsibilities.

5.1.2 The AUDIT tool

5.1.2.1 Hazardous alcohol use domain

This domain showed that the participants are probably enjoying drinking alcohol. The researcher relates the domain characteristic with the availability of money that enabled the participants to drink alcohol daily or almost daily. The domain was also probably influenced by friendship where the participants wanted to remain in these friendships groups. Probably the participants are called by friends to the drinking dens to have fun and entertainment. The domain should form bases for discussion at the rehabilitation centers where the chain of friendship with the alcohol drinkers should be de-linked.

5.1.2.2 Dependence alcohol use domain

This domain showed that the participants are experiencing challenges, the challenges may have ignited a certain concept in their mind, but the concept may have been ignored. The thinking may have concerned them almost daily. At a certain point, the participants started experiencing intolerance when the majority reported that they needed a drink in the morning. The domain reflects a step-by-step progression from hazardous alcohol use to dependence, focusing on the difficult situation of alcohol use.

5.1.2.3 Harmful alcohol use

Again, this is a phase attained from dependence on alcohol use. At this phase, the participants acknowledged that the alcohol had taken control of their daily activities. The majority are remorseful about the situation. Negative activities had taken place in their lives; they could not meet responsibilities, and people had been injured due to their drinking. The majority wanted to cut down or stop drinking alcohol, but they are unable. When helplessness invades them, they sought support from the family who show empathy and support.

The AUDIT tool does not guide when an alcohol user should sought for medical support. When compared with our model, the model guide that upon abstinence, the alcohol user should be counseled and followed up to continue with alcohol recovery. The model recommends that close contact between the alcohol user and the clinician be continued. The continuous recovery process shows this.

5.1.3 The liver biomarkers

In Kenya, liver biomarkers can only be done in medical institutions with laboratory facilities. Provision of this type of service requires procurement of reagents at the facilities. Liver biomarkers have a high sensitivity and reliability compared to other tests for alcoholic liver injury. A challenge to the sub-Saharan countries is its availability. Our study could have the samples collected, transported, stored, and then analyzed.

Alanine aminotransferase was elevated in all the participants. The researcher found that this is a significant biomarker in determining alcoholic liver injury. The researcher picked this biomarker as a key component to formulating a model for alcoholic liver

injury. When combined with other biomarkers, alanine aminotransferase was significant and dependable.

Regarding Aspartate aminotransferase, the results are distributed across different ranges, with more than three-quarters of the participants at a range above the upper limit. Other studies reported that aspartate aminotransferase is an important test for alcoholic liver injury. Due to this, the test was picked as a key parameter for the formulation of the model. When combined with alanine aminotransferase, the test provides an important combination for alcoholic liver injury.

Gamma glutamyltransferase was elevated in all the participants. It was a significant biomarker in determining alcoholic liver injury. Many studies reviewed supported its use as an important biomarker. The researcher used it as among the biomarkers that helped formulate the model.

Alkaline phosphatase was another biomarker that showed a critical relationship with other biomarkers. The biomarker showed significance when it was combined with other biomarkers. Other studies reviewed supported its use when combined with other biomarker tests to diagnose an alcoholic liver injury. Thus the researcher used it as an important biomarker to formulate the assessment and referral model.

The four liver biomarkers of Alanine aminotransferase, aspartate aminotransferase, gamma glutamylaminotransferase, and alkaline phosphatase are important biomarkers of the liver. Our study realized that a majority of the participants had these biomarkers elevated. Our statistical analysis showed significant relationships in all four biomarkers of the liver. Studies reviewed reported that these are important biomarkers for alcoholic

liver injury. Therefore, the researcher involved all the biomarkers in formulating the assessment and referral model for alcoholic liver injury.

5.1.4 Correlation of the AUDIT and Biomarker results

Our study showed that the AUDIT test was important in diagnosing alcoholic liver injury among alcohol users. The tool recommended by WHO has been in use for nearly half a century across the globe. The tool was formulated and tested in six Countries, Kenya being among them. The tool was clear to use without ambiguity on its questions. Our study generated results that showed that the participants are involved in dangerous alcohol use. The AUDIT tool findings showed that most of the participants are involved in daily alcohol consumption. The tool positively identified participants as hazardous alcohol users, dependent alcohol users, or harmful alcohol users.

The study also used the alcohol liver biomarkers to identify the alcohol use of the participants positively. The biomarkers involved positively showed that our participants are alcohol drinkers. Different ranges are identified guided by their upper limits. Again, our participants are in ranges; some are within the normal range while others showed elevated parameters. In some participants, the parameters are elevated in one-fold, others two folds while others are in three folds. The liver biomarkers are acceptable by various regulatory bodies involved in studies on the liver. Their elevation is acceptable to signify liver injury.

The AUDIT results are correlated with the liver biomarkers for statistical significance through statistical analysis. The results showed the significance of the association. Literature showed that the two complement one another in diagnosing alcoholic liver injury. The results enabled the researcher to strategize to form an assessment and referral model for alcoholic liver injury.

5.1.5 Strategy to formulation of the model

The AUDIT results guided the researcher, which had items subdivided into three domains of hazardous, dependence, and harmful alcohol use. The scores on the different items are categorized such that each item had a minimum score of 0 and a maximum score of 4. Similarly, the four critical liver biomarkers are picked guided by the literature review. They included AST, ALT, GGT, and AP. Other biomarkers are important but did not have much influence over the four. The four liver biomarkers are awarded scores guided by the folds above the upper limit. Then model formulation was started guided by the AUDIT results and the liver biomarkers results. A table was drawn comparing the two tests' results with intervention on the client's assessment and referral of the clients. The column for the biomarker was removed, and the model was left with the AUDIT test score with assessment and referral columns.

The model was formulated where after admission, the client is requested to consent for the AUDIT test, and upon the score, the client is then taken through abstinence and counseling sessions. During counseling, the clients are encouraged to open up and discuss with the counselor. The counseling session may involve different family members and may take several sessions or even days. Depending on the categorization of the client, the next step may commence immediately or may be delayed. This decision is left to the caregiver.

The rehabilitation phase involves therapies that may or may not include medication and psychotherapy. This phase may take several weeks or months, depending on the client's response. Some clients may start rehabilitation and fail to improve; then, the caregiver may refer them to a referral hospital for further management. The client may improve and respond to therapy to progress to the recovery phase. The recovery phase is

continuous, and the client is continuously recovering; otherwise, they may relapse going back to the drinking days.

5.2 Conclusion

Conclusion was done guided by the bio-demographic data and the four specific objectives. Participants are selected from Murang'a and Uasin Gishu counties. Two counties with high alcohol consumption rate in Kenya.

5.2.1 Bio-demographic data

Gender

Male are the majority of the participants in the study, with few females. There are certain probabilities to the availability of more men than women. Probably more men are involved in alcohol consumption than females. Probably more men are ready for rehabilitation than women. The stigma of women and alcohol consumption probably influenced women presenting themselves in the rehabilitation centers. More men are probably on the focus from the community to cut down on alcohol than females.

Age

The study suggests that the trend of alcohol consumption be taken as a true picture of the status in the Country where beginners are few in early adulthood, the alcohol consumers increase with advancement in age where between 28 years and 37 years they are at the peak age of alcohol consumption and then beyond the age of 28 years the trend slows down. The study suggests that interventions on alcoholic liver injury should focus on alcohol beginners and peak alcohol users. Beyond 37 years, the damage may be set, and efforts to salvage the liver may need advanced clinical intervention.

Marital status

Participants in the study are majority married or single. Married participants are at 41%, while single was represented by 31%. Other marital statuses had few participants. Thus, most of the participants had moral responsibilities to care for their families and provide the necessary support. A balance between alcohol consumption and family responsibilities could be challenging for alcohol users. However, despite admission to the rehabilitation centers, the families are still attached to the alcohol users.

Single persons may have had their priorities divided between family responsibilities and alcohol consumption. They may have felt inadequate to support families while still drinking alcohol. The probable period when they will marry may remain unknown to their relatives. Probably one component of therapy while at the rehabilitation centers should be about family life and its importance.

Level of education

The study participants are educated since most had a secondary school education level or above. Thus, the low level of education was not the major contributor to alcohol consumption. The participants are eligible to read and write, showing that they could search for the good and bad of alcohol or search for information about the alcoholic liver injury. With a high level of education, one would contemplate that there should be a relationship with their monthly income.

Monthly Income

The participants in the study are of an educated class that would have various sources of income. Our study realized that most participants had a monthly income of about Ksh 1 to 5,000. This translates to about Ksh 167 per day. This amount was too little for first-generation beer but too much for second or third-generation alcohol. Our

participants may have been more involved in second or third-generation alcohol than the first-generation beer.

Relapse to alcohol

Our study showed more persons had not experienced relapses. This was a positive mark that could lead to better outcomes during their stay at the rehabilitation center. The first time they are admitted at the rehabilitation centers, the chances of no future relapses could be below with comprehensive therapy. For those who had relapsed, a lot of effort was required to prevent future relapse, which could worsen their future decisions on alcohol abstinence.

Duration consumed alcohol

Participants in this study had consumed alcohol for long durations. Alcohol consumption for long periods regularly is likely to cause alcoholic liver injury. Presenting themselves to the rehabilitation centers revealed that they had realized the negative impact of alcohol consumption over the long duration they had consumed alcohol.

Admission criteria

On admission criteria to the rehabilitation centers, some participants are referrals from other centers while others are not knowledgeable about a referral or otherwise. Some said that they are not referred. There was no clear policy of admission criteria at the rehabilitation centers. The ministry probably missed this opportunity to prescribe how rehabilitation centers should admit their clients.

Influence to alcohol consumption

The major contributors to alcohol consumption are the desire to remain in peer groups and the availability of money. Other factors such as stressful situations and being at home early to be with a spouse did not significantly impact. Therefore alcohol consumption was made possible due to the money factor; if eliminated, the consumers would sought for other sources to acquire money.

5.2.2 To assess the AUDIT screening results

The first specific objective was about the AUDIT screening results for alcoholic liver injury among adults of alcohol consumption in selected counties. The alcohol use identification test has been accepted as a tool for assessing alcoholic liver injury. Other tools include:

- The CAGE (Cut down, Annoyed, Guilty, Eye-opener) tool.
- The Michigan Alcoholism Prognosis Scale (MAPS).
- The High-Risk Alcohol Relapse (HRAR).

This study opted to use the AUDIT tool due to its wide acceptability and ease of use. During its formation, the tool was tested among the cohort in 6 different Countries Kenya being one of them.

The AUDIT tool was easily acceptable by the research assistant, and the training was smoothly conducted. The questions are easy to understand among the participants. The tool was analyzed using the SPSS version 24. The tool was easy to summarize, guided by the three domains.

The hazardous domain was the first one which involved questions 1 to 3. The first question was on the sequence of alcohol consumption; the study found that participants

are on constant consumption of alcohol almost every alternate day or daily. Alcohol consumption at this rate has a hugely damaging impact on the liver and will negatively impact later life.

The second item of the hazardous domain was about the amount of alcoholic drink a consumer could drink on a typical day. The majority of the participants are drinking ten or more. Clients should be made to verbalize their feelings about drinking on a typical day. To some, this would be a day to remember when they did it to the extreme. The rehabilitation center should utilize this chance to explain alcoholic liver injury progression to liver cirrhosis. It is a huge amount of toxins subjected to the liver to detoxify. This could quicken the progression rate of the alcoholic liver injury to cirrhosis.

The third item of the hazardous domain focused on consuming six or more drinks on occasion; occasions could be like when on holidays or in ceremonies; this item showed a high percentage that reported a daily occurrence. This affects the body, family resources, and society. There should be limitations on daily activities that pertain to alcohol consumption and, where necessary, should be avoided in totality.

The fourth item on the dependence domain was about the inability to stop drinking once started again; daily occurrence dominated the item again. This showed that alcohol was taking control over the consumer's life and that the consumer had little or no control at this level. Alcohol consumption had taken priority in their life ahead of any other important item.

The fifth item of the dependence domain was about the inability to fulfill tasks expected to undertake. Here the participants reported that it happened almost daily; this

showed that doing wrong was part of their daily activity. They would wrong their spouses, family members, society, the government, or even their employer. This could be too much to handle; making mistakes daily would put them on the negative receiving end. Maybe they would have wished to come out of it where possible.

The sixth item of the dependence domain was the need for a drink in the morning. This was defined as an eye-opener (CAGE tool) or even addiction status in some other literature. An almost daily need for a drink in the morning had many negative impacts on their lives. The government has restricted alcohol selling premises to function starting from certain day hours. Maybe they had to sought the alcohol from other quarters against the government regulations. The risk of going against the government regulation was huge. When unavailable, these clients are candidates for alcoholic fits, which are fetal and can lead to mortality. When they took the morning drink, they took it quickly and fast to leave the premises. The huge amount of toxins exposed to the liver is damaging with serious effects on the organ.

The seventh item of the harmful domain was about feeling remorseful after drinking alcohol. More than half of the participants mentioned this as a daily or almost daily occurrence. This feeling denoted that the participants are not happy about their actions on drinking. Maybe they looked back and realized how much had been lost due to their drinking.

The eighth item of the harmful domain was about unable to remember events on the night before due to drinking. Again, this was a daily occurrence to the majority of the participants. This may show that they are over drunk or there was excessive drinking. Too much alcohol consumption has similar effects on the liver.

The ninth item of the harmful domain was about someone injured due to their alcohol drinking. The majority of the participants acknowledged their actions by reporting on the events. Whether it was positive or negative, they reported that they acknowledged their action was positive.

The tenth item of the harmful domain was the desire to cut down on alcohol use. Almost all the participants reported their desire to cut down on alcohol consumption. This may support that their admission to the rehabilitation centers was voluntary with a need to change for the better in their lives. A life without alcohol consumption.

5.2.3 Liver biomarkers

The liver biomarkers that are tested on the study included ALT,ALP, AST, GGT, Proteins and Bilirubin.

Alanine aminotransferase

This biomarker of the liver was elevated in almost all the participants. Few (2) had high levels, which may have shown advanced levels of liver damage. Otherwise, all the participants had elevated ALT, showing alcohol liver injury in almost all of them. Alcohol users with elevated ALT levels have high rates of morbidity and mortality related to alcoholic liver injury.

Aspartate Aminotransferase

It is probably the most reliable biomarker of all. Its elevation in alcohol consumers is dependable to alcoholic liver injury. In our study, the biomarker was elevated, with few (7) participants reporting normal results. Abstinence from alcohol consumption would have increased the life span of the otherwise sick persons due to alcoholic liver injury.

Gamma Glutamyl aminotransferase

This is another reliable biomarker of the liver. It was elevated in all the participants. Again, when combined with other liver biomarkers, it shows alcoholic liver injury. Our participants are likely cases of morbidity due to alcoholic liver injury.

Alkaline phosphatase

This biomarker was elevated on most participants except only one participant. The majority had elevated levels showing that their alcohol consumption affected liver function.

5.2.4 Correlation of the AUDIT and liver biomarkers results

When correlated, the audit results and the liver biomarkers showed significance, complimenting one another. Other liver biomarkers such as the bilirubin and proteins showed significance when correlated with other biomarkers. The correlation was an important step towards achieving a strategy for formulating an assessment and referral model for alcoholic liver injury.

5.2.5 Strategy to development of an assessment and referral model for alcoholic liver injury.

The developed model looked simple and easy to use. The clinician should be trained on its implementation then trials for use take place. Afterward, the tool should be adopted for use.

New knowledge emerging from the study

An assessment and referral model is simple to use and less costly for diagnosis of alcoholic liver injury.

5.3 Recommendations

5.3.1 Demographic Factors

Gender

More studies should be done to find out whether more men are involved in alcohol consumption than females, whether there is a stigma of the female gender when they present themselves at the rehabilitation centers, or any other study that can elicit more information on the skewness of more male than female at the rehabilitation centers.

Marital status

The clients should be encouraged to continue with the morals of family life, and those who did not have spouses should be encouraged to continue doing so. During their stay at the rehabilitation centers, family responsibilities should be emphasized.

Level of education

Rehabilitation centers should use the knowledge base for the clients to further educate them of the negative effects of alcohol on their bodies, families, and society. The centers should teach moral etiquettes of the society to the clients

Monthly income

Availability of money may have been a major contributor to alcohol consumption for our participants. Thus therapeutic programs should include money management and proper use of resources to minimize the allocation of money to alcohol.

Relapse to alcohol

During the admission period at the rehabilitation centers, one area that should emphasize is how to prevent relapses. This should be done theoretically and even with

previous relapsed persons narrating their negative experiences and cautioning non-relapse members.

Duration consumed alcohol

The clients should be asked the duration they have consumed various categories of alcohol, such as first-generation, second generation, and third generation. The ministry of health should guide the damage likely caused by the different generations focusing on the fact that some have known ingredients while others have unknown ingredients. Duration one may have consumed a certain generation of alcohol should guide the urgency of care to the alcohol consumption.

Admission criteria

The regulatory body/bodies to rehabilitation centers or the ministry of health need to provide clear policies and guidelines on admission processes for alcohol users, alcoholic liver injury persons, or persons of relapses.

Influence to alcohol consumption

The rehabilitation centers need to include the major influencers of alcohol consumption in their programs, such as the desire to be retained in peer groups and the availability of money. More studies are needed to find out sources of money for the unemployed cohorts who continue drinking alcohol.

5.3.2 To assess the AUDIT screening results

The first item of the hazardous domain should be the foundation to show alcohol consumption daily or almost every day is not helpful but will affect the liver in later life.

The second item of the hazardous domain should be about drinking on a typical day should be discussed in detail. Its effect on the progression of liver damage from alcoholic liver injury to cirrhosis should be discussed.

The third item on the hazardous domain was about occasional drinking of alcohol again. The rehabilitation centers should focus on the values and virtues of the society, family, and self to explain moderation and control during ceremonies or other occasions.

The fourth item of the dependence domain should be discussed, and the clients informed to take control over their alcohol drinking. This is because the study's finding had shown that the alcohol had taken control over their life; this had to be reversed.

The fifth item of the dependence domain was about the inability to fulfill the everyday tasks; the clients should be informed to prioritize this. This would make other people happy, congratulating them or even offering rewards. This could turn the negatives into positives. This area of therapy should be explained to the relatives to offer rewards where necessary. Rewards could involve saying, 'Thank you.

The sixth item of the dependence, which is on a drink in the morning to get started, should be discouraged. It should be explained to the clients the risk of this action to the body and the government. The body is exposed to huge toxins to detoxify in a short period. The action is against the government regulation that is punishable.

The seventh item of the harmful domain, which is about feeling remorseful, should be emphasized in the rehabilitation centers. The Gibbs Reflection cycle should be incorporated into the curriculum to reflect on their lives and take action given another opportunity.

The lightweight item of the harmful domain is about the inability to remember what happened the night before due to drinking; clients should be informed that the actions show too much drinking, which has similar damaging effects on the liver. This should be discouraged, and clients informed to desist from it.

The ninth item of the harmful domain is about someone injured due to drinking alcohol. The clients should be encouraged to take responsibility for their positive and negative actions, focusing on doing activities that would lead to positive ends.

The tenth and last item of the AUDIT tool about harmful alcohol use concerned their desire to cut down on alcohol consumption. The caregivers should encourage the desire, and the clients should vow to continue with the desire.

Therefore, there should be detailed discussions on the AUDIT tool analyzing the different domains and how to mitigate the different items on the tool. The study also recommends that the AUDIT tool be used on all admitted clients at the rehabilitation centers.

5.3.3 Liver biomarkers

Alanine aminotransferase

The biomarker is a dependable test for an alcoholic liver injury that is more reliable when combined with other biomarkers. The study recommends that this biomarker be combined with other biomarkers to provide a high-level diagnosis for alcoholic liver injury.

Alanine aminotransferase

Clients should be encouraged to abstain from alcohol to attain normal levels and maintain the normal levels. This can happen through abstaining from alcohol use.

Gamma Glutamyl aminotransferase

A reliable biomarker of alcoholic liver injury should be combined with other biomarkers to offer more diagnosis evaluation for alcoholic liver injury. Abstinence should be encouraged to lower the levels to normal values and evade those levels that are significant to liver damage.

Alkaline phosphatase

The one participant who had normal results needed further evaluation, and if found true positive results, this should be encouraged for maintenance. The other majority should be informed of the damage caused to the liver and requested to abstain from alcohol. Coffee is linked to lowering alkaline phosphatase; it should be encouraged to alcohol abstinence persons. It is important to stick to lower levels of coffee to avoid unwanted side effects since coffee is a stimulant and may lead to hypertension and sleep disturbances.

5.3.4 Correlation of the AUDIT and liver biomarkers results

The correlation was significant, and the study recommended using the AUDIT tool and liver biomarker to a more generalized study. The step was crucial towards formulating an assessment and referral model for alcoholic liver injury.

5.3.5 Developed tool

After the model was developed, it was posted to the rehabilitation centers. Currently, the model is on trial at the two counties, after which it will be reviewed, and inputs from the users will be considered. The researcher recommends a trial of the model outside the two counties then adoption for use in various health facilities of rehabilitation in the Country.

REFERENCES

Åberg, F., et al. (2021). "A Dynamic aspartate-to-alanine aminotransferase ratio provides valid predictions of incident severe liver disease." Hepatology Communications 5(6): 1021-1035.

Åberg, F., et al. (2021). "A Dynamic aspartate-to-alanine aminotransferase ratio provides valid predictions of incident severe liver disease." Hepatology Communications 5(6): 1021-1035.

Addolorato, G., Mirijello, A., Barrio, P., & Gual, A. (2016). Treatment of alcohol use disorders in patients with alcoholic liver disease. *Journal of Hepatology*, *65*(3), 618-630.

Ahmad, S. (2021). Attitude toward alcohol consumption among Indian male adolescents. *Alcoholism Treatment Quarterly*, 1-6.

Agarwal, S., Fulgoni, V. L., & Lieberman, H. R. (2015). Assessing alcohol intake & its dose-dependent effects on liver enzymes by 24-h recall and questionnaire using NHANES 2001-2010 data. Nutrition journal, 15(1), 1-12.

Aguinis, H., & Bakker, R. M. (2021). Time is of the essence: Improving the conceptualization and measurement of time. Human Resource Management Review, 31(2), 100763.

Akter, S., et al. (2021). "Application of Biochemical Tests and Machine Learning Techniques to Diagnose and Evaluate Liver Disease." Advances in Bioscience and Biotechnology 12(6): 154-172.

Anders, M., et al. (2021). "A Real-World Study on the Use of the Alcohol Use Disorders Identification Test (AUDIT) in Men Admitted to a Psychiatric Hospital." Medical Science Monitor: International Medical Journal of Experimental and Clinical Research 27: e929667-929661.

Ando, Y. and J. H. Jou (2021). "Nonalcoholic fatty liver disease and recent guideline updates." Clinical Liver Disease 17(1): 23.

Andrade, R. J. and M. Robles-Díaz (2020). "Diagnostic and prognostic assessment of suspected drug-induced liver injury in clinical practise." Liver International 40(1): 6-17.

Andresen-Streichert, H., et al. (2018). "Alcohol biomarkers in clinical and forensic contexts." Deutsches Ärzteblatt International 115(18): 309.

Arab, J. P., Bataller, R., & Roblero, J. P. (2020). Are We Really Taking Care of Alcohol-Related Liver Disease in Latin America?. Clinical Liver Disease, 16(3), 91.

Arab, J. P., et al. (2020). "Are We Really Taking Care of Alcohol-Related Liver Disease in Latin America?" Clinical Liver Disease 16(3): 91.

Arab, J. P., et al. (2020). "Latin American Association for the study of the liver (ALEH) practise guidance for the diagnosis and treatment of non-alcoholic fatty liver disease." Annals of Hepatology.

Arab, J. P., et al. (2020). "Are We Really Taking Care of Alcohol-Related Liver Disease in Latin America?" Clinical Liver Disease 16(3): 91.

Arnts, J., et al. (2021). "Diagnostic Accuracy of Biomarkers of Alcohol Use in Patients With Liver Disease: A Systematic Review." Alcoholism: Clinical and Experimental Research 45(1): 25-37.

Årving, A., Høiseth, G., Hilberg, T., Trydal, T., Husa, A., Djordjevic, A., ... & Bogstrand, S. T. (2020). Comparison of the Diagnostic Value of Phosphatidylethanol and Carbohydrate-Deficient Transferrin as Biomarkers of Alcohol Consumption. *Alcoholism: Clinical and Experimental Research*.

Asrani, S. K., et al. (2021). "Reducing the global burden of alcohol-associated liver disease: A blueprint for action." Hepatology 73(5): 2039-2050.

Asrani, S. K., et al. (2021). "Reducing the global burden of alcohol-associated liver disease: A blueprint for action." Hepatology 73(5): 2039-2050.

Assanangkornchai, S., et al. (2020). "Socio-economic inequalities in the association between alcohol use disorder and depressive disorder among Thai adults: a population-based study." BMC psychiatry 20(1): 1-11.

Atkinson, A. M., et al. (2021). "'We're in this together': A content analysis of marketing by alcohol brands on Facebook and Instagram during the first UK Lockdown, 2020." International Journal of Drug Policy 98: 103376.

Atkinson, A. M., et al. (2021). "'We're in this together': A content analysis of marketing by alcohol brands on Facebook and Instagram during the first UK Lockdown, 2020." International Journal of Drug Policy 98: 103376.

Babor, T. F., Higgins-Biddle, J. C., Saunders, J. B., & Monteiro, M. G. The Alcohol Use Disorders Identification Test.

Balachandran, P., Elsohly, M., & Hill, K. P. (2021). Cannabidiol interactions with medications, illicit substances, and alcohol: A comprehensive review. Journal of general internal medicine, 1-11.

Barbosa, C., et al. (2021). "Alcohol consumption in response to the COVID-19 pandemic in the United States." Journal of Addiction Medicine 15(4): 341.

Barbosa, C., et al. (2021). "Alcohol consumption in response to the COVID-19 pandemic in the United States." Journal of Addiction Medicine 15(4): 341.

Belus, J. M., Rose, A. L., Andersen, L. S., Joska, J. A., Myers, B., Regenauer, K. S., ... & Magidson, J. F. (2021). The role of reward and reinforcement in understanding alcohol use among adults living with HIV in South Africa. Psychology of Addictive Behaviors.

Bemi, G., Venkatesan, L., & Shobana, G. (2013). Effectiveness of soya milk upon menopausal symptoms. *TNNMC Journal of Community Health Nursing*, *1*(1), 17-19.

Ben El Jilali, L., et al. (2020). "Prevalence of alcohol consumption and alcohol use disorders among middle and high school students in the province of Khemisset, Morocco: a cross-sectional study." International Journal of Adolescence and Youth 25(1): 638-648.

Bergasa, N. V. (2022). Alcohol Induced Liver Disease. In Clinical Cases in Hepatology (pp. 255-293). Springer, London.

Berzigotti, A., et al. (2021). "EASL Clinical Practise Guidelines on non-invasive tests for evaluation of liver disease severity and prognosis–2021 update." Journal of Hepatology 75(3): 659-689.

Bijnens, E. M., Derom, C., Thiery, E., Martens, D. S., Loos, R. J., Weyers, S., & Nawrot, T. S. (2021). Serum gamma-glutamyl transferase, a marker of alcohol intake, is associated with telomere length and cardiometabolic risk in young adulthood. Scientific reports, 11(1), 1-8

Blair, A. H., et al. (2017). "The alcohol use disorders identification test (AUDIT): exploring the factor structure and cutoff thresholds in a representative post-conflict population in northern Uganda." Alcohol and Alcoholism 52(3): 318-327.

Blair, A. H., et al. (2017). "The alcohol use disorders identification test (AUDIT): exploring the factor structure and cutoff thresholds in a representative post-conflict population in northern Uganda." Alcohol and Alcoholism 52(3): 318-327.

Bloom, P. P., Meyerowitz, E. A., Reinus, Z., Daidone, M., Gustafson, J., Kim, A. Y., ... & Chung, R. T. (2021). Liver biochemistries in hospitalized patients with COVID-19. Hepatology, 73(3), 890-900.

Bortolotti, F., Raffaelli, R., Di Simone, N., Semprebon, M., Mirandola, M., Simonetto, C., ... & Scambia, G. (2020). CDT reference values for monitoring chronic alcohol abuse in pregnancy. *Clinica Chimica Acta*.

Boschuetz, N., et al. (2020). "Changes in alcohol use patterns in the United States during COVID-19 pandemic." Wmj 119(3): 171-176.

Brennan, P. N., et al. (2021). "Guideline review: EASL clinical practise guidelines: drug-induced liver injury (DILI)." Frontline Gastroenterology.

Buchanan, R. and J. M. Sinclair (2021). "Alcohol use disorder and the liver." Addiction 116(5): 1270-1278.

Buchanan, R. and J. M. Sinclair (2021). "Alcohol use disorder and the liver." Addiction 116(5): 1270-1278.

Callinan, S., et al. (2021). "Shifts in alcohol consumption during the COVID-19 pandemic: early indications from Australia." Addiction 116(6): 1381-1388.

Callinan, S., et al. (2021). "Shifts in alcohol consumption during the COVID-19 pandemic: early indications from Australia." Addiction 116(6): 1381-1388.

Callinan, S., Smit, K., Mojica-Perez, Y., D'Aquino, S., Moore, D., & Kuntsche, E. (2021). Shifts in alcohol consumption during the COVID-19 pandemic: early indications from Australia. Addiction, 116(6), 1381-1388.

Cao, J., Qiu, W., Yu, Y., Li, N., Wu, H., & Chen, Z. (2022). The association between serum albumin and depression in chronic liver disease may differ by liver histology. BMC Psychiatry, 22(1), 1-10.

Cargill, Z., Kattiparambil, S., Hansi, N., Barnabas, A., Shawcross, D. L., Williams, R., & Agarwal, K. (2021). Severe alcohol-related liver disease admissions post-COVID-19 lockdown: canary in the coal mine?. Frontline Gastroenterology, 12(4), 354-355.

Cerovic, I., Mladenovic, D., Ješic, R., Naumovic, T., Brankovic, M., Vucevic, D., ... & Radosavljevic, T. (2013). Alcoholic liver disease/nonalcoholic fatty liver disease index: distinguishing alcoholic from nonalcoholic fatty liver disease. *European journal of gastroenterology & hepatology*, *25*(8), 899-904.

Chaoji, S., & Humaney, N. (2017). Clinical Profile of Alcoholic Patients Admitted in Medical Wards or Medical Intensive Care Unit in a Tertiary Care Hospital. *alcohol*, *70*, 100calories.

Chavan, S. S., Birajdar, S. V., & Pawar, N. R. (2018). Clinical profile of patients with alcohol use disorder. *International Archives Of Integrated Medicine*, *5*(2), 48-56.

Chavan, V. and G. Harshe (2016). "A Study of Patients of Alcoholic Liver Disease with Special Reference to Different Scoring Systems for Prognostication." Sch J Appl Med Sci Sch J App Med Sci [Internet] 4(5A): 1506-1509.

Chavan, V. and G. Harshe (2016). "A Study of Patients of Alcoholic Liver Disease with Special Reference to Different Scoring Systems for Prognostication." Sch J Appl Med Sci Sch J App Med Sci [Internet] 4(5A): 1506-1509.

Chavan, V. B., & Harshe, G. G. (2016). A Study of Patients of Alcoholic Liver Disease with Special Reference to Different Scoring Systems for Prognostication. *Sch J Appl Med Sci Sch J App Med Sci*, *4*(5A), 1506-9.

Chen, B. R., & Pan, C. Q. (2022). Non-invasive assessment of fibrosis and steatosis in pediatric non-alcoholic fatty liver disease. Clinics and Research in Hepatology and Gastroenterology, 46(1), 101755.

Chen, H., et al. (2021). "Too little, too late: Palliation and end-stage liver disease." Journal of Gastroenterology and Hepatology.

Chen, P.-H., et al. (2021). "Inter-Hospital Escalation-of-Care Referrals for Severe Alcohol-Related Liver Disease with Recent Drinking During the COVID-19 Pandemic." Alcohol and Alcoholism.

Cheng, J. L., Wang, X. L., Yang, S. G., Zhao, H., Wu, J. J., & Li, L. J. (2017). Non-ALT biomarkers for markedly abnormal liver histology among Chinese persistently normal alanine aminotransferase-chronic hepatitis B patients. *World journal of gastroenterology*, *23*(15), 2802.

Cheng, J.-L., et al. (2017). "Non-ALT biomarkers for markedly abnormal liver histology among Chinese persistently normal alanine aminotransferase-chronic hepatitis B patients." World journal of gastroenterology 23(15): 2802.

Cheng, J.-L., et al. (2017). "Non-ALT biomarkers for markedly abnormal liver histology among Chinese persistently normal alanine aminotransferase-chronic hepatitis B patients." World journal of gastroenterology 23(15): 2802.

Clare, Philip J., Alexandra Aiken, Wing See Yuen, Emily Upton, Kypros Kypri, Louisa Degenhardt, Raimondo Bruno et al. "Alcohol use among young Australian adults in May-June 2020 during the COVID-19 pandemic: a prospective cohort study." Addiction (2021).

Crabb, D. W., Im, G. Y., Szabo, G., Mellinger, J. L., & Lucey, M. R. (2020). Diagnosis and Treatment of Alcohol-Associated Liver Diseases: 2019 Practise Guidance From the American Association for the Study of Liver Diseases. *Hepatology*, *71*(1), p309

Cusi, K., et al. (2021). "Efficacy and safety of PXL770, a direct AMP kinase activator, for the treatment of non-alcoholic fatty liver disease (STAMP-NAFLD): a randomised, double-blind, placebo-controlled, phase 2a study." The Lancet Gastroenterology & Hepatology 6(11): 889-902.

da Cunha, V. P., et al. (2022). "Application of the ARIMA Model to Predict Under-Reporting of New Cases of Hansen's Disease during the COVID-19 Pandemic in a Municipality of the Amazon Region." International journal of environmental research and public health 19(1): 415.

Daly, M. and E. Robinson (2021). "High-risk drinking in midlife before versus during the COVID-19 crisis: longitudinal evidence from the United Kingdom." American Journal of Preventive Medicine 60(2): 294-297.

Daly, M. and E. Robinson (2021). "High-risk drinking in midlife before versus during the COVID-19 crisis: longitudinal evidence from the United Kingdom." American Journal of Preventive Medicine 60(2): 294-297.

De Biase, S., Cook, L., Skelton, D. A., Witham, M., & Ten Hove, R. (2020). The COVID-19 rehabilitation pandemic. Age and ageing, 49(5), 696-700.

Deas, D., Johnson, N., & Thomas, S. (2019). Carbohydrate deficient transferrin (CDT) predicts heavy drinking in adolescents with alcohol dependence. *Alcohol*, *81*, 27-30.p8

Decraecker, M., Dutartre, D., Hiriart, J. B., Irles-Depé, M., Chermak, F., Foucher, J., & de Lédinghen, V. (2022). Long-term prognosis of patients with metabolic (dysfunction)-associated fatty liver disease by non-invasive methods. Alimentary pharmacology & therapeutics.

Demilew, D., et al. (2021). "Assessment of alcohol use disorder and its associated factors among alcohol users of medical and surgical outpatients attending a specialized hospital in Gondar, Ethiopia: a cross-sectional study." International Journal of Mental Health Systems 15(1): 1-9.

Diehl, A. M. (2018). "Developmental morphogens & recovery from alcoholic liver disease." Alcohol and Cancer: 145-151.

DiMartini, A. F., et al. (2022). "Barriers to the management of alcohol use disorder and alcohol-associated liver disease: strategies to implement integrated care models." The Lancet Gastroenterology & Hepatology 7(2): 186-195.

Donoghue, K. (2021). The correlates and extent of prescribing of medications for alcohol relapse prevention in England. Addiction.

Dugum, M., & McCullough, A. (2015). Diagnosis and management of alcoholic liver disease. *Journal of clinical and translational hepatology*, *3*(2), 109.

Dumbili, E. W. (2015). *Media, alcohol consumption and young people in an eastern Nigerian university campus: a qualitative study* (Doctoral dissertation, Brunel University London).p17

DuPont, R. L., Shea, C. L., Barthwell, A. G., Baxter, L. E., & Beaubler, A. (2013). Drug Testing: A White Paper of the American Society of Addiction Medicine (ASAM). *American Society of Addiction Medicine. White Paper*.

Eashwar, V. A., et al. (2019). "Pattern of alcohol consumption and its associated morbidity among alcohol consumers in an urban area of Tamil Nadu." Journal of family medicine and primary care 8(6): 2029.

Eashwar, V. A., et al. (2019). "Pattern of alcohol consumption and its associated morbidity among alcohol consumers in an urban area of Tamil Nadu." Journal of family medicine and primary care 8(6): 2029.

Eashwar, V. A., Gopalakrishnan, S., Umadevi, R., & Geetha, A. (2019). Pattern of alcohol consumption and its associated morbidity among alcohol consumers in an urban area of Tamil Nadu. Journal of family medicine and primary care, 8(6), 2029.

Ehrie, J., et al. (2020). "Survey of addiction specialists' use of medications to treat alcohol use disorder." Frontiers in psychiatry 11: 47.

Ehrie, J., et al. (2020). "Survey of addiction specialists' use of medications to treat alcohol use disorder." Frontiers in psychiatry 11: 47.

Ehrie, J., Hartwell, E. E., Morris, P. E., Mark, T. L., & Kranzler, H. R. (2020). Survey of Addiction Specialists' Use of Medications to Treat Alcohol Use Disorder. Frontiers in psychiatry, 11, 47-47.

Ellison, R. C. (2007). Health risks and benefits of moderate alcohol consumption: Proceedings of an international symposium-Introduction to symposium.

Estes, C., et al. (2018). "Modeling the epidemic of nonalcoholic fatty liver disease demonstrates an exponential increase in burden of disease." Hepatology 67(1): 123-133.

Estes, C., et al. (2018). "Modeling the epidemic of nonalcoholic fatty liver disease demonstrates an exponential increase in burden of disease." Hepatology 67(1): 123-133.

European Association For The Study Of The Liver. (2012). EASL clinical practical guidelines: management of alcoholic liver disease. *Journal of Hepatology*, *57*(2), 399-420.

Fatima, K., et al. (2022). "Efficacy of statins in treatment and development of non-alcoholic fatty liver disease and steatohepatitis: a systematic review and meta-analysis." Clinics and Research in Hepatology and Gastroenterology 46(4): 101816.

Flemming, J. A., et al. (2021). "NAFLD and Alcohol-Associated Liver Disease Was Responsible for Almost All New Diagnoses of Cirrhosis in Canada by 2040." Hepatology 74(6): 3330-3344.

Flemming, J. A., et al. (2021). "NAFLD and Alcohol-Associated Liver Disease Will Be Responsible for Almost All New Diagnoses of Cirrhosis in Canada by 2040." Hepatology 74(6): 3330-3344.

Flores, Y. N., Zhang, Z. F., Bastani, R., Leng, M., Crespi, C. M., Ramírez-Palacios, P., ... & Salmerón, J. (2018). Risk factors for liver disease among adults of Mexican descent in the United States and Mexico. *World journal of gastroenterology*, *24*(37), 4281.

Francis, J. M., et al. (2015). "Comparison of self-reported alcohol use with the alcohol biomarker phosphatidylethanol among young people in northern Tanzania." Drug and alcohol dependence 156: 289-296.

Francis, J. M., et al. (2015). "Comparison of self-reported alcohol use with the alcohol biomarker phosphatidylethanol among young people in northern Tanzania." Drug and alcohol dependence 156: 289-296.

Francis, J. M., Weiss, H. A., Helander, A., Kapiga, S. H., Changalucha, J., & Grosskurth, H. (2015). Comparison of self-reported alcohol use with the alcohol biomarker phosphatidylethanol among young people in northern Tanzania. *Drug and alcohol dependence*, *156*, 289-296.

Freedman, L. S., Kipnis, V., Schatzkin, A., Tasevska, N., & Potischman, N. (2010). Can we use biomarkers in combination with self-reports to strengthen the analysis of nutritional epidemiologic studies? *Epidemiologic Perspectives & Innovations*, *7*(1), 2.

Freiman, J. M., et al. (2021). "Prevalence of elevated liver transaminases and their relationship with alcohol use in people living with HIV on anti-retroviral therapy in Uganda." PloS one 16(6): e0250368.

Freiman, J. M., et al. (2021). "Prevalence of elevated liver transaminases and their relationship with alcohol use in people living with HIV on anti-retroviral therapy in Uganda." PloS one 16(6): e0250368.

Froehlich, J. C., et al. (2015). "Prazosin reduces alcohol intake in an animal model of alcohol relapse." Alcoholism: Clinical and Experimental Research 39(8): 1538-1546.

Froehlich, J. C., et al. (2015). "Prazosin reduces alcohol intake in an animal model of alcohol relapse." Alcoholism: Clinical and Experimental Research 39(8): 1538-1546.

Fujii, H., Nishimoto, N., Yamaguchi, S., Kurai, O., Miyano, M., Ueda, W., ... & Okawa, K. (2016). The Alcohol Use Disorders Identification Test for Consumption (AUDIT-C) is more useful than pre-existing laboratory tests for predicting hazardous drinking: a cross-sectional study. *BMC public health*, *16*(1), 379.

Gala, K. S. and V. Vatsalya (2020). "Emerging noninvasive biomarkers, and medical management strategies for alcoholic hepatitis: present understanding and scope." Cells 9(3): 524.

Gala, K. S., & Vatsalya, V. (2020). Emerging Noninvasive Biomarkers, and Medical Management Strategies for Alcoholic Hepatitis: Present Understanding and Scope. *Cells*, *9*(3), p524.

Gandhi, C. R. (2020). "Pro-and anti-fibrogenic functions of gram-negative bacterial lipopolysaccharide in the liver." Frontiers in medicine 7: 130.

Gao, B., et al. (2019). "Inflammatory pathways in alcoholic steatohepatitis." Journal of hepatology 70(2): 249-259.

Gao, B., et al. (2021). "Microbial Products and Metabolites Contributing to Alcohol-Related Liver Disease." Molecular Nutrition & Food Research 65(5): 2000023.

Garcia-Cortes, M., et al. (2020). "Drug induced liver injury: An update." Archives of Toxicology: 1-27.

Garnett, C., et al. (2022). "Alcohol consumption and associations with sociodemographic and health-related characteristics in Germany: A population survey." Addictive behaviors 125: 107159.

George, I. B., Foster, P. C., & Hall, L. E. (2011). Other Theories from the 19505. *Nursing Theories: The Base for Professional Nursing Practise, 6/e*, 181.

Gerussi, A., Bernasconi, D. P., O'Donnell, S. E., Lammers, W. J., Van Buuren, H., Hirschfield, G., ... & GLOBAL PBC Study Group. (2021). Measurement of gamma glutamyl transferase to determine risk of liver transplantation or death in patients with primary biliary cholangitis. Clinical Gastroenterology and Hepatology, 19(8), 1688-1697.

Ghosh, S., et al. (2019). "Alcohol biomarkers and their relevance in detection of alcohol consumption in clinical settings." Int Arch Subst Abuse Rehabil 1(002).

Ghosh, S., Jain, R., Jhanjee, S., Rao, R., & Mishra, A. (2019). Alcohol biomarkers and their relevance in detection of alcohol consumption in clinical settings. Int Arch Subst Abuse Rehabil, 1(002).

Ginès, P., Castera, L., Lammert, F., Graupera, I., Serra-Burriel, M., Allen, A. M., ... & LiverScreen Consoughtium Investigators. (2022). Population screening for liver fibrosis: Toward early diagnosis and intervention for chronic liver diseases. Hepatology, 75(1), 219-228.

Gonzales, K., Roeber, J., Kanny, D., Tran, A., Saiki, C., Johnson, H., ... & Miller, T. (2014). Alcohol-attributable deaths and years of potential life lost—11 states, 2006–2010. *MMWR Morb Mortal Wkly Rep*, *63*(10), 213-216.

Gough, G., et al. (2015). "The utility of commonly used laboratory tests to screen for excessive alcohol use in clinical practise." Alcoholism: Clinical and Experimental Research 39(8): 1493-1500.

Gough, G., Heathers, L., Puckett, D., Westerhold, C., Ren, X., Yu, Z., ... & Liangpunsakul, S. (2015). The utility of commonly used laboratory tests to screen for excessive alcohol use in clinical practise. *Alcoholism: Clinical and Experimental Research*, *39*(8), 1493-1500.

Gowin, J. L., et al. (2017). "Vulnerability for alcohol use disorder and rate of alcohol consumption." American Journal of Psychiatry 174(11): 1094-1101.

Gowin, J. L., et al. (2017). "Vulnerability for alcohol use disorder and rate of alcohol consumption." American Journal of Psychiatry 174(11): 1094-1101.

Gutierrez, H. L., Hund, L., Shrestha, S., Rayburn, W. F., Leeman, L., Savage, D. D., & Bakhireva, L. N. (2015). Ethylglucuronide in maternal hair as a biomarker of prenatal alcohol exposure. *Alcohol*, *49*(6), 617-623.

Haile, Y. G., Kebede, K. B., Limenhe, A., Habatmu, K., & Alem, A. (2020). Alcohol use disorder among prisoners in Debre Berhan prison, Ethiopia: a cross-sectional study. Substance abuse treatment, prevention, and policy, 15, 1-11.

Hamada, H., Ando, W., Takao, M., & Sugano, N. (2021). Gamma-Glutamyl Transferase: A Useful Marker of Habitual Drinking in Cases of Alcohol-Associated Osteonecrosis of the Femoral Head. Alcohol and Alcoholism, 56(2), 175-180.

Harper, G. W., et al. (2021). "Mental health challenges and needs among sexual and gender minority people in western Kenya." International journal of environmental research and public health 18(3): 1311.

Harris, A. H., Ellerbe, L., Reeder, R. N., Bowe, T., Gordon, A. J., Hagedorn, H., ... & Trafton, J. A. (2013). Pharmacotherapy for alcohol dependence: Perceived treatment barriers and action strategies among Veterans Health Administration service providers. *Psychological services*, *10*(4), 410.

Harris, J. C., Leggio, L., & Farokhnia, M. (2021). Blood Biomarkers of Alcohol Use: A Scoping Review. Current Addiction Reports, 8(4), 500-508.

Hayde, N. (2021). "Substance use and abuse in pediatric transplant recipients: What the transplant provider needs to know." Pediatric Transplantation 25(1): e13877.

Helander, A., Böttcher, M., Fehr, C., Dahmen, N., & Beck, O. (2008). Detection times for urinary ethyl glucuronide and ethyl sulfate in heavy drinkers during alcohol detoxification. *Alcohol & Alcoholism*, *44*(1), 55-61.

Herrick-Reynolds, K. M., et al. (2021). "Evaluation of early vs standard liver transplant for alcohol-associated liver disease." JAMA surgery 156(11): 1026-1034.

Higgins-Biddle, J. C. and T. F. Babor (2018). "A review of the Alcohol Use Disorders Identification Test (AUDIT), AUDIT-C, and USAUDIT for screening in the United States: Past issues and future directions." The American journal of drug and alcohol abuse 44(6): 578-586.

Hofmeister, M. G., et al. (2021). "Factors Associated With Hepatitis A Mortality During Person-to-Person Outbreaks: A Matched Case–Control Study—United States, 2016-2019." Hepatology 74(1): 28-40.

Høiseth, G., Hilberg, T., Trydal, T., Husa, A., Vindenes, V., & Bogstrand, S. T. (2022). The alcohol marker phosphatidylethanol is closely related to AST, GGT, ferritin and HDL-C. Basic & Clinical Pharmacology & Toxicology, 130(1), 182-190.

Hundt, M. A., Deng, Y., Ciarleglio, M. M., Nathanson, M. H., & Lim, J. K. (2020). Abnormal Liver Tests in COVID-19: A Retrospective Observational Cohort Study of 1,827 Patients in a Major US Hospital Network. *Hepatology*, *72*(4), 1169-1176.

Imajo, K., et al. (2022). "MRI-Based Quantitative R2* Mapping at 3 Tesla Reflects Hepatic Iron Overload and Pathogenesis in Nonalcoholic Fatty Liver Disease Patients." Journal of Magnetic Resonance Imaging 55(1): 111-125.

Jain, A. K., & Nandy, P. (2018). Study of clinical, laboratory, and upper gastrointestinal endoscopic profile in patients of alcoholic liver disease in Sikkim. *Medical Journal of Dr. DY Patil Vidyapeeth*, *11*(3), 228.

Jain, D., et al. (2021). "Evolution of the liver biopsy and its future." Translational Gastroenterology and Hepatology 6.

Jamali, R. (2013). Non-alcoholic fatty liver disease: Diagnosis and evaluation of disease severity. *Thrita*, *2*(4), 43-51.

James, D. B., Lee, K. K., Patrao, T., Courtney, R. J., Conigrave, K. M., & Shakeshaft, A. (2020). Understanding the client characteristics of Aboriginal residential alcohol and other drug rehabilitation services in New South Wales, Australia. Addiction science & clinical practise, 15(1), 1-14.

Jang, Y., et al. (2021). "A qualitative study of self-management experiences in people with non-alcoholic fatty liver disease." Nursing Open 8(6): 3135-3142.

Jenkins, R., et al. (2015). "Alcohol consumption and hazardous drinking in western Kenya—a household survey in a health and demographic surveillance site." BMC psychiatry 15(1): 1-10.

Jenkins, R., Othieno, C., Ongeri, L., Kiima, D., Sifuna, P., Kingora, J., ... & Ogutu, B. (2015). Alcohol consumption and hazardous drinking in western Kenya—a household survey in a health and demographic surveillance site. *BMC psychiatry*, *15*(1), 230.

Julien, J., Ayer, T., Bethea, E. D., Tapper, E. B., & Chhatwal, J. (2020). Projected prevalence and mortality associated with alcohol-related liver disease in the USA, 2019–40: a modelling study. The Lancet Public Health, 5(6), e316-e323.

Julien, J., Ayer, T., Bethea, E. D., Tapper, E. B., & Chhatwal, J. (2020). Projected prevalence and mortality associated with alcohol-related liver disease in the USA, 2019–40: a modelling study. The Lancet Public Health, 5(6), e316-e323.

Julien, J., et al. (2020). "Projected prevalence and mortality associated with alcohol-related liver disease in the USA, 2019–40: a modelling study." The Lancet Public Health 5(6): e316-e323.

Kader, R., Seedat, S., Koch, J. R., & Parry, C. D. (2012). A preliminary investigation of the AUDIT and DUDIT in comparison to biomarkers for alcohol and drug use among HIV-infected clinic attendees in Cape Town, South Africa. *African journal of psychiatry*, *15*(5), 346-351.

Kamath, P. S. and W. R. Kim (2007). "The model for end-stage liver disease (MELD)." Hepatology 45(3): 797-805.

Kamau, E. and G. MacNaughton (2019). "The Impact of SDG 3 on Health Priorities in Kenya." Journal of Developing Societies 35(4): 458-480.

Kang, K., et al. (2021). "Distinctive gut microbial dysbiosis between chronic alcoholic fatty liver disease and metabolic-associated fatty liver disease in mice." Experimental and therapeutic medicine 21(5): 1-14.

Kapuria, D., Bollipo, S., Rabiee, A., Ben-Yakov, G., Kumar, G., Siau, K., ... & Global Online Alliance for Liver Studies (GOAL). (2021). Roadmap to resuming care for liver diseases after coronavirus disease-2019. Journal of gastroenterology and hepatology, 36(4), 885-892.

Kapuria, D., et al. (2021). "Roadmap to resuming care for liver diseases after coronavirus disease-2019." Journal of Gastroenterology and Hepatology 36(4): 885-892.

Kapuria, D., et al. (2021). "Roadmap to resuming care for liver diseases after coronavirus disease-2019." Journal of Gastroenterology and Hepatology 36(4): 885-892.

Kawaida, K., et al. (2021). "Optimal Cutoff Values of the Alcohol Use Disorders Identification Test and its Short Version for Detecting Excessive Alcohol Use in Japanese College Students." The Tohoku Journal of Experimental Medicine 253(1): 3-10.

Khalifa, A., et al. (2021). "The Utility of Liver Biopsy in the Evaluation of Liver Disease and Abnormal Liver Function Tests." American Journal of Clinical Pathology.

Khatiwada, P., et al. (2020). "Alcoholic Hepatitis: A Common Disease with Uncommon Presentation." Case Reports in Gastroenterology 14(2): 448-452.

Kim, D., Adeniji, N., Latt, N., Kumar, S., Bloom, P. P., Aby, E. S., ... & Dhanasekaran, R. (2021). Predictors of outcomes of COVID-19 in patients with chronic liver disease: US multi-center study. Clinical Gastroenterology and Hepatology, 19(7), 1469-1479.

Kim, S.-H., et al. (2021). "Study on the pathogenesis of liver injury caused by alcohol and drugs." Journal of Exercise Rehabilitation 17(5): 319.

Kirouac, M., Kruger, E., Wilson, A. D., Hallgren, K. A., & Witkiewitz, K. (2019). Consumption outcomes in clinical trials of alcohol use disorder treatment: Consideration of standard drink misestimation. The American journal of drug and alcohol abuse, 45(5), 451-459.

Kisseleva, T. and D. Brenner (2021). "Molecular and cellular mechanisms of liver fibrosis and its regression." Nature Reviews Gastroenterology & Hepatology 18(3): 151-166.

Kolade, O. A., Tijani, A., Oloyede Oladeji, M., & Bayo Lawal, A. (2014). Midwives' Knowledge and Utilization of Anti-Shock Garment In Prevention of Postpartum Haemorrhage Shock at the University College Hospital, Ibadan Nigeria. *IOSR J Nurs Health Sci*, *3*, 9-16.

Kolla, B. P., et al. (2021). "Prevalence of insomnia symptoms and associated risk factors in UK Biobank participants with hazardous alcohol use and major depression." Drug and alcohol dependence 229: 109128.

Kunutsor, S. K., Apekey, T. A., Seddoh, D., & Walley, J. (2014). Liver enzymes and risk of all-cause mortality in general populations: a systematic review and meta-analysis. *International journal of epidemiology*, *43*(1), 187-201.

Kwo, P. Y., Cohen, S. M., & Lim, J. K. (2017). ACG clinical guideline: evaluation of abnormal liver chemistries. *The American journal of gastroenterology*, *112*(1), 18.

Kwong, E. K. and P. Puri (2021). "Gut microbiome changes in Nonalcoholic fatty liver disease & alcoholic liver disease." Translational Gastroenterology and Hepatology 6.

Lachenmeier, D. W., et al. (2021). "The impact of unrecorded alcohol use on health: What do we know in 2020?" Journal of Studies on Alcohol and Drugs 82(1): 28-41.

Lachenmeier, D. W., et al. (2021). "The impact of unrecorded alcohol use on health: What do we know in 2020?" Journal of Studies on Alcohol and Drugs 82(1): 28-41.

Lala, V., et al. (2020). "Liver function tests." StatPearls [Internet].

Lala, V., Goyal, A., Bansal, P., & Minter, D. (2020). Liver function tests. *StatPearls*.

Lawler, S., et al. (2021). "Unpacking violent behavior in young adulthood: the relative importance of hazardous alcohol use." Journal of interpersonal violence: 08862605211044103.

Liang, H.-W., et al. (2021). "Mulberry leaves extract ameliorates alcohol-induced liver damages through reduction of acetaldehyde toxicity and inhibition of apoptosis caused by oxidative stress signals." International Journal of Medical Sciences 18(1): 53.

Lim, S. S., et al. (2016). "Measuring the health-related Sustainable Development Goals in 188 countries: a baseline analysis from the Global Burden of Disease Study 2015." The Lancet 388(10053): 1813-1850.

Lindvig, K. P., et al. (2021). "Diagnostic accuracy of routine liver function tests to identify patients with significant and advanced alcohol-related liver fibrosis." Scandinavian Journal of Gastroenterology 56(9): 1088-1095.

Litten, R. Z., Bradley, A. M., & Moss, H. B. (2010). Alcohol biomarkers in applied settings: recent advances and future research opportunities. *Alcoholism: Clinical and Experimental Research*, *34*(6), 955-967.

Liu, Z., et al. (2021). "Global trend of aetiology-based primary liver cancer incidence from 1990 to 2030: A modelling study." International Journal of Epidemiology 50(1): 128-142.

Liu, Z., Xu, K., Jiang, Y., Cai, N., Fan, J., Mao, X., ... & Chen, X. (2021). Global trend of aetiology-based primary liver cancer incidence from 1990 to 2030: A modelling study. International Journal of Epidemiology, 50(1), 128-142.

Llamosas-Falcón, L., Shield, K. D., Gelovany, M., Hasan, O. S., Manthey, J., Monteiro, M., ... & Rehm, J. (2021). Impact of alcohol on the progression of HCV-related liver disease: A systematic review and meta-analysis. Journal of Hepatology.

Long, J. E., et al. (2020). "Alcohol use and viral suppression in HIV-positive Kenyan female sex workers on antiretroviral therapy." PloS one 15(11): e0242817.

Lu, J., et al. (2020). "Co-expression of alcohol dehydrogenase and aldehyde dehydrogenase in Bacillus subtilis for alcohol detoxification." Food and Chemical Toxicology 135: 110890.

Ma, X., et al. (2022). "Relationship of circulating total bilirubin, UDP-glucuronosyltransferases 1A1 and the development of non-alcoholic fatty liver disease: a cross-sectional study." BMC gastroenterology 22(1): 1-7.

Machado, P. M. A., et al. (2021). "Analysis of the AUDIT factor structure in adolescents between 18 and 19 years." Revista de saude publica 55.

Madson, M. B., Schutts, J. W., Jordan, H. R., Villarosa-Hurlocker, M. C., Whitley, R. B., & Mohn, R. S. (2020). Identifying at-risk college student drinkers with the AUDIT-US: a receiver operating characteristic curve analysis. *Assessment*, *27*(6), 1089-1099

Mahboub, N., et al. (2021). "People who use drugs in rehabilitation, from chaos to discipline: Advantages and pitfalls: A qualitative study." PloS one 16(2): e0245346.

Mahpour, A. and A. C. Mullen (2021). "Our emerging understanding of the roles of long non-coding RNAs in normal liver function, disease, and malignancy." JHEP Reports 3(1): 100177.

Malakouti, M., et al. (2017). "Elevated liver enzymes in asymptomatic patients–what should I do?" Journal of clinical and translational hepatology 5(4): 394.

Malakouti, M., Kataria, A., Ali, S. K., & Schenker, S. (2017). Elevated Liver Enzymes in Asymptomatic Patients–What Should I Do?. *Journal of clinical and translational hepatology*, *5*(4), 394..

Manning, V., et al. (2021). "Effect of cognitive bias modification on early relapse among adults undergoing inpatient alcohol withdrawal treatment: a randomized clinical trial." JAMA psychiatry 78(2): 133-140.

Manning, V., Garfield, J. B., Staiger, P. K., Lubman, D. I., Lum, J. A., Reynolds, J., ... & Verdejo-Garcia, A. (2021). Effect of cognitive bias modification on early relapse among adults undergoing inpatient alcohol withdrawal treatment: a randomized clinical trial. JAMA psychiatry, 78(2), 133-140.

Manning, V., Piercy, H., Garfield, J. B. B., & Lubman, D. I. (2020). Personalized approach bias modification smartphone app ("SWIPE") to reduce alcohol use among people drinking at hazardous or harmful levels: protocol for an open-label feasibility study. JMIR research protocols, 9(8), e21278.

Manthey, J., et al. (2019). "Global alcohol exposure between 1990 and 2017 and forecasts until 2030: a modelling study." The Lancet 393(10190): 2493-2502.

Mantovani, A., et al. (2022). "Non-alcoholic fatty liver disease and risk of incident chronic kidney disease: an updated meta-analysis." Gut 71(1): 156-162.

Mathurin, P., & Bataller, R. (2015). Trends in the management and burden of alcoholic liver disease. *Journal of hepatology*, *62*(1), S38-S46.

Mellinger, J. L., et al. (2020). PROVIDER ATTITUDES AND PRACTISES FOR ALCOHOL SCREENING, TREATMENT AND EDUCATION IN PATIENTS WITH LIVER DISEASE. The Liver Meeting Digital Experience™, AASLD.

Mellinger, J., Winder, G. S., & Fernandez, A. C. (2021). Measuring the Alcohol in Alcohol-Associated Liver Disease: Choices and Challenges for Clinical Research. Hepatology, 73(3), 1207-1212.

Méndez-Sánchez, N., et al. (2020). "The mechanism of dysbiosis in alcoholic liver disease leading to liver cancer." Hepatoma research 6.

Mendez-Sanchez, N., et al. (2021). "The Latin American Association for the Study of the Liver (ALEH) position statement on the redefinition of fatty liver disease." The Lancet Gastroenterology & Hepatology 6(1): 65-72.

Mendizabal, M., Ridruejo, E., Piñero, F., Anders, M., Padilla, M., Toro, L. G., ... & Silva, M. O. (2021). Comparison of different prognostic scores for patients with cirrhosis hospitalized with SARS-CoV-2 infection. Annals of hepatology, 25, 100350.

Messina, M. P., et al. (2021). "Knowledge and practise towards alcohol consumption in a sample of university students." International journal of environmental research and public health 18(18): 9528.

Michalopoulos, G. K. and B. Bhushan (2021). "Liver regeneration: biological and pathological mechanisms and implications." Nature reviews Gastroenterology & hepatology 18(1): 40-55.

Mitra, P. (2022). Substance Use in Older Adults. In Substance and Non-Substance Related Addictions (pp. 39-48). Springer, Cham.

Molla, N. H., Kathak, R. R., Sumon, A. H., Barman, Z., Mou, A. D., Hasan, A., ... & Ali, N. (2021). Assessment of the relationship between serum uric acid levels and liver enzymes activity in Bangladeshi adults. Scientific Reports, 11(1), 1-9.

Monk, R. and D. Heim (2021). "The contextual milieu of alcohol consumption." The handbook of the psychology of alcohol consumption. Palgrave Macmillan.

Mookerjee RP, Lackner C, Stauber R, Stadlbauer V, Deheragoda M, Aigelsreiter A, et al. The role of liver biopsy in the diagnosis and prognosis of patients with acute deterioration of alcoholic cirrhosis. J Hepatol 2011;55:1103–1111

Moriarty, K. J. (2020). Alcohol care teams: where are we now?. Frontline Gastroenterology, 11(4), 293-302.

Moriles, K. and S. Azer (2021). "Alanine amino transferase." StatPearls.

Moriles, K., & Azer, S. (2021). Alanine amino transferase. StatPearls. Retrieved from https://www.statpearls.com/articlelibrary/viewarticle/56363/ on 07/01/2022 .

Moriles, K., & Azer, S. (2021). Alanine amino transferase. StatPearls. Retrieved from https://www.statpearls.com/articlelibrary/viewarticle/56363/ on 07/01/2022 .

Moura Cunha, G., et al. (2021). "Quantitative magnetic resonance imaging for chronic liver disease." The British journal of radiology 94(1121): 20201377.

Moura Cunha, G., et al. (2021). "Quantitative magnetic resonance imaging for chronic liver disease." The British journal of radiology 94(1121): 20201377.

Mugenda, O. M., & Mugenda, A. G. (2003). Research methods. *Quantitative and qualitative approaches*, 46-48.

Muñiz-Hernández, S., Velázquez-Fernández, J. B., Díaz-Chávez, J., López-Sánchez, R. C., Hernández, J. A., & Rendón-Ramírez, A. (2014). Alcoholism: Common and Oxidative Damage Biomarkers. *Journal of Clinical Toxicology*, *S*, *7*, S7-006.

NACADA, 2012. National Survey on Drug Abuse in Kenya http://www.nacada.go.ke/component/content/article/19-highlights/71-drug-highlights. Accessed on 7th July 2016

Nath, P., & Singh, S. P. (2016). Serum Transaminases: Quo Vadis. *Biochem Anal Biochem*, *5*(260), 2161-1009.

Nati, M., et al. (2022). "The Role of Innate Immune Cells in Nonalcoholic Fatty Liver Disease." Journal of Innate Immunity 14(1): 31-41.

Ndrepepa, G. (2021). "Aspartate aminotransferase and cardiovascular disease–a narrative review." J Lab Precis Med 6: 8725.

Negi, C. K., et al. (2022). "Insights into the molecular targets and emerging pharmacotherapeutic interventions for nonalcoholic fatty liver disease." Metabolism 126: 154925.

Neuman, M. G., Mueller, J., & Mueller, S. (2021). Non-invasive Biomarkers of Liver Inflammation and Cell Death in Response to Alcohol Detoxification. Frontiers in physiology, 12.

Newsome, P. N., et al. (2018). "Guidelines on the management of abnormal liver blood tests." Gut 67(1): 6-19.

Ngo, B., et al. (2021). "Hazardous alcohol use is associated with greater pain interference and prescription opioid misuse among persons living with HIV and chronic pain." BMC Public Health 21(1): 1-9.

Niclasen, B., et al. (2021). "Implementation of AUDIT in the treatment planning process for alcohol use disorder in Greenland." Nordic Journal of Psychiatry 75(2): 145-151.

Niclasen, B., Flyger, J., Becker, U., Nielsen, B., & Nielsen, A. S. (2021). Implementation of AUDIT in the treatment planning process for alcohol use disorder in Greenland. Nordic Journal of Psychiatry, 75(2), 145-151.

Niemelä, O. (2016). Biomarker-based approaches for assessing alcohol use disorders. *International journal of environmental research and public health*, *13*(2), 166.

Niemelä, O. and Maremmani, I. (2016) Biomarker-Based Approaches for Assessing Alcohol Use Disorders; International Journal of Environmental Research and Public Health; 13, 166, 1-19.

Nivukoski, U., Bloigu, A., Bloigu, R., Kultti, J., Tuomi, H., & Niemelä, O. (2021). Comparison of serum calprotectin, a marker of neutrophil activation, and other mediators of inflammation in response to alcohol consumption. Alcohol, 95, 45-50.

Noorbakhsh, S., et al. (2018). "Psychometric properties of the Alcohol Use Disorders Identification Test (AUDIT) and prevalence of alcohol use among Iranian psychiatric outpatients." Substance abuse treatment, prevention, and policy 13(1): 1-8.

Ochiai, Y., Kawamura, Y., Kobayashi, M., Shindoh, J., Kobayashi, Y., Okubo, S., ... & Kumada, H. (2021). Effects of alcohol consumption on multiple hepatocarcinogenesis in patients with fatty liver disease. Hepatology Research, 51(1), 62-68.

Oh, R. C., et al. (2017). "Mildly elevated liver transaminase levels: causes and evaluation." American family physician 96(11): 709-715.

Oh, R., Hustead, T. R., Ali, S. M., & Pantsari, M. W. (2017). Mildly elevated liver transaminase levels: causes and evaluation. *American family physician*, *96*(11), 709-715.

Organization, W. H. (2010). "Global information system on alcohol and health." Geneva: World Health Organization.

Organization, W. H. (2010). Global strategy to reduce the harmful use of alcohol, World Health Organization.

Organization, W. H. (2013). Global action plan for the prevention and control of noncommunicable diseases 2013-2020, World Health Organization.

Organization, W. H. (2019). Global status report on alcohol and health 2018, World Health Organization.

O'toole, M. S., Zachariae, R., Renna, M. E., Mennin, D. S., & Applebaum, A. (2017). Cognitive behavioral therapies for informal caregivers of patients with cancer and cancer survivors: a systematic review and meta-analysis. *Psycho-Oncology*, *26*(4), 428-437.

Palepu, A., Khan, N. A., Norena, M., Wong, H., Chittock, D. R., & Dodek, P. M. (2008). The role of HIV infection and drug and alcohol dependence in hospital mortality among critically ill patients. *Journal of critical care*, *23*(3), 275-280.

Palit, P., et al. (2021). "Phytopharmaceuticals mediated Furin and TMPRSS2 receptor blocking: can it be a potential therapeutic option for Covid-19?" Phytomedicine 85: 153396.

Panel, C. P. G., et al. (2021). "EASL Clinical Practise Guidelines on non-invasive tests for evaluation of liver disease severity and prognosis–2021 update." Journal of hepatology.

Patel, R. and M. Mueller (2021). "Alcoholic liver disease." StatPearls [Internet].

Paulus, D. J., et al. (2021). "Difficulties regulating positive and negative emotions in relation to coping motives for alcohol use and alcohol problems among hazardous drinkers." Addictive behaviors 115: 106781.

Pearson, M. M., et al. (2021). "Associations Between Alcohol Use and Liver-Related Outcomes in a Large National Cohort of Patients With Cirrhosis." Hepatology Communications 5(12): 2080-2095.

Petersen, O. H. (2021). Different Effects of Alcohol on the Liver and the Pancreas. Function, 2(2), zqab008.

Phillips, T., Porter, A., & Sinclair, J. (2020). Clinical competencies for the Care of Hospitalized Patients with alcohol use disorders. Alcohol and Alcoholism, 55(4), 395-400.

Pilowsky, D. J., & Wu, L. T. (2012). Screening for alcohol and drug use disorders among adults in primary care: a review. *Subst Abuse Rehabil*.

Puya Y. (2021) High Alkaline Phosphatase Symptoms & How to Reduce It retrieved from https://labs.selfdecode.com/blog/alkaline-phosphatase/ on 16/01/2022

Quante, A. S., et al. (2016). "Projections of cancer incidence and cancer-related deaths in Germany by 2020 and 2030." Cancer medicine 5(9): 2649-2656.

Quante, A. S., Ming, C., Rottmann, M., Engel, J., Boeck, S., Heinemann, V., ... & Strauch, K. (2016). Projections of cancer incidence and cancer-related deaths in Germany by 2020 and 2030. Cancer medicine, 5(9), 2649-2656.

Rashid, A., et al. "Financing of NCD Prevention in LMICs: Kenya Case Study."

Rasmussen, D. N., et al. (2021). "Prognostic performance of seven biomarkers compared to liver biopsy in early alcohol-related liver disease." Journal of Hepatology.

Rathod, S., et al. (2018). "Prevalence and correlates of alcohol use in a central Nepal district: secondary analysis of a population-based cross-sectional study." Global Mental Health 5.

Rehm, J., et al. (2020). "Adaptation of and protocol for the validation of the alcohol use disorders identification test (audit) in the russian federation for use in primary healthcare." Alcohol and Alcoholism 55(6): 624-630.

Reichenheim, M. E., Interlenghi, G. S., Ferreira, M. F., & de Moraes, C. L. (2021). The Alcohol Use Disorders Identification Test (AUDIT) in Adolescents: Using a Model-Based Approach to Identify Patterns of Alcohol Misuse. Substance Use & Misuse, 56(13), 1915-1922.

Rhodes, D. (2019). Drug and alcohol services cut by£ 162m as deaths increase2018 20 August 2019.

Rhodes, D. (2019). Drug and alcohol services cut by£ 162m as deaths increase2018 20 August 2019.

Rigopoulou, E. I., et al. (2021). "Alcoholic liver disease and autoimmune hepatitis: Sometimes a closer look under the surface is needed." European Journal of Internal Medicine 85: 86-91.

Rigopoulou, E. I., Gatselis, N., Arvaniti, P., Koukoulis, G. K., & Dalekos, G. N. (2021). Alcoholic liver disease and autoimmune hepatitis: Sometimes a closer look under the surface is needed. European Journal of Internal Medicine, 85, 86-91.

Rose, L., Yu, L., Casey, J., Cook, A., Metaxa, V., Pattison, N., ... & Meyer, J. (2021). Communication and virtual visiting for families of patients in intensive care

during COVID-19: A UK national survey. Annals of the American Thoracic Society, (ja).

Rumgay, H., et al. (2021). "Global burden of cancer in 2020 attributable to alcohol consumption: a population-based study." The Lancet Oncology 22(8): 1071-1080.

Rungratanawanich, W., et al. (2021). "Advanced glycation end products (AGEs) and other adducts in aging-related diseases and alcohol-mediated tissue injury." Experimental & Molecular Medicine 53(2): 168-188.

Rutayisire, R. (2017). Establishment of Adult Reference Intervals for Selected Biochemical Analytes in Adult Rwandan Population (Doctoral dissertation, COHES, JKUAT).

Salık, F., et al. (2021). "Liver function as a predictor of mortality in COVID-19: A retrospective study." Annals of hepatology 26: 100553.

Samuelson, D. R., et al. (2019). "Intestinal Microbial Products From Alcohol-Fed Mice Contribute to Intestinal Permeability and Peripheral Immune Activation." Alcoholism: Clinical and Experimental Research 43(10): 2122-2133.

Savola, O., Niemelä, O., & Hillbom, M. (2004). Blood alcohol is the best indicator of hazardous alcohol drinking in young adults and working-age patients with trauma. *Alcohol and Alcoholism*, *39*(4), 340-345.

Schaub, M. P., Tiburcio, M., Martínez-Vélez, N., Ambekar, A., Bhad, R., Wenger, A., ... & Souza-Formigoni, M. L. O. (2021). The effectiveness of a web-based self-help program to reduce alcohol use among adults with drinking patterns considered harmful, hazardous, or suggestive of dependence in four low-and middle-income countries: randomized controlled trial. Journal of medical Internet research, 23(8), e21686.

Scholey, A., Ayre, E., Stock, A. K., Verster, J. C., & Benson, S. (2020). Effects of Rapid Recovery on Alcohol Hangover Severity: A Double-Blind, Placebo-Controlled, Randomized, Balanced Crossover Trial. *Journal of Clinical Medicine*, *9*(7), 2175.p1

Ščupáková, K. r., et al. (2018). "Spatial systems lipidomics reveals nonalcoholic fatty liver disease heterogeneity." Analytical chemistry 90(8): 5130-5138.

Seitz, H. K. and M. G. Neuman (2021). "The history of alcoholic liver disease: From an unrecognized disease to one of the most frequent diseases in hepatology." Journal of clinical medicine 10(4): 858.

Seitz, H. K., Bataller, R., Cortez-Pinto, H., Gao, B., Gual, A., Lackner, C., ... & Tsukamoto, H. (2018). Alcoholic liver disease. *Nature Reviews Disease Primers*, *4*(1), 16.

Shah, V. H. (2015). Managing alcoholic liver disease. *Clinical and molecular hepatology*, *21*(3), 212-219.

Sharma, S. (2021). Assessing NGO's engagement in WASH: The contributions of school sanitation projects to just transition, Hochschulbibliothek der Technischen Hochschule Köln.

Shen, N. T., et al. (2021). "Identification of Quantifiable Predictors of Relapse in Patients with Alcohol-Associated Liver Disease." Hepatology Communications.

Sheng, G., Peng, N., Hu, C., Zhong, L., Zhong, M., & Zou, Y. (2021). The albumin-to-alkaline phosphatase ratio as an independent predictor of future non-alcoholic fatty liver disease in a 5-year longitudinal cohort study of a non-obese Chinese population. Lipids in Health and Disease, 20(1), 1-10.

Shreevastva, N. K., et al. (2017). "A study of AST: ALT ratio in alcoholic and nonalcoholic liver diseases'." Saudi Journal of Medical and Pharmaceutical Sciences 49(29): 1047-1050.

Shreevastva, N. K., Pandeya, A., & Mishra, D. K. (2017). A study of AST: ALT ratio in alcoholic and nonalcoholic liver diseases'. *Saudi Journal of Medical and Pharmaceutical Sciences*, *49*(29), 1047-1050.

Shwetha, R., Rani, S. U., & Ashok, J. (2021). Study of Profile of Alcoholics Attending Deaddiction Center: A Cross-Sectional Study. Annals of Community Health, 9(1), 303-307.

Simonetto, D. A., Shah, V. H., & Kamath, P. S. (2020). Outpatient management of alcohol-related liver disease. *The Lancet Gastroenterology & Hepatology*, *5*(5), 485-493.

Singal, A. K. and P. Mathurin (2021). "Diagnosis and treatment of alcohol-associated liver disease: A review." Jama 326(2): 165-176.

Singal, A. K., Bataller, R., Ahn, J., Kamath, P. S., & Shah, V. H. (2018). ACG clinical guideline: alcoholic liver disease. *The American journal of gastroenterology*, *113*(2), 175.

Snowden, A., Donnell, A., & Duffy, T. (2014). *Pioneering theories in nursing*. Andrews UK Limited.

Solomons, H. D. (2012) Carbohydrate deficient transferrin and alcoholism Vol. 2: pg. 75-78

Stephens, C., et al. (2019). "Drug-Induced Liver Disease: Mechanism and Diagnosis." Evidence-based Gastroenterology and Hepatology 4e: 715-728.

Stoner, S. A., Mikko, A. T., & Carpenter, K. M. (2014). Web-based training for primary care providers on screening, brief intervention, and referral to treatment (SBIRT) for alcohol, tobacco, and other drugs. *Journal of substance abuse treatment*, *47*(5), 362-370.

Substance Abuse and Mental Health Services Administration (2012) The Role of Biomarkers in the Treatment of Alcohol Use Disorders. Vol. 11 Issue 2

Sun, S., et al. (2020). "Therapeutic manipulation of gut microbiota by polysaccharides of Wolfiporia cocos reveals the contribution of the gut fungi-induced PGE2 to alcoholic hepatic steatosis." Gut microbes 12(1): 1830693.

Surial, B., et al. (2021). "The Impact of Binge Drinking on Mortality and Liver Disease in the Swiss HIV Cohort Study." Journal of clinical medicine 10(2): 295.

Takahashi, R., et al. (2017). "Correlates of alcohol consumption in rural western Kenya: A cross-sectional study." BMC psychiatry 17(1): 1-10.

Takano, A., & Matsumoto, T. (2021). A Mixed-Methods Evaluation of Usability and Acceptability of Web-Based Relapse Prevention and Self-Monitoring Program: Secondary Analysis of a Pilot Randomized Controlled Trial. Frontiers in psychiatry, 12, 90.

Targher, G., & Byrne, C. D. (2015). Circulating markers of liver function and cardiovascular disease risk. *Arteriosclerosis, thrombosis, and vascular biology*, *35*(11), 2290-2296.

Thomes, P. G., et al. (2021). "Natural Recovery by the Liver and Other Organs after Chronic Alcohol Use." Alcohol Research: Current Reviews 41(1).

Thomes, P. G., Rasineni, K., Saraswathi, V., Kharbanda, K. K., Clemens, D. L., Sweeney, S. A., ... & Casey, C. A. (2021). Natural Recovery by the Liver and Other Organs after Chronic Alcohol Use. Alcohol Research: Current Reviews, 41(1).

Tincopa, M. A., et al. (2021). "Patient disease knowledge, attitudes and behaviours related to non-alcoholic fatty liver disease: a qualitative study." BMJ open gastroenterology 8(1): e000634.

Uljas, E., Jalkanen, V., Kuitunen, A., Hynninen, M., & Hästbacka, J. (2020). Prevalence of risk—drinking in critically ill patients, screened with carbohydrate-deficient transferrin and AUDIT-C score: A retrospective study. *Acta Anaesthesiologica Scandinavica*, *64*(2), 216-223.

Urbano, T., et al. (2021). "Association of urinary and dietary selenium and of serum selenium species with serum alanine aminotransferase in a healthy italian population." Antioxidants 10(10): 1516.

Ursic-Bedoya, J., Faure, S., Donnadieu-Rigole, H., & Pageaux, G. P. (2015). Liver transplantation for alcoholic liver disease: Lessons learned and unresolved issues. *World Journal of Gastroenterology: WJG*, *21*(39), 10994.

Valery, P. C., et al. (2018). "Projections of primary liver cancer to 2030 in 30 countries worldwide." Hepatology 67(2): 600-611.

Vanzetto, S., Zabotto, M., Fasciana, F., Varinelli, A., Cirnigliaro, G., Ferrara, L., ... & Viganò, C. (2021). Structured Evaluation of Rehabilitation Programs Outcomes in Psychiatry: Application of a Recovery-Centered Model. Psychiatric Quarterly, 1-18.

Vatsalya, V. (2020). "Novel biomarker for the diagnosis and prognosis of acute alcoholic hepatitis." Clinical & experimental pharmacology 10(4).

Vatsalya, V., et al. (2021). "Characterization of Early-Stage Alcoholic Liver Disease with Hyperhomocysteinemia and Gut Dysfunction and Associated Immune Response in Alcohol Use Disorder Patients." Biomedicines 9(1): 7.

Vatsalya, V., et al. (2021). "Characterization of Early-Stage Alcoholic Liver Disease with Hyperhomocysteinemia and Gut Dysfunction and Associated Immune Response in Alcohol Use Disorder Patients." Biomedicines 9(1): 7.

Verhoog, S., et al. (2020). "The use of the alcohol use disorders identification test–Consumption as an indicator of hazardous alcohol use among university students." European addiction research 26(1): 1-9.

Villarosa-Hurlocker, M. C., Schutts, J. W., Madson, M. B., Jordan, H. R., Whitley, R. B., & Mohn, R. C. (2020). Screening for alcohol use disorders in college student drinkers with the AUDIT and the USAUDIT: a receiver operating characteristic curve analysis. The American journal of drug and alcohol abuse, 46(5), 531-545.

Wandera, B., Tumwesigye, N. M., Nankabirwa, J. I., Kambugu, A. D., Parkes-Ratanshi, R., Mafigiri, D. K., ... & Sethi, A. K. (2015). Alcohol consumption among HIV-infected persons in a large urban HIV clinic in Kampala Uganda: a constellation of harmful behaviors. *PloS one*, *10*(5), e0126236.

Wang, J., Li, P., Jiang, Z., Yang, Q., Mi, Y., Liu, Y., ... & Li, S. (2016). Diagnostic value of alcoholic liver disease (ALD)/nonalcoholic fatty liver disease (NAFLD) index combined with γ-glutamyl transferase in differen-tiating ALD and NAFLD. *Korean Journal of Internal Medicine*.

World Health Organization. (2011). Scaling up action against noncommunicable diseases: How much will it cost?.

World Health Organization. (2018). *Global status report on alcohol and health 2018*. World Health Organization.

Wu, L., et al. (2021). "Elevated gamma-glutamyl transferase has a non-linear association with incident non-alcoholic fatty liver disease in the non-obese Chinese population: a secondary retrospective study." Lipids in health and disease 20(1): 1-11.

Wu, T. and V. Shah (2021). Biomarkers of endothelial dysfunction in alcoholic hepatitis, Springer: 1-3.

Xu, S., et al. (2021). "Problematic use of alcohol and online gaming as coping strategies during the COVID-19 pandemic: a mini review." Frontiers in psychiatry 12.

Yang, Y., et al. (2021). "Alcohol-induced Hsp90 acetylation is a novel driver of liver sinusoidal endothelial dysfunction and alcohol-related liver disease." Journal of hepatology.

Yeverino-Gutiérrez, M. L., González-González, M. D. R., & González-Santiago, O. (2020). Mortality from alcohol-related liver cirrhosis in Mexico (2000–2017). *Frontiers in Public Health*, *8*.p1

Zewdu, S., et al. (2019). "Treatment gap, help-seeking, stigma and magnitude of alcohol use disorder in rural Ethiopia." Substance abuse treatment, prevention, and policy 14(1): 1-10.

Zhang, Z., et al. (2021). "Effects of Smoking, and Drinking on Serum Gamma-Glutamyl Transferase Levels Using Physical Examination Data: A Cross-Sectional Study in Northwest China." International Journal of General Medicine 14: 1301

Zhu H, Jia Z, Misra H, Li YR (2012) Oxidative stress and redox signaling mechanisms of alcoholic liver disease: updated experimental and clinical evidence. J Dig Dis 13: 133-142.

APPENDICES

Appendix I: Consent Information Form

Study title; Development of an assessment and referral tool for alcoholic liver injury among adults in selected rehabilitation centers in Kenya

1) **Purpose**

You are invited to participate in filling a questionnaire as part of a research study to be carried out by Njoroge George K. a student at the Mount Kenya University (MKU). The purpose of this study is to develop an assessment and referral tool for alcoholic liver injury among adults in selected rehabilitation centers in Kenya

2) **Procedures:**

The researcher/ research assistant will not ask you for specific information about yourself or the people you know. You will be given a questionnaire to fill which will take you approximately 20 minutes to fill. After that the researcher/ research assistant will correct the filled questionnaire form.

3) **Risks:**

There will be minimal risks to you for participating in this study. There is a possibility that some of the questions may make you uncomfortable. If so, know that you do not have to answer these questions if you do not want to. Should this occur, the researcher/ research assistant will keep confidential all information given out through the study.

4) **Benefits**

Regarding benefits, there are no direct benefits for you as an individual participant, but the information collected will help to better understand issues surrounding alcoholic liver disease among adults.

5) **Voluntary Participation and withdrawal**

Your participation is entirely voluntary and should you change mind, you have the right to drop out any time. You may skip some questions or stop participation at any time.

6) **Confidentiality**

After analysis the questionnaires will be stored under key and lock for a period of 5 years. Electronic files will be saved on a password and fire-wall protection computers. The researcher will not identify you or use any information that would make it possible for anyone to identify you in any written reports about the study.

7) **Contact Persons**

You will be issued with a script containing information for the principal investigator and the other co-investigators of the study. Principal investigator is George Njoroge, telephone number 0722345142, CO-investigators are Prof. C. Mwenda, telephone number is 0723846810, Dr. E. Mesha telephone number is 0708409802 and Dr. S. Waithaka, telephone number is 0722362719. If you have any questions or more concerns you can also contact the Directorate of research, Institutional Ethics and Review committee at Mount Kenya University

8) Compensation/Incentives/undue influence

There was be no intended compensations, incentives or undue influences on the study

9) Conflict of interest

There was no conflict of interest on the study

.

Appendix II: Client's Certificate of Consent

I _____ in full realization of this study, I agree that

My participation is voluntary

I am free to withdraw at any stage of the study

My refusal to participate in the study will not deny me care from health workers

I was accorded an opportunity for questions

I have consented to fully participate in the study

Sign_____ Date _____

STATEMENT BY THE RESEARCHER/RESEARCH ASSISTANT

I confirm the that _____(client's name) was offered an opportunity to ask questions about the study and that these questions are ansared satisfactory. I also confirm that the client has signed the consent voluntarily.

Name of researcher/research assistant _____

Sign_____ Date _____

Appendix III: Interviewer's Questionnaire

CODE

Instructions

- Do not write client's name.
- Assistant researcher to read questions to the client as they are written.
- Assistant researcher to tick/write where appropriate within the spaces provided.

SECTION A: DEMOGRAPHIC DATA

1) What is your age in years?_____

2) What is the client's gender Single ☐ Married ☐ Separated ☐
   Windowed ☐ Divorced ☐

3) Level of education. No formal education ☐ Primary School ☐
   Secondary/High School College ☐ University ☐

4) Your employment Status. Employed ☐ unemployed ☐

5) Average monthly income (Specify)……

6) County of origin (Specify)……

7) Do you consume other substances of addiction other than alcohol

   Yes ☐ No ☐

   Specify……

   ……

8) Client has been drinking alcohol for how long?

   .....

9) In relation to alcoholic effects, have you ever visited medical facility before?

   Yes ☐ No ☐

10) Have you ever stopped alcohol consumption then resumed? Yes ☐ o ☐

Specify……

……

SECTION B

11) What influence you most to drink alcohol?

a) Watching football in beer clubs ☐

b) Desire to remain in group of friends ☐

c) Nice women in beer clubs ☐

d) Afraid to be early at home with spouse ☐

e) Alcohol addiction. ☐

12) Does alcohol consumption affect your liver? Yes ☐ No ☐

Explain……

……

13) Do you experience liver problem? Yes ☐ No ☐

Explain……

……..……

14) Covid-19 restrictions affected drinking of alcohol. Agree ☐ artially ☐

Disagree ☐

15) Are you on any medication due to drinking alcohol? Yes ☐ No ☐

Specify……

……

16) Do you smoke cigarette? Yes ☐ No ☐

Specify……

……

17) ALCOHOL USE DISORDER IDENTIFICATION TEST (AUDIT) TOOL

Item	Item question	0	1	2	3	4	SCORES	SUB TOTAL
1	How often do you have a drink of alcohol?	Never	Monthly or less	2 to 4 times a month	2 to 3 times a week	4 or more times a week		
2	How many drinks containing alcohol do you have on a typical day when you are drinking?	1 or 2	3 or 4	5 or 6	7 or 9	10 or more		
3	How often do you have 6 or more drinks on an occasion?	Never	Less than monthly	monthly	weekly	Daily or almost daily		
4	How often during the last year have you found that you are unable to stop drinking once you had started?	Never	Less than monthly	monthly	weekly	Daily or almost daily		
5	How often during the	Never	Less than monthly	monthly	weekly	Daily or almost		

	last year have you failed to do what was normally expected of you because of drinking?					daily		
6	How often during the last year have you needed a first drink in the morning to get yourself going after a heavy drinking session?	Never	Less than monthly	monthly	weekly	Daily or almost daily		
7	How often during the last year have you had a feeling of guilty or remorse after drinking?	Never	Less than monthly	monthly	weekly	Daily or almost daily		
8	How often during the last year have you	Never	Less than monthly	monthly	weekly	Daily or almost daily		

	been unable to remember what happened the night before because of your drinking?							
9	Have you or someone else been injured because of your drinking?	No		Yes, but not in the last year		Yes, during the last year		
10	Has a relative, friend or other health care worker been concerned about your drinking or suggest you cut down?	No		Yes, but not in the last year		Yes, during the last year		
						TOTAL SCORES		

BMI calculation

Blood pressure……

Weight in Kgs…….

Height in cms…….

Waste circumflex……

Laboratory Investigations

1ml of venous blood was collected for test on AST/ALT, GGT, ALP.

Appendix IV: Interviewer's Questionnaire

Questionnaire for in-depth interview for alcoholic liver injury

Introduction—Research on Development of an assessment and referral tool for Alcoholic Liver Injury among adults in selected Counties in Kenya by George Njoroge PHD student Mount Kenya University.

Welcome to this indepth interview—(Pause for a response)

The interview will take about 20 minutes and was recorded for purposes of analysis

Do not mention your name or your institutional name.

The information given was confidential and will not be released to any unauthorized persons.

Question1--Describe the effects of alcohol on liver injury?

Question2--Describe the effects of alcohol abstinence on the liver?

Question3--What are the institutional considerations for admission of Alcoholic Liver Injury clients?

Question4--What is your grading system for clients with Alcoholic Liver Injury during the admission period?

Question5--What guidelines are in place to evaluate Alcoholic Liver Injury?

Question6--What are the institutional considerations for referral for Alcoholic Liver Injury to other tertiary institutions?

Question7--For clients with relapse how do you evaluate the Alcoholic Liver Injury?

Question8--What is the importance of having a grading system for Alcoholic Liver Injury?

Appendix V: Introduction Letter

Mount Kenya University

DIRECTORATE OF GRADUATE STUDIES

PHDNS/2018/37022

29th April, 2021

The Director, Research Coordination Division
National Commission for Science, Technology & Innovation
Utalii House, 8th & 9th Floor
P.O Box 30623- 00100
NAIROBI

Dear Sir/Madam,

RE: GEORGE NJOROGE - REGISTRATION NO. PHDNS/2018/37022

The purpose of this letter is to introduce the above named student who is pursuing **Doctor of Philosophy in Nursing** in the Department of **Nursing Education, Leadership Management and Research** in the School of **Nursing.**

The title of his research is ***"Development of an Assessment and Referral Tool for Alcoholic Liver Injury among Adults in Selected Counties in Kenya."***

He has been cleared by the University's Ethics Review Committee (Certificate attached) and now has to proceed to the field to collect data for his research between **May and October, 2021.**

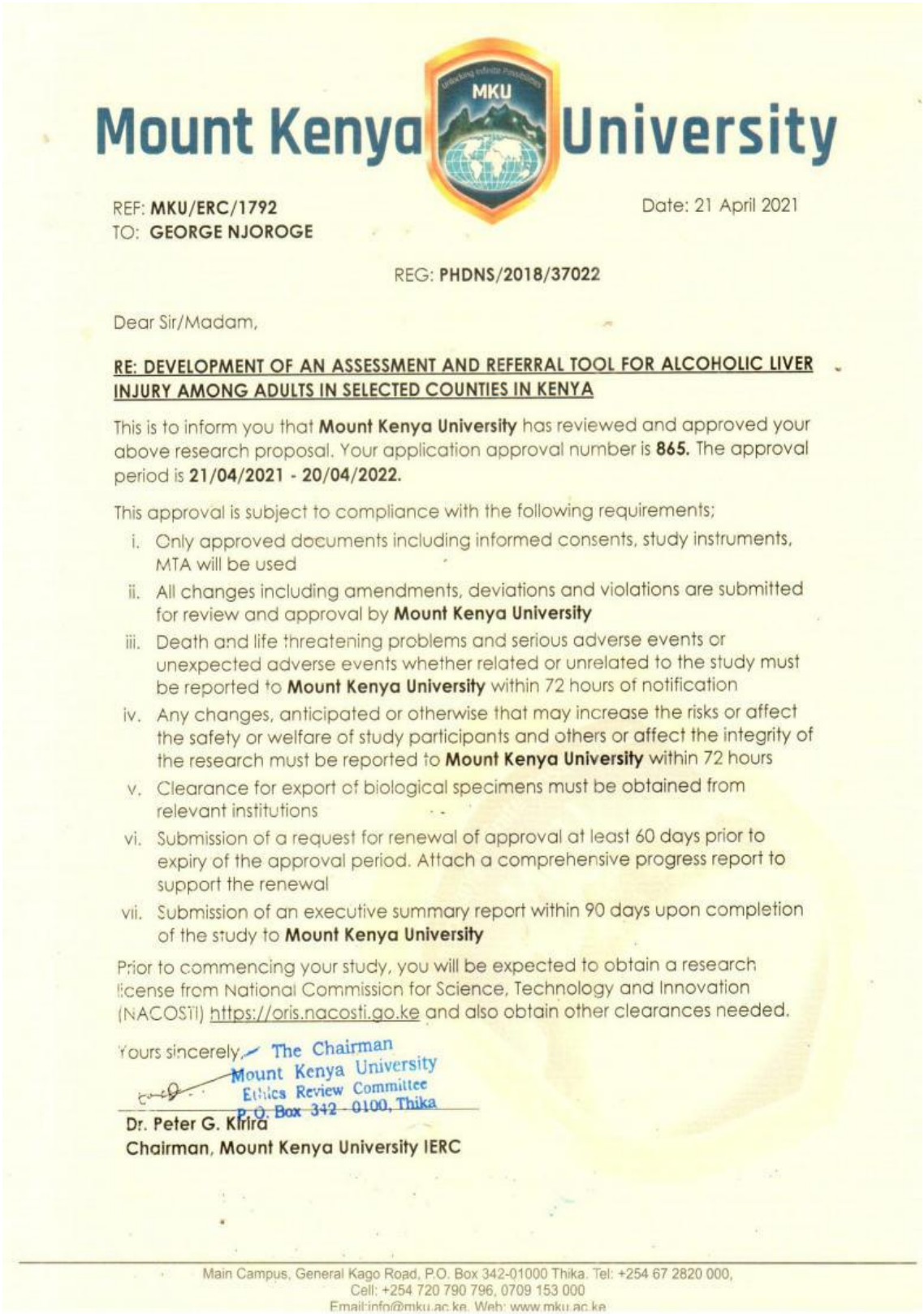
Any assistance accorded to him will be highly appreciated.

Thank you.

Mount Kenya University
P.O. Box 342-01000, THIKA
Office of the Director
Graduate Studies

Dr. Samuel M. Karanga, Ph.D.
Director, Graduate Studies
Enc.

Appendix VI: Ethical Clearance



Mount Kenya University

REF: **MKU/ERC/1792**
TO: **GEORGE NJOROGE**

Date: 21 April 2021

REG: **PHDNS/2018/37022**

Dear Sir/Madam,

RE: DEVELOPMENT OF AN ASSESSMENT AND REFERRAL TOOL FOR ALCOHOLIC LIVER INJURY AMONG ADULTS IN SELECTED COUNTIES IN KENYA

This is to inform you that **Mount Kenya University** has reviewed and approved your above research proposal. Your application approval number is **865.** The approval period is **21/04/2021 - 20/04/2022.**

This approval is subject to compliance with the following requirements;

i. Only approved documents including informed consents, study instruments, MTA will be used
ii. All changes including amendments, deviations and violations are submitted for review and approval by **Mount Kenya University**
iii. Death and life threatening problems and serious adverse events or unexpected adverse events whether related or unrelated to the study must be reported to **Mount Kenya University** within 72 hours of notification
iv. Any changes, anticipated or otherwise that may increase the risks or affect the safety or welfare of study participants and others or affect the integrity of the research must be reported to **Mount Kenya University** within 72 hours
v. Clearance for export of biological specimens must be obtained from relevant institutions
vi. Submission of a request for renewal of approval at least 60 days prior to expiry of the approval period. Attach a comprehensive progress report to support the renewal
vii. Submission of an executive summary report within 90 days upon completion of the study to **Mount Kenya University**

Prior to commencing your study, you will be expected to obtain a research license from National Commission for Science, Technology and Innovation (NACOSTI) https://oris.nacosti.go.ke and also obtain other clearances needed.

Yours sincerely,

The Chairman
Mount Kenya University
Ethics Review Committee
P.O. Box 342 - 0100, Thika

Dr. Peter G. Kirira
Chairman, Mount Kenya University IERC

Main Campus, General Kago Road, P.O. Box 342-01000 Thika. Tel: +254 67 2820 000,
Cell: +254 720 790 796, 0709 153 000
Email:info@mku.ac.ke. Web: www.mku.ac.ke

Appendix VII: NACOSTI Permit

REPUBLIC OF KENYA

NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Ref No: 793571

Date of Issue: 18/May/2021

RESEARCH LICENSE

This is to Certify that Mr.. George KIMANI Njoroge of Mount Kenya University, has been licensed to conduct research in Muranga, Uasin-Gishu on the topic: DEVELOPMENT OF AN ASSESSMENT AND REFERRAL TOOL FOR ALCOHOLIC LIVER INJURY AMONG ADULTS IN SELECTED COUNTIES IN KENYA for the period ending : 18/May/2022.

License No: NACOSTI/P/21/10477

793571

Applicant Identification Number

Director General
NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

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Kind regards,

Catalina

Catalina Gradin

Technical Assistant – Translation Rights & Licensing
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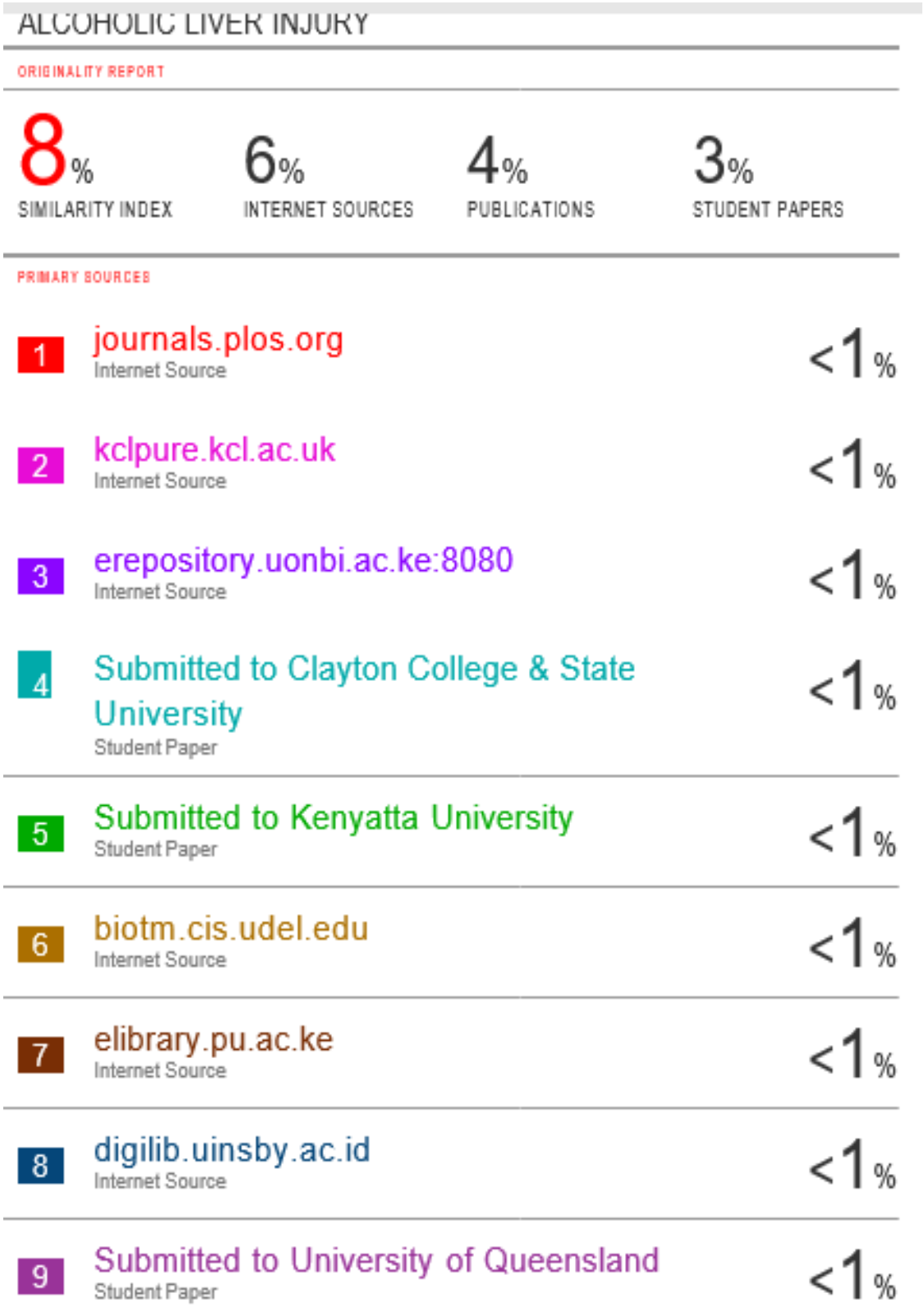

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Appendix X: MAP

Uasin Gishu

Muranga