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Gender and Risk Behaviors Association With Hepatitis-B Infections Among Liberia Military Personnel

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This is to certify that the doctoral study by

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has been found to be complete and satisfactory in all respects,
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Walden University
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Abstract

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Master of Science in Military Command, Nanjing Army Command and Staff College, China, 2019

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Bachelor of Science in Nursing, Agadir Health Training Institute, Morocco, 2004

Doctoral Study Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Public Health

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Abstract

The increasing number of hepatitis B-related deaths in the Armed Forces of Liberia was due to the lack of understanding of the associated risks with the disease. Gender, substance use, and condom use have been researched as related risk factors for hepatitis B virus infection (HBV). The goal of this study was to determine if gender (male or female) and risk factors (substance use, alcohol abuse, and condom use) predicted hepatitis B infections after adjusting for age, marital status, education, and military rank among Liberia military population. The theory that grounded this study was Bronfenbrenner's socio-ecological model (SEM) which posits that the intrapersonal, interpersonal, community, and policy influence human behaviors. A binomial logistic regression analysis was used to determine if gender, substance use, and condom use predicted HBV infection using a secondary data set. This result showed that gender and marital status were statistically significant. Men had 2.79 times higher odds of been infected with HBV infection than women (OR = 2.79, p = 0.048, [95% CI = 1.01, 7.72]). Participants who were not married had only 33.7% reduced chance of being HBV infected than those who were married (OR =.66, p = 0.031, [95% CI = .46, .96]). Future researchers should conduct primary studies to understand specific factors associated with the disease. Implications for positive social change begin with the dissemination of this study's results to the soldiers, local health authorities, and during scientific conferences. Health promotion and outreach programs based on these findings could change soldiers' behaviors that may reduce the disease impact, improve forces health, and promote positive social change.

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Dedication

Let me take this time to dedicate this important milestone in my career to my wife, Mrs, Josephine J.G. Kowo, children (Joseph Bonah, Jartu, Janga, Daddy, Jusu, Adam Kamradt-Scott), my parents, brother, and sisters. A special dedication to the personnel of the AFL Medical Command. My family and my unit supported me during this critical period of my life. On many occasions, I deprived my family the needed resources and time to pay tuition and stay out of the home to the detriment of the children growth. May the Almighty God continue to strengthen and bless you.

Acknowledgments

As a practicing Christian, let me take this time to thank the Almighty God for the strength and spiritual protection throughout this academic sojourn. Many thanks and appreciation to my committee member; Dr. Manoj Sharma (Chair), Dr. Harrison Ndetan (Member), and Dr. Sanggon Nam (URR) for the critical review and guidance. Special thanks to the Government of Liberia headed by H.E President of the Republic of Liberia, Dr. George Manneh Weah, who, through his insightful leadership, provided a partial tuition payment to Walden University. Many thanks to the Minister of Defense, Maj. Gen (Rtd). Daniel D. Ziankhan, Jr., the Chief of Staff, Maj. Gen. Prince C. Johnson III, who, through their leadership at the Ministry of Defense and the Armed Forces of Liberia, helped me to reach thus far. Let me also acknowledge the support from my entire family, especially Hon. Janga A. Kowo, Comptroller and Accountant General of Liberia, provided his contribution to my education. Lastly, many that to gallant men and women of the AFL especially the Medical Command, friend well-wishers who one way or the other contributed to this study.

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Section 1: Foundation of the Study and Literature Review

Background of the Problem

The World Health Organization (WHO) fact sheet of 2020 showed that about 296 million people lived with hepatitis B virus infection (HBV)n 2019, and there were 1.5 million new infections each year. In 2019 alone, nearly 820,000 hepatitis B deaths were recorded worldwide. Africa is the second-highest affected in the WHO region, with 81 million people infected (WHO, 2020). The trend and devastation of the disease have not been fully understood. Most world leaders and their population are unaware of the disease prevalence and increasing incidence rates (WHO, 2021). The WHO 2021 report on Africa also shows that chronic hepatitis B affects over 60 million people, with 90% of the infected population lacking the much-needed care (WHO, 2021). The poor healthcare coverage results in at least 200 000 deaths a year on the continent, mainly affecting the youthful and productive population (WHO, 2021). Sub-Saharan Africa, of which Liberia is a part, is considered a high endemic region. According to Shobaya et al. (2016), the world is classified into high, intermediate, and low HBV endemic, with Sub-Saharan Africa among the high endemic areas.

Locally, there is a lack of sufficient data on the burden of hepatitis B infection. However, Shobaya et al. (2016) prevalence studies showed that of their 126 adult patient records reviewed, 87 (69%) men and 39 (31.1%) women tested positive for HBV infection. Specifically for the Liberian army, hepatitis B infection is the primary cause of chronic illness and the leading cause of death among the soldiers. The trend in the disease impact was seen during a behavioral survey conducted to determine the prevalence of

HIV in the military. The principal investigator (PI) asked questions about hepatitis B infections among the soldiers and their families. The survey results showed a high HBV prevalence among men than among women in the military (10.6% vs. 2.8%; $p<0.01$) (Liberia SABER, 2018; unpublished). Unfortunately, these studies did not show the association of gender and the risk behaviors with the high disease incidence among the uniform personnel.

Problem Statement

The increasing number of hepatitis B-related death in the Armed Forces of Liberia was due to the lack of understanding of the associated risks with the disease. Gender and other risk behaviors such as substance use, and condom use were observed in other studies as related factors to the disease spread. The military public health leaders lacked the understanding to strategically develop health promotion programs to reduce the disease impact among the personnel.

In this study, I addressed the gap in knowledge about the association of gender, substance use, and condom use with hepatitis B. With the available results, policymakers can now develop strategies to reduce the impact of the disease on the forces. The WHO fact sheet of 2020 stated that about 296 million people lived with Hepatitis B in 2019, and 1.5 million new infections each year. In 2019 alone, nearly 820,000 hepatitis B deaths were recorded worldwide. Africa is the second-highest affected in the WHO region, with 81 million people infected (WHO, 2020). The trend and devastation of the disease have not been fully understood. Most world leaders and their population are unaware of the disease prevalence and increasing incidence rates (WHO, 2021).

Unfortunately, the World Health Organization 2021 report on Africa also showed that chronic hepatitis B affects over 60 million people, with 90% of the infected population lacking the much-needed care (WHO, 2021). The poor healthcare coverage results in at least 200 000 deaths a year on the continent, mainly affecting the youthful and productive population (WHO, 2021). Sub-Saharan Africa, of which Liberia is a part, is considered a high endemic region. According to Shobaya et al. (2016), the world is classified into high, intermediate, and low HBV endemic, with Sub-Saharan Africa among the high endemic areas. There is a lack of sufficient data on the burden of hepatitis B infection in Liberia.

However, Shobaya et al. (2016) prevalence studies showed that of their 126 adult patients records review, 87 (69%) men and 39 (31.1%) women tested positive for HBV infection. In the Liberian Armed Forces, Hepatitis B infection is the primary cause of chronic illness and the leading cause of death among the soldiers. The trend in the disease impact was seen during a behavioral survey conducted to determine the prevalence of HIV in the military. PI asked questions about Hepatitis B infections among the soldiers and their families. The survey results showed a high HBV prevalence among males than females in the military (10.6% vs. 2.8%; $p<0.01$) (Liberia SABER, 2018; unpublished). Unfortunately, these studies did not show the factors associated with the disease. However, due to the high prevalence among the male soldiers, substance use, and condom use, this study did not establish that gender was a significant risk behavior for HBV infection.

The specific research problem that I addressed in this study was that the existing literature has not demonstrated that gender and risk behaviors such as substance use, and condom use are independent risk factors associated with Hepatitis B infection among the Liberia military populations.

Purpose Statement

The purpose of this quantitative study was to determine if gender and risk factors (substance use, alcohol abuse, and condom use) predict hepatitis B Infections after adjusting for age, marital status, education, and military rank among Liberia Military population. According to Burkholder et al. (2016), the independent or predictor variable is considered the presumed factor that causes a change or potential significant effect on the dependent or outcome variable. At the same time, the dependent variable was the presumed outcome after manipulating the independent variable. Lastly, confounders are categories of variables or extraneous factors that could have an undesired effect or influence on the results of an entire study (Burkholder et al., Cox, 2016).

Nature of the Study

To address the research questions in this quantitative study, I obtained and used the secondary dataset from the Department of Defense (U.S. DoD) HIV Seroprevalence and Behavioral Epidemiology Risk Survey (SABERS) obtained during the 2018 behavioral studies in the Armed Forces of Liberia. With this SABERS study, I used the cross-sectional non-experimental study design. Furthermore, I determined the correlation between the independent and dependent variables. Therefore, I requested the data file from the Department of Defense HIV/AIDS Prevention Program (DHAPP), San Diego,

California, USA, data repositories for this planned research design. The Armed Forces of Liberia and United States Department of Defense (DoD) HIV seroprevalence and SABERS military-specific clean excel data file had all the variables, including gender (nominal), substance use (nominal), age (scale), military ranks (ordinal), marital status (nominal), and education (ordinal), condom use (nominal) to answer my research questions. These variables were both categorical and scale levels of measurement.

Research Questions

Research Question 1 (RQ1): Is there an association between gender and hepatitis B infection among the Liberian military when controlling for substance use, condom use, marital status, education, age, and military ranks?

Null Hypothesis ($H_0$1): There is no significant association between gender and hepatitis B infection among the Liberian military when controlling for substance use, condom use, marital status, education, age, military ranks.

Alternative Hypothesis (H_a1): There is a significant association between gender and hepatitis B infection among the Liberian military when controlling for substance use, condom use, marital status, education, age, military ranks.

Research Question 2 (RQ2): Is there an association between substance use and hepatitis B infection among Liberian military personnel when for controlling for gender, condom use, marital status, education, age, and military ranks?

Null Hypothesis ($H_0$2): There is no significant association between substance use and hepatitis B infection among Liberian military personnel when controlling for gender, condom use, marital status, education, age, and military ranks?

Alternative Hypothesis (H_a2): There is a significant association between substance use and hepatitis B infection among Liberian military personnel when controlling for gender, condom use marital status, education, age, and military ranks.

Research Question 3 (RQ3): Is there an association between condom use and hepatitis B infection among Liberian military personnel when controlling for, gender, substance use, marital status, education, age, and military ranks?

Null Hypothesis ($H_0 3$): There is no significant association between condom use and hepatitis B infection among Liberian military personnel when controlling for gender, substance use, marital status, education, age, and military ranks?

Alternative Hypothesis ($H_a 3$): There is a significant association between condom use and hepatitis B infection among Liberian military personnel when controlling for gender, substance use, marital status, education, age, and military ranks.

Theoretical Framework

The theories, concepts, and behavioral models that I used to ground this study were from Urie Bronfenbrenner's (1980) socio-ecological model (SEM). The SEM posits that human health behaviors are influenced by multiple levels of influence, including intrapersonal, interpersonal, organizational, community, and the public policy levels. Furthermore, the influence of health behaviors varies by the target behavior and context. The social-ecological model is a framework that helps understand the multifaceted levels that society poses on an individual. The SEM's different factors and determinants promote prevention, control behaviors, and intervention to improve behavior patterns

affecting every model level. Preventing risk factors requires approaching problems simultaneously at all levels.

Hepatitis B prevention requires a holistic approach that includes all model levels. The SEM facilitates understanding various factors that increase the risk behaviors associated with hepatitis B infections. The model includes four overlapping rings that illustrate the influencing factors between all levels (individual, interpersonal, community, and society).

I used this model to describe how gender impacts hepatitis B infection from an intrapersonal personal perspective. This individual-level focused on the biological and personal history factors, including age, education, and condom use (Center for Disease Control and Prevention [CDC], 2021). I assumed that substance use among military personnel was associated with their social and sexual networks. This level showed that family, friends, and neighbors influence individual health and behavior. Finally, behaviors are also shaped by the environment and institutional associations. For example, the military profession serves as a risk factor for HBV infection due to the nature of the job.

Definition of Terms

Armed Forces of Libera (AFL): The Armed Forces of Liberia is the restructured military institution established by an act of the Republic of Liberia legislature in 2006.

Armed Forces of Liberia Personnel: These are active-duty personnel of the AFL age 18 years and above who joined the force in 2006.

Department of Defense HIV and AIDS Prevention Program (DHAPP). This organization is a United States Foreign Aid policy assisting foreign military partners in 65 countries around the globe to develop and implement culturally focused and military-specific HIV/AIDS prevention, care, and treatment programs (Department of Defense HIV/AIDS Prevention Program, n.d.).

Gender: In this study, gender is dichotomous. It is either male or female.

Hepatitis B Infection: The World Health Organization (WHO) defines Hepatitis B infection as a viral infection that invades and attacks the liver leading to either an acute or chronic disease (WHO,2021).

Hepatitis B Surface Antigen (HBsAg): This is a laboratory examination to determine the presence of the hepatitis B virus in the blood. A positive result indicates that the infected person can spread the virus to the uninfected via blood and body fluid.

Substance Use: clinical records in all the AFL health facilities show that significant substances are highly used among AFL personnel. They are marijuana and alcohol. For the sake of this study, these are the two substances that will be analyzed.

Assumptions

I requested and collected the secondary dataset used in this study from the Department of Defense HIV and AIDS Prevention Program (DHAPP) data repositories. Though the primary research was a collaborative effort between the Armed Forces of Liberia and data are kept with DHAPP, it was essential to make critical assumptions. According to Burkholder, Cox, and Crawford (Eds, 2016), "an assumptions is a condition that is taken for granted without which the research project would be pointless" (p. 175).

Therefore, I assumed that the primary study dataset was kept safe and all identifiable information secured. The primary study researchers collected data from soldiers and family members with the assumption that the data collection met all requirements to maintain validity and reliability to support this secondary research. I also assumed that the researchers in the primary study obtained ethical approval from the local and international ethical review boards before the study starts. Finally, I assumed that all quality measures were considered during the primary studies. These assumptions were very important for this secondary study because the study's success depended on the dataset quality. Because most secondary dataset were de-identified, ethical considerations were not major concern. Therefore, I obtained the dataset with no major ethical issues.

Limitations

Some of the limitations of this study were the constraints associated with secondary data use. This type of dataset required that I recode some of the responses and values to answer my research questions using the multiple binary regression test statistics. This secondary dataset that I used to answer my research questions was collected and intended for HIV and AIDS prevalence in the Armed Forces of Liberia. Therefore, the data collected in the research design and instrument selection were not used to answer my specific research questions. Another critical limitation/challenge to note was the limited research on hepatitis B infection in Liberia and specifically the variable of concern. The research was the first hepatitis B-related research on the Liberian military. Furthermore, Walden University dataset base has limited information about my specific research topic and population.

Scope and Delimitations

This study provides a general understanding of the cause for the increasing number of hepatitis B-related death in the Armed Forces of Liberia. Gender and marital status have been observed as related factors to the disease spread. This secondary study covered only uniform personnel of the Armed Forces of Liberia. Hepatitis B infection is the only outcome variable of concern for this study. This study was delimited to understand the association between the mentioned independent and dependent variables. The dataset that I used in this study had information for both soldiers and family members. With stratification, only active-duty military personnel data were analyzed.

I used the SEM as the theoretical foundation for this study. This theory posits that human health behavior is influenced by multiple levels of influence, including intrapersonal, interpersonal, organizational, community, and the public policy levels. Because I focused only active-duty personnel and the sample size, the result may not be generalizable to the entire Liberian population.

Significance of the Studies

To the best of my knowledge and the existing literature, this is the first-ever study on this topic among the selected population. This research may be useful to the AFL and Ministry of Defense (MoD) leaderships in understanding how the various contributing factors associated with hepatitis B infections among the forces. As commanding officer of the Armed Forces Health Services and senior health administrator, the result of these studies have guided me to considered possible policy actions that will help improve the social condition of the soldiers and their families. Furthermore, this study is the first in

Liberia since establishing the new Armed Forces of Liberia in 2016. Finally, this study may improve positive social change action that may be taken in Liberia and the armed forces. In this study, I identified the intrapersonal, interpersonal, community, and societal factors associated with the disease impact.

Summary

In this study, I tried to understand if there was an association between gender, substances use, and condom use with hepatitis B infection in the Liberian military population. Africa has the highest burden of the disease. According to the WHO (2021) report on Africa, hepatitis B affects over 60 million people, with 90% of the infected population lacking the much-needed care (WHO, 2021). Moreover, the poor healthcare coverage has resulted into at least 200,000 deaths a year on the continent, mainly affecting the youthful and productive population (WHO, 2021). Among the various African regions, Sub-Saharan Africa including is considered a high endemic region.

The main problem that was driving this study is due to the increasing number of hepatitis B-related death in the Armed Forces of Liberia. The poor response to the disease was due to the lack of understanding of the associated risks with the disease. So, the purpose of this quantitative study was to determine the association of independent variables such as gender (male & female) and risk behaviors (substance use, alcohol abuse, and condom use) with the dependent variable hepatitis B Infections after adjusting for possible confounders such as age, marital status, level of education, and military rank among Liberia Military population. I achieved this purpose by conducting using the theoretical framework backed by an extensive literature review of other successful

application. The theories or and behavioral models that ground this study was the Urie Bronfenbrenner's (1980) SEM which posits that human health behavior is influenced by multiple levels of influences, including intrapersonal, interpersonal, organizational, community, and the public policy levels.

The limitation associated with this study was the fact the secondary data I used were not intended for this study. However, because the primary researcher collected data about HBV infections and or behavioral question, it was important to note that the data answered my research questions. This research was strictly delimited to answering the above research questions and restricted to only active-duty personnel of the AFL.

The next part of the section involved conducting an exhaustive literature review that provided a comprehensive understandings, concepts, constructs, and related discussions about the topic. The following literature review identified the impact of hepatitis B infection globally, within the African region, with emphasis on the West Africa region. The literature search delved deeper into the impact of the disease in Liberia and the Armed Forces of Liberia. The literature review revealed what have or have not been researched and provided insight on how other studies used the SEM to address similar public health behavioral problems.

Review of the Literature

In this literature review, my goal was to provide a broader understanding of the impact of hepatitis B on the global population. I used the literature review section to help identify the gap in the current literature and showed how this study may contribute to narrowing the research gaps. The impact of hepatitis B infection is overwhelming and

requires a holistic approach to address the problem. The burden of the infection is highest in the African region is overwhelming. Initially, I used this literature review section and provided a general picture of the global prevalence and effort to combat the disease, emphasizing various strategies that global health governing bodies have established to meet sustainable development goals. I delved into understanding the contributing factors associated with the high burden of the disease on the African continent. After addressing the continental impact of hepatitis B infection, primary emphasis was placed on the West African subregion, in which Liberia, a member country of the Economic Community of West African State (ECOWAS), was the central area of focus.

Furthermore, I provided a better understanding of the various impact of the disease on uniform personnel and their families—Hepatitis B infection in the military show many challenges associated with soldiers performing their duties. I highlighted the role military duties contribute to contracting the disease. Specifically, I identified key contributing factors such as gender and risk behaviors such as substance abuse, improper use of condoms, and other societal issues. Finally, with issues arising on how societies can, especially military institutions, can mitigate the impact of hepatitis B on military forces, I highlighted the efforts to prevent the disease and improve military missions.

With the emphasis on the SEM, as the theoretical framework, I revealed the intrapersonal, interpersonal, community, and societal factors contributed to the hepatitis B incident. The constructs associated with the SEM helped me understand the prevalence and the impact of the disease on the global population, including the military. In addition, the biological factor, especially gender, highlighted how male behaviors contributes to

the risk and impact on the disease burden. Finally, I identified the gap in developing strategies that promote positive social change. A positive social changes actions among practitioners that would prevent the impact of the disease and reduce the behavioral and environmental factors contributing to the disease higher incident rates.

Literature Search Strategies

The success of the literature review depended on the extensive such within many databases on the Worldwide Web, including the Walden University library website. In addition, I searched the peer-reviewed and scholarly journal articles in the research area to begin the literature search. The keywords and databases searched included *gender, hepatitis b infection, military personnel, behavioral factors in Liberia, risk factors, substance use, and STIs.* I used Walden university database such as APA Psych-Info, CINAHL & MEDLINE, ProQuest Health & Medical Collection, and Google Scholar to search for key research terms associated with my research topic. I also used some published dissertations, books, and government documents related to the study area. I gathered critical information using the Google search engine, a good research tool for scientific research. Some of the search terms I used were (a) Global impact of hepatitis B, (b) hepatitis B infection in Africa, (c) hepatitis B infection in West Africa, (d) hepatitis B situation in Liberia, (e) gender and hepatitis B infection (f) substance use relation with HBV (g) condom use and prevalence of HBV infection.

A General Overview of Hepatitis B Infection

The WHO defines viral Hepatitis B infection as a viral infection that invades and attacks the liver and it tissues, leading to acute or chronic disease (WHO,2021). This

HBV infection is mainly transmitted from the mother to the babies during pregnancy and delivery (WHO, 2019). Other means of contracting hepatitis B include contact with blood or body fluids during sexual intercourse with an infected partner or an unsafe exposure to sharp instruments, including injections. Chronic hepatitis infection is less prevalent in adults than children under five years. The World Health Organization estimates that the adult population suffers 5% of chronic diseases while 95% of children under five years develop chronic diseases (WHO, 2021). This complication gap calls for strengthening and promoting early childhood vaccination. The hepatitis B virus survives outside the human body for at least 7 days and may infect unvaccinated individuals. The virus incubation period ranges from 30 to 180, but it is detected between 30 and 60 days (WHO, 2021). After detection, the virus is either self-limiting or may progress to complications such as hepatocellular carcinoma (HCC). The key risk factor associated with the complications is infection during infancy.

It is difficult to differentiate between the different types of hepatitis infection in terms of clinical presentation. The symptoms common to this disease includes yellowing of the skin and eyes. Others include dark urine, jaundice, extreme fatigue, vomiting, nausea, and abdominal pain. People who suffer acute hepatitis can develop acute liver failure, leading to death. The most prevalent complication, as mentioned above, is the HCC. Laboratory diagnosis will determine the specific types of infection. According to the World Health Organization (2021), 30,4 million people, approximately 10.5%, were living with hepatitis B infection in 2019. Only 6.6 million (22%) of the people diagnosed were in treatment with this amount. There is no cure for HBV. However, hospital

management may include adequate nutritional balance, including replacement of fluids lost from fluid imbalance and providing oral tenofovir or entecavir to slow the virus's progress. Vaccination against hepatitis B infection is the gold standard for achieving the World Health Assembly 2030 elimination target (Schmit et al., 2021).

It is essential to quantify the burden of hepatitis B infection in the general population. According to Schmit et al. (2021), the baseline hepatitis B monitoring process guides the quantification of chronic disease with hepatitis B surface antigen (HBsAg) in the general population. While HBsAg prevalence in adults informs the liver-disease burden, the prevalence of the disease in children aged 5 years serves as a proxy indicator to understand the cumulative incidence and vaccination program success (Schmit et al., 2021). Based on these facts, it is essential to promote a vaccination program because a safe and complete vaccination provides 98% to 100% protection against the infection and averts complications.

Global Perspective of Hepatitis B and its Impact

According to WHO, in 2019 alone, about 296 million people were living with chronic hepatitis B infection, with a yearly disease incidence of 1.5 million new infections in the same year (WHO, 2021; CDC, 2021). In addition, about 820 000 individuals died from the disease complications such as cirrhosis and hepatocellular carcinoma (WHO, 2021). The highest hepatitis B burden is associated with the WHO Pacific and African Regions, with 116 million and 81 million chronically infected, respectively. Furthermore, in the WHO Eastern Mediterranean Region and South-East Asia Regions, 60 million and 18 million people are infected, respectively. Finally,

approximately 14 million and 5 million people are infected in the WHO European Region and the Americas, respectively (WHO, 2021). The table below depicts the summary of the impact of hepatitis B on the global population.

Table 1

Summary of Global Hepatitis B Impact in WHO Region

WHO Region	Chronically Infected Population
Pacific	116 million
Africa	81 million
Eastern Mediterranean	60 million
South-East Asia	18 million
European Region	14 million
Americas	5 million

Note. Global Burden of chronic hepatitis B infection (WHO, 2021)

The above table shows that about 67% of the total burden is experienced in African and the Pacific WHO regions (Schmitt et al., 2021). The disease burden is high because the current prevalence is due to a lack of previous infant vaccination programs; according to Schmitt et al. (2021), the prevalence of hepatitis B infection in the under-five years dropped from 4.7% pre-vaccine era mid-1990 to 0.9% in the post-childhood vaccine in 2019. However, it is estimated that at least 1.5 million population is infected with the virus every year despite the early childhood vaccination program (Schmitt et al., 2021; WHO, 2021).

The World Health Assembly (WHA) has adopted a global elimination program amid the worldwide burden. Initially, in 2016, the WHA adopted the Global Health Sector Strategy (GHSS) 2016–2020 to address the burden associated with viral hepatitis infections and align the strategy with the Sustainable Development Goals (WHO, 2021). Furthermore, during the 74th World Health Assembly in 2021, the previous approach (GHSS 2016) was adopted, and a new target was set from 2022 to 2030. During this

conference, the WHA set a goal to eliminate hepatitis B by 2030, calling for a 90% reduction in the incidence and a 65% reduction in mortality rate, respectively (Schmit et al., 2021; WHO, 2021). In addition, all ages of hepatitis B prevalence range from 3.5% to 5.6%, while children under five years of prevalence range from 1.3% to 3.4% (Schmit et al., 2021). With these alarming data and efforts to combat hepatitis B infection, countries need increased awareness and formulate evidence-based policies to reduce the disease impact.

The Impact of Hepatitis B on the African Continent

The Hepatitis B mortality and morbidity rate on the African continent has surpassed other known diseases such as HIV/AIDS, Malaria, and Tuberculosis. According to the WHO Africa (2021), the hepatitis B virus has raised concerns and become a more significant threat in the African regions due to the diseases mentioned above that are also burdening the continent. Hepatitis B virus affects between 60-and 100 million persons in the African region (Breakwell et al., 2017, WHO, 2021). It is estimated that all countries in the region have either intermediate (2%-7%) or high (equal or above 8%) prevalence of chronic infections (Breakwell et al., 2017).

In most cases, chronically infected individuals will either develop liver cirrhosis or cancer. According to Breakwell (2017), the overall lifetime risk of progression to the complication is between 15%- and 25%, depending on the age of the affected population. As the hepatitis B global impact, in the African region, approximately 70% to 90% of infants infected before 1year are likely to develop chronic infection compared with 20%-50% of children between ages 1 to 5 years. However, children above 5 years have a lower

risk of developing chronic infections compared to previous age groups (5% to 10%; Breakwell et al., 2017).

The African continent has recorded the highest death associated with HBV complications compared to other WHO regions. With the estimated global HBV deaths of approximately 887,000 deaths, Africa recorded about 250,000 deaths in 2015 (Ingasia et al., 2020). The Western Pacific and the African continent account for over 6% of the disease's global prevalence. Ingrassia and colleagues (2020) studied the HBV genotype E dispersal patterns and found its dominance in Africa, especially the Sub-Saharan region. So, in sub-Saharan Africa, including the Eastern, Central, Southern, and Western African regions, HBV genotypes A, D and E predominantly circulate, with West Africa accounting for the most virulent genotype E.

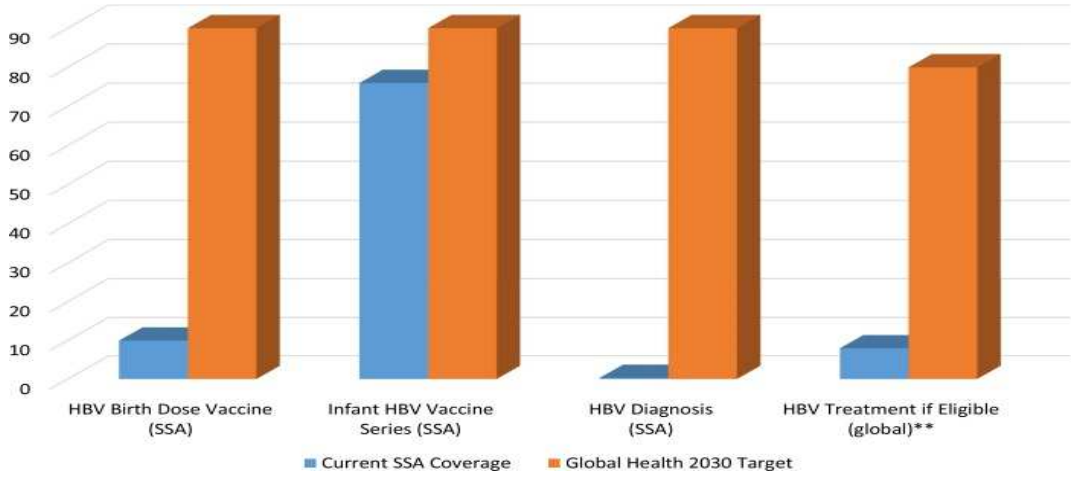
On the other hand, West Africa remains the only region where HBV is hyperendemic, with above 8% of HBsAg chronic carriers in the population (Ingasia et al., 2020). Hepatitis B virus genotype E is rarely found outside the African region. Cases of this genotype in other regions are harbored among African descendants. Unfortunately, the HBV genotype E develops a high virus load in the host and is more infectious and quickly progresses to complications (Cirrhosis & HCC) than another genotype (A, D, I; Ingasia et al., 2020). Comparatively, Sub-Saharan Africa is most affected by HBV than any other region on the African continent.

One of the best preventive measures and strategies to prevent HBV infection is the introduction of the birth dose vaccine for newborns. Most Sub-Saharan African (SSA) countries are yet to introduce the birth-dose vaccine for their newborn populations.

According to Dionne-Odom et al. (2018), WHO recommends a universal birth dose vaccine for all infants which require HBV vaccine within 24 hours of birth. Despite the WHO recommendations since 2009, birth-dose vaccination coverage was only 38% worldwide and only 10% in SSA (Dionne-Odom et al. 2018). In SSA during the same year, only 11 of the 54 African countries had introduced HBV birth dose for their population (Dionne-Odom et al. 2018). However, significant progress has been made with HBV vaccination associated with the HBV 3-dose pentavalent with 87% global coverage and 76% in SSA (Dionne-Odom et al. 2018). See Figure 1 below for the details

Figure 1.

Elimination of Vertical Transmission of Hepatitis B in Africa: A Review of Available Tools and New Opportunities - Clinical Therapeutics



https://pubmed.ncbi.nlm.nih.gov/29983265

Hepatis B infection in Liberia

Hepatitis B is highly endemic in the West African region compared to others in Africa. According to Assih and colleagues (2018), the West African regions are the most affected with endemicity above 8% and have ten genotypes (A-J) accounting for about 40

sub-genotypes. In West Africa, of which Liberia is a part, HBV genotype E is the most prevalent type (Assih et al., 2018; Ingasia et al., 2020). The research focuses on the impact of HBV on the Liberian population, with particular emphasis on the Armed Forces of Liberia. Unfortunately, it is difficult to obtain adequate HBV data in Liberia due to the lack of consistent research activities on this disease. When some data are available, there are significant variations and outdated. In our World in Data (2017) on Liberia, the 560 indicators showed the hepatitis B incidence and mortality rate per 100,000 population over 27 years. During the period under review, the peak of hepatitis B in Liberia was 5 285 per 100,000 population in 2005. The figure later declined to 4 748 per 100,000 population.

On the other hand, the highest mortality rate was in 1995 at 6.32 per 100,000 population and fell significantly to 1.80 per 100 000 individuals in 2017. This data did not stratify by age or gender but instead measured across all ages and sexes. The data showed the progress made over the years through various strategies, including vaccination programs.

The Asian Liver Center at Stanford University (2019) data estimated that in 2018, Liberia's HBsAg prevalence was 17.2%. However, contrary to this prevalence rate, the Coalition for Global Hepatitis Elimination (CGHE) 2019 to 2021 report shows that the HBsAg prevalence was 10.5 in the same year (CGHE, 2021). The table below shows the CGHE summary (2021) summary data.

Table 2

Coalition for Global Hepatitis Elimination 2019 Summary Data

Indicators	Ave Rate	Range	Year
Prevalence of Chronic HBV (HBsAg)	10.03	8.18 - 11.83	2019
Children Under 5 Years	2.2	1.55 - 2.80	2019
Number of People Living with Chronic HBV	480,465	391,863 - 566,813	2019
HBV Related Death Rate	10.8	7.61 - 15.30	2019
HBV Related Deaths	519	365 - 733	2019
Percent of Liver Cancer Death Attributable to HBV	50	42 - 59	2019

Additionally, few cross-sectional studies provide a better understanding of the national prevalence rates from an institutional perspective. During a rigorous search in multiple databases, I discovered three different studies conducted in three different facilities with distinct approaches, including the John F. Kennedy (JFK) hospital, ELWA hospital, and Tellewonyan hospital in Lofa county. Lieb et al. (2021) conducted a study at JFK, Liberia's largest tertiary health facility, to determine the prevalence of HBV and hepatitis C virus among healthcare workers. The study results showed that among the 245 participants, 15 participants (6.12 %) were positive for HBV and concluded that the targeted population had a 5% prevalence rate (Lieb et al., 2021). Although the result from this study may not be generalizable to the total population, it provides a picture of the

prevalence of HBV among healthcare practitioners because the institution (JFK) has the highest number of health workers for a single facility in the country.

Another study conducted at the Seventh Day Adventist (SDA) hospital in the same vicinity as JFK focused on adult patients admitted to the hospital. The result showed that 57 of the 134 participants (45.24%) had HBV (Shobayo et al., 2016). With the 134 participants sample size recorded, the male gender was mainly affected than the female participants. The results showed that of the 87 male participants, 43 (49.4%) were HBsAg positive compared to 39 female participants, with 14 (35.9%) positive for the disease, respectively. These studies conducted in a single healthcare facility confirmed HBV endemicity in Liberia. The prevalence indicates the public health burden associated with the disease needs further investigations.

Finally, the last study focuses on the prevalence of HBV in healthy individuals who volunteer to donate blood in the regional Tellawayon hospital. The researchers conducted this study in Lofa county, a distance from the previous two studies. These researchers seek to determine the prevalence of HBV among walk-in blood donors. About 584 dossiers of the walk-in voluntary blood donors were screened for donation in 2020 at the Tellewayan hospital. The result showed that among the 584 study participants, only 19 (3.3%) tested positive for HBsAg (Fadolo et al., 2021). Like the other studies, there was a significant difference by gender, with males having the highest HBV seropositivity among the blood donors.

Table 3

Three Distinct HBV Studies Conducted in Liberia

Study Site	Population	Sample Size	Prevalence rate	Year	Location
JFK Center	Healthcare Worker	245	5 %	2021	Monrovia
SDA Hospital	Patients Admitted	134	45.245	2016	Monrovia
Tellewonyan	Blood donors	584	3.3%	2022	Lofa

This comprehensive overview of hepatitis B infection in diverse Liberian populations demonstrates the endemicity of hepatitis B infection affecting the entire country. Healthcare providers, patients, admitted to the healthcare settings, and healthy adults blood donors cover the country's general population. Though no specific study has targeted the general population, uniform personnel, including the military personnel, constitute members of this selected population. These studies also show the disparities in the disease impact by region, with the most affected urban communities.

The Prevalence of Hepatitis B in Global Military Populations

Hepatitis B affects many militaries around the world. Therefore, Villar et al. (2015) conducted a cross-sectional study among young Brazilian military personnel aged 18-25 to determine HBV and HCV prevalence rates. None of the 433 military male study participants presented HBsAg or anti-HBc IgM in their serum. However, 18 (4.1%) of the participant were positive for total anti-HBc, while 247 (57.0%) were positive for anti-HBs (Villar et al.,2015). The major prevalent risks factors associated with these results

were prior dental treatment (77.1%), the practice of oral sex (59.1%), and alcohol consumption (52.2%) (Villar et al., 2015).

On the other hand, the high prevalence of hepatitis B in China could affect its military population. The WHO 2021 report on HBV showed that about 87 million people are chronic carriers in China, accounting for about one-third of the global population. The report also indicates that about 25% of the chronic carriers are diagnosed, but only 10% of the total population is on treatment. A cross-sectional study conducted in China showed the prevalence of HBV and the disparity of infections among military personnel. The studies aimed to investigate HBV infection among military personnel in eastern China to provide health promotion and prevention activities. Officers and soldiers are the two basic categories of personnel in every military establishment. In most cases, officers are among the upper class with better social-economic status than the soldiers. In this study, the researcher identified that officers were mainly affected than the enlisted or soldiers (Wang et al., 2018).

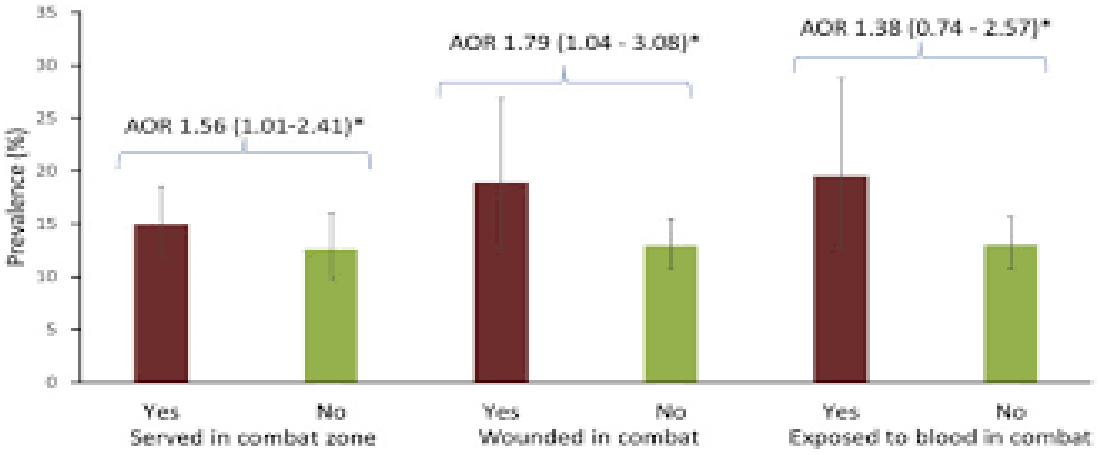
In this study, the researchers recruited 15,508 soldiers and 2386 officers. Among the soldiers, 15,225 males and 283 females were between the ages of 18 to 23 years, and for the officers, 2116 males and 270 females were between the ages of 25 to 55 years, respectively (Wang et al., 2018). In this study, the officers had more years of military experience than the soldiers. The study results showed that 68 participants, all male, tested positive for HBsAg with a 0.44% prevalence rate among the soldiers (Wang et al., 2018). Among the officers, 41 participants tested positive for HBsAg, including 36 males and females, accounting for a 1.72% prevalence rate (Wang et al., 2018). The main risk

factor associated with HBV in China is vaccine refusal because most infection in this study was associated with either perinatal or early childhood transmission (Wang et al., 2018).

Hepatitis B infection is also public health concern in the United States. The disease impact both uniform personnel and the general population. A study conducted among the U.S. veterans shows that the combat environment was independently associated with Hepatitis B infection (Beste et al., 2019). Approximately 2.2 million Americans are infected with HBV and may not be aware of their status (Beste et al., 2019). According to Beste et al., the U.S. National Health and Nutrition Evaluation Survey (NHANES) estimates 3.9% and 0.3% exposure and infection rate among the U.S. population, respectively. The Asian Americans subgroup is mainly affected, while Military veterans had higher odds of HBV exposure than the nonveterans. Specifically, military-related risk factors identified in the study include prior exposure to combat, blood transfusion, or travel to endemic regions (Beste et al., 2019).

Figure 2

Prevalence of Hepatitis B Virus Exposure in the Veterans Health with Military-Related Risk Factors.



Beste et al. (2019) reanalyzed a store serum samples from the NHANES storage facility (N= 1146) from 1998 to 2000. These samples were used to determine HBV exposure prevalence (core antibody positive), infection (surface antigen/DNA positive), and immunity (surface antigen negative, surface antibody positive, and core antibody negative). The research used logistic regression to determine an association between military-related risk factors and HBV infections. This study's results showed that HBV exposure, Infections, and immunity were 13.6% (95% CI, 11.5–16.1), 0.7% (95% CI, 0.3–1.5), and 6.2% (95% CI, 4.7–8.2), respectively (Beste et al., 2019). Most of the participants had high exposure to traditional risk factors such as drug use, high-risk sexual practices, and combat exposures. Hepatitis B exposure was (53%), and 59.5% of these exposures were associated with combat exposures. After adjusting for demographic and traditional risk factors, combat services and being wounded in combat were independently associated with HBV exposures; (adjusted odds ratio, 1.56; 95% CI, 1.01–

2.41) and (adjusted odds ratio, 1.79; 95% CI, 1.04–3.08), respectively, (Beste et al., 2019).

The seroprevalence of HBV infection was not well understood among United States active personnel until a recent cross-sectional study Scott and colleagues conducted. Scott et al. (2020) assessed the epidemiology of HBV in deployed military forces to identify the burden of HBV infection in the threat it poses to the mission. About 10,000 servicemen, including the Army, Air Force, Navy, and Marine Corps personnel who completed their combat operations in Iraq and Afghanistan from October 2007 through October 2010, participated in the studies. This study's results showed the prevalence of chronic HBV infection at accession screening was 2.3/1,000 (95% CI: 1.4, 3.2), and most cases (16/21, 76%) were identified after deployment (Scott et al., 2020). Most importantly, the researchers identified 110 military-associated HBV infections among the study participants (Scott et al., 2020).

Social Factors Associated with Hepatitis B Infection in Military Population.

Hepatitis B infection is associated with social and economic factors in many countries. Military personnel are members of the general society who are also affected by these factors. A study conducted in Turkey shows that migration is among many factors facilitating HBV spread (Tosun et al., 2018). Movement from one place to another or being deployed from one region are regular activities associated with soldiering. In addition, military personnel tend to move very often away from their families to execute national duties. In their study, Tosun et al. (2018) seeks to understand the social and

economic factors such as gender, age, occupation, employment, and social status associations with HBV infections prevalence.

Tosun et al. (2018) study showed that the population aged between 46 to 66+ had a higher prevalence of HBV, while the male was 5% more likely to contract HBV infection than females. There is no significant difference from a study conducted by Zhao et al. (2021) among couples in China. Also, participants who lived in the poorest communities in Turkey had an approximately 16% chance of being affected by the virus compared with those living in wealthier neighborhoods (Tosun et al., 2018). On the other hand, participants with better welfare, such as a higher number of rooms in their homes and higher income, were less likely to develop HBV than those with lower incentives (Tosun et al., 2018). These results are not different from what happened in the Armed Forces of Liberia. The prevalence of HBV infection is high among enlisted soldiers than commissioned officers. Comparatively, officers have better incomes and have better accommodations than enlisted soldiers in the AFL.

Another social factor to consider is the risk factors associated with intra-familial HBV infections. According to Zhao et al. (2021), having a spouse with positive HBV status or exposure to HBV was significantly associated with the infection. On the other hand, sharing needles in hospital settings or among drug users was associated with HBV high prevalence rates (Zhao et al., 2021). Unfortunately, no study in the AFL has determined these associated risk factors among the family members. However, our clinical data show that many couples live within the military barracks whose spouses are either infected with HBV or previously exposed.

Age Association with Hepatitis B Infection

Studies have shown that age contributes to HBV positive antigen carriers to progress to hepato-cellular-carcinoma (HCC) and other liver complications. According to You et al. (2016), females below 40 years progress very slowly to liver disease complications than females 50 years and above. The study results also show that liver cirrhosis is most likely in females with chronic hepatitis B than in their male counterparts after 50 years (You et al., 2016).

One of the significant risk factors associated with HBV infection is unprotected intercourse, especially with sexually active groups. Therefore, the age of individuals is essential to consider as it relates to HBV infections among a given population. Kolou et al. (2017) conducted a study in Lomé, Togo, from 2009 to 2011 on 1200 individuals of all ages. This population was screened for HBsAg with an overall prevalence of 19.08%. Among the infected individuals, participants between the age groups 20-29 and 30-39 had higher infection rates, with lower rates found among participants above 50 years (Kolou et al., 2017). In this study, the prevalence in the male (25.00%) was significantly higher than in females (14.80%) (Kolou et al., 2017). The young populations are mostly affected by infections related to sexual intercourse. Most military troops are young, and the ages are found within the infected age groups, as mentioned in this study. The research found a high prevalence of hepatitis B virus infection in the age range of 20-39 years old individuals in Lomé (Kolou et al., 2017).

Like in Togo, hepatitis B in Pakistan is a significant public health problem mainly affecting males than females within the lower age group. Khan et al. (2011)

conducted a cross-sectional study in the Punjab region in Pakistan and found that of the 4890 ELISA-positive patients screened for HBV infection, 3143 tested positive. More men (68.15%) than women (31.85%) were infected (Khan et al., 2011). The age group largely affected are aged between 21-and 30 (34.93%) and 31-40 (23.83%). The infection rate was less among the older population between ages 41-50 (16.13%) and 51-60 (7.09%). This study concurs with a study conducted in Lomé, Togo (Kolou et al., 2017), which shows that ages 20-29 and 30-40 years were most affected in their prevalence studies. Comparatively, the AFL clinical data show that personnel in these age groups are also at a greater risk of the infection.

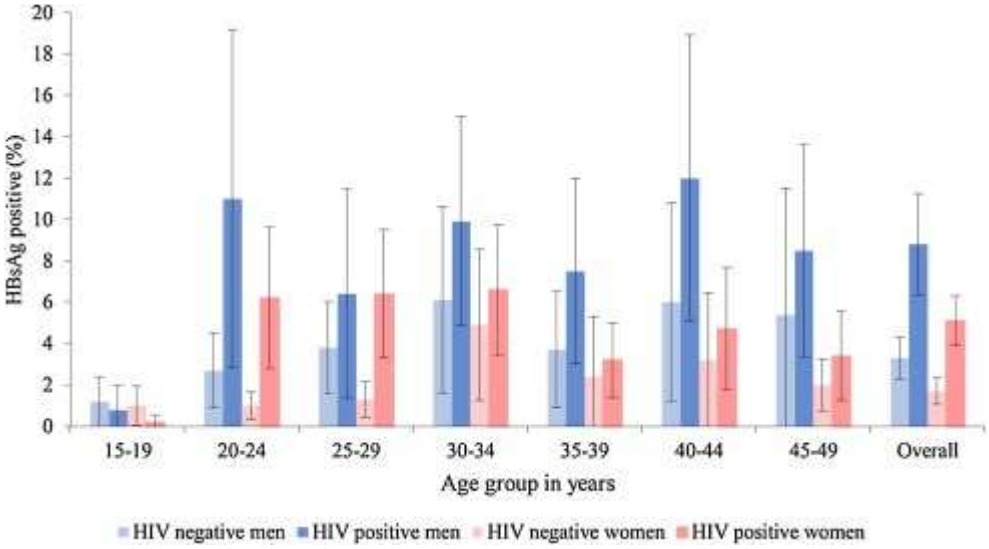
Another study that assessed the prevalence of hepatitis B virus (HBV) infection among vaccinated or unvaccinated married couples in China showed that age was significantly associated with HBV infection. Guo et al. (2020) found that age was significantly correlated with HBV core antibody in vaccinated and unvaccinated personnel. Also, an HBV seroprevalence study conducted in Sierra Leone among blood donors shows that the younger age between 27-29 years was associated with HBV Infections (Tognon et al., 2020). Contrary to these age groups, Birku et al. (2015) study identified key risk factors associated with hepatitis B infections among the personnel, including≥40 years. Tadongfack et al. (2020), in their seroprevalence and associated risk factors of Hepatitis B infection study, found that age was a significantly associated risk factor for HBV infections.

In South Africa, Samsunder et al. (2019) conducted a population-based household survey in the KwaZulu-Natal region. About 9791 people aged between 15 and 49 years

were enrolled with peripheral blood tests for HBV markers. The results show that the overall prevalence in the region was 4.0% (95% confidence interval (CI) 3.4–4.5%), with men accounting for 4.8% (95% CI 3.8–5.8%) and women 3.2% (95% CI 2.5–3.9). The age group most affected was between 40-44 years. See below in figure 3.

Figure 3

Seroprevalence of HBV (HBsAg)-HIV co-infection by sex and age group.



Marriage Association with Hepatitis B Infection

Marriage is a risk factor for HBV infection regardless of the individual social affiliations. Married couples with discordant HBV status have a higher risk of transmitting the virus, especially in the absence of full immunization. A study that Guo et al. (2019) conducted in China determined the prevalence of HBV infection among married individuals who were either vaccinated or not in 2006 and 2014 show the unvaccinated had the highest risk of HBV infection than the vaccinated married couples.

For unvaccinated married couples, the Anti-HBc positivity showed a statistically significant correlation between infected wives (RR = 1.32) and the infected husbands (RR = 1.39) (Guo et al., 2019). On the other hand, HBsAg positivity showed a statistically significant correlation between infected wives (RR = 1.97) and the infected husbands (RR = 2.19) (Guo et al., 2019). The study results did not show statistically significant results for vaccinated married couples (Guo et al.,2019).

In a related study conducted in Japan, a 65-year-old man died of a fulminant hepatitis B infection complication that his wife transferred to him (Sato et al.,2019). In addition, this 65-year-old man died of acute liver failure associated with grade IV coma within 12 days of the disease onset (Sato et al.,2019). After Sato et al. (2019) isolated the patient's HBV, they found that the isolates were genotype and sub-genotype B/B1 with multiple genomic mutations. Furthermore, there was a 100% similarity between the husband (patient) and his wife's genome, indicating vertical transmission.

Hepatitis B virus transmission among family members is higher if both parents have the infection. A study in Iran aimed to investigate chronic HBV infection (CHB) among members in the Golestan province. The province is considered a high-risk region for hepatitis B infections (Katoonizadeh et al.,2018). It was a population-based prospective study known as the Golestan Cohort Study (GCS), which targeted 2590 individuals aged 40 years and older who were HBsAg+ (Katoonizadeh et al., 2018). The study included first-degree relatives, especially 1454 spouses who were screened. This study showed a high virus exposure rate between spouses (male and female) was 52.6 %, with the HBsAg transmission rate among spouses at 2.2% (Katoonizadeh et al., 2018).

On the other hand, Katoonizadeh et al. (2018) also found that the hepatitis B core antibody was positive in 761 (52.3%) spouses. These results cross across other marriage couples regardless of country of origin. Marriage is a risk factor for hepatitis B infection since the primary cause of transmission is unprotected sexual activities. The military families are not acceptation of these risks.

Gender Association with Hepatitis B Infection

Hepatitis B infection has no gender boundaries. The disease affects both males and females regardless of origin. In military organizations, a male is the most dominant gender, which gives a major disparity in the prevalence of the disease. A cross-sectional study conducted in Beijing, China, showed that gender was a risk factor for HBV infections even among vaccinated individuals. The relative risk (RR) in male was 0.60, (95%CI = 0.36–1.00), while relative risk in female was 0.71 [95%CI = 0.52–0.97] (Guo et al., 2019). Tadongfack et al. (2020) study, which focuses on the seroprevalence and associated risk factors of Hepatitis B infection in the rural area of Deschang in Cameroon, found that more females (62 %) participated in the research than males (37%). The prevalence of hepatitis B infection among the female participants was less (4.35%) than among male participants (6.31%).

Furthermore, Ayano et al. (2018) conducted a systematic review and meta-analysis of gender differences in the epidemiology of HIV, hepatitis B, and hepatitis C infections in people with severe mental illness. In this study, the prevalence of HBV-associated mental illness was 15.63% (95% CI 7.19–30.69), with the rate higher in men (18.91%) than in women (12.02%). The specific risk factor associated with men being

more susceptible to the disease was not investigated. Specifically for the military population, the males are predominantly affected by HBV infections. Birku et al. (2015) prevalence among military personnel at Bahir Dar Armed Forces General Hospital, Ethiopia, was primarily male (89.8%), showing hepatitis B infection prevalence above 8%. Also, in China, the participants in an epidemiological survey of HBV infection and low-level hepatitis B surface Antigen (HBsAg) in military camps in eastern China were the male-dominant sex (Wang et al., 2018). The study results show that the hepatitis B surface antigen (HBsAg) positive rate was 0.44% in soldiers accounting for 88.24%, while the officers' HBsAg positive rate was 1.72% (Wang et al., 2018).

Gender Disparity in Hepatitis B Infections

Many studies have indicated the disparities between males and females related to HBV infections complications. This section will identify these specific risk factors that make men more susceptible to the disease than females. Many studies have shown that liver complications associated with HCC predominantly affect males two or more times than females (Bashir et al., 2021). These multifactorial disparities including specific gender risk behavior, metabolic or hormonal, and tumor biology (Bashir et al., 2021). The researchers also mentioned sex differences in several aspects of alcohol consumption with known hepatotoxin and hepatocarcinogen, leading to HBV complications. Alcohol use disorder (AUD) with excessive consumption is more prevalent in men than women. Females are more likely to comply with healthy behavior recommendations that could prevent liver complications than males (Bashir et al., 2021).

Bashir et al. (2021) also mentioned that hepatitis B core promoter in males, sex hormones, and stress are also responsible for the disparity in HCC complications in men than in women. Specifically, Bashir et al. (2021) quoted many studies for their findings that high serum testosterone levels in males predispose them to develop HCC, indicating androgens' synergistic and oncogenic effect. On the other hand, estrogen in females slows the progression of HBV infections and HBV-related HCC, decreasing HBV RNA transcription (Bashir Hamidu et al., 2021; Montella et al., 2015).

Many other studies also confirm that men's susceptibility to hepatitis B infection is higher than females. Further studies demonstrated that men progress to chronic illnesses more than HCC because HBV surface antigen (HBsAg) and DNA virus titers are higher than females (Ruggieri & Malorni, 2015). In addition to previous studies linking sex hormone impact on HBV infections, Ruggieri and Malomi (2015) discovered that response to vaccine could be another factor associated with HBV infection in gender disparity. Compared to both sexes, the researchers found that anti-HBV antibodies tilter is higher in females than males after vaccination because there is a predictor of unresponsiveness to HBV vaccination among males (Ruggieri & Malorni, 2015). Unfortunately, this study did not specify which specific region. So, this disparity cross-across all regions, including Sub-Saharan Africa.

Other risk factors such as the environment and education contribute to gender disparity in HBV infections. A meta-analysis conducted on the African continent to determine the impact and prevalence of hepatitis B infections among pregnant women showed that women in rural communities had a higher risk of HBV infection (Bigna et

al., 2019). This study shows that the gender development index, especially with male education, the female year of schooling, and systemic inequalities, is a major contributing factor to HBV infections (Bigna et al., 2019). Big and colleagues (2019) also highlighted that the poor health system in Africa, especially in both central and western regions, contributes to the HBV prevalence rate, which can remedy with increased incomes.

Military Specific Gender Disparities

All militaries worldwide have substantial gender disparities, with males being the most dominant sex. Apart from gender-specific infections and diseases, men are affected mainly by the number of common illnesses found in the military. For example, a study conducted in Ethiopia Army Hospital shows that about 89.9 % of the population who participated in HBV prevalence studies were males (Birku et al., 2015). Also, Wang et al.'s (2018) epidemiological survey of HBV infection and low-level Hepatitis B surface Antigen (HBsAg) in military camps in eastern China involve all males, the dominant gender. This study focused on the infection rate between officers and enlisted. The 15,508 soldiers and 2386 officers tested from military camps were males (Wang et al., 2018).

Deployment outside their original homes served as a risk factor for hepatitis B infections among military personnel. Military males' personnel are more likely to be deployed than their female counterparts. Diop et al. (2017) conducted a study to determine the prevalence of hepatitis B surface antigen and its associated factors in Senegalese military personnel sent on a mission to Darfur. This study shows that about 85% of the exiled Senegalese military population have been exposed to hepatitis B

infection and 11% with chronic surface antigen (HBsAg) carriers (Diop et al., 2017). All the 169 participants in this study were male soldiers. These results are not different from what is happening in the Liberia military because clinical data also show that most males have hepatitis B infections.

Many other risk factors are associated with HBV infections among the male gender, especially with parenteral infections. Young men are more likely to take health risks than the female gender. Moreover, military deployments to high-risk locations away from family facilitate these behaviors. The Brazilian military prevalent study revealed that deployment to Columbia, with an HBV prevalence of 18.6 % in the general population, was the risk factor for infection (Villar et al., 2015). These instances are essential because behavioral factors such as condom use and substance abuse (alcohol, drugs, etc.) among the young soldiers, especially males, are important risk factors.

Substance Use and Abuse Association with Hepatitis B Infections

The World Health Organization defines substance as harmful or hazardous use of psychoactive substances, including alcohol and illicit drugs (WHO, 2020). Like the name, these psychoactive substances imply dependence syndrome characterized by behavioral, physiological, and cognitive factors. Persistency in substance abuse leads to the desire to get more, hence addiction. Substance abuse is a global public health challenge. The harmful use of alcohol alone results in 3.3 million deaths each year, with youth 15 years or older consuming 6.2 liters of pure alcohol (WHO, 2020).

On the other hand, about 31 million persons have associated drug use disorders, including 11 million who inject drugs (WHO, 2020). The impact of substance abuse is

far-reaching, with immense global consequences and disease burden. Of the world population that injects a drug, 1.3 million people living with HIV (PLWHA), 5.5 million with hepatitis C, and 1 million live with both diseases (WHO, 2020).

Public health is a multidisciplinary field charged with preventing disease and injury and promoting health and positive social change. Substance abuse is a global public health challenge because it focuses on strategies for preventing these behavioral factors. Globally, alcohol and marijuana use are a significant public health challenge needing serious attention from public health policymakers. These substances contribute to the increasing number of preventable and premature deaths (Woolard et al., 2013). Woolard et al. (2013) further mentioned that alcohol avoidance significantly reduces mortality. Alcohol use still accounts for approximately 4% of global deaths.

These two substances use is among the most avoidable risk factors for death, yet adherence is still far from reality. There are many socioeconomic factors associated with substance abuse. Moreover, studies have shown that socioeconomic status, such as income, housing, and education, are contributing factors. One of these studies conducted by Patrick and Colleagues (2012) showed that family socioeconomic status directly correlates with alcohol and marijuana use.

In Liberia, secondary school students have a high prevalence of alcohol and drug use records. According to Pullen et al. (2016), a cross-sectional survey conducted among 802 Liberian school students with 51% of respondents rate showed that 9% of Liberia's youths used marijuana (Pullen et al., 2016). These abuses have seen an increased prevalence of HIV and related illnesses and a change in behaviors. In the AFL, substance

abuse has behavioral consequences because in most instances, the level of discipline among the personnel declined significantly, leading to an increase in Non-Judicial Punishments (NJP) and Jail time.

Multidisciplinary Considerations for Substance Use and Abuse

Laws and Policies

The role of government in public health policymaking is essential to regulate public health actions. The government must be fully involved in public health policy guided by the state's law. The law is affected by public health, accommodating, and restrictive for the population (Bhattacharya, 2013). In most cases, the law affects general health by setting boundaries of authority among decision-makers and ensuring transparency and accountability to the extent possible (Bhattacharya, 2013). The government and its agencies must create and implement public health policies with support from the judicial system.

Liberia's legal provisions for the control of narcotic drugs are set out in the Public Health Law (PHL), which focuses on more policy issues related to health, and the Liberia Drugs Enforcement Agency (LDEA) is responsible for the efficient and effective law enforcement. Prevention against substance use requires working on programs that could reduce the risk factors of consuming these substances. Therefore, the government's intervention in substance abuse issues is vital to minimize the impact on society. The government's responsibility is to use public health law to regulate the population's health behavior.

Epidemiology and Medicine.

Globally, alcohol and marijuana use, and abuse contribute to increasing premature deaths and disease (Woolard et al., 2013). Woolard et al. (2013) further mentioned that though the avoidance of alcohol significantly reduces the mortality rate, alcohol use still accounts for approximately 4% of global death. These two substances use one of the most avoidable risk factors for death, as mentioned in the University of Houston report among active-duty soldiers, which shows that 294 (80%) met the criteria for substance abuse or dependence, including alcohol illicit drugs. The epidemiology is also emphasized by Pullen et al. (2016) results from the survey conducted among Liberia students. Of 802 Liberian school students who participated in the survey, 51% of respondents' rates showed that 9% of Liberia youths used Marijuana.

The medical use of marijuana is raising global attention. Over the past years, consumers have used marijuana for recreational purposes, and the international community is also discussing the therapeutic effect to be used in medical practices. In the United States, the Food and Drugs Authority (FDA) has discouraged the population against its use and classified the substances as "Schedule 1" (high risk for addiction and no medical benefit) (Miller & Oberbarnscheidt, n.d). Despite the FDA's stance on the product, many states legalized the product for various health conditions such as depression, anxiety, glaucoma, nail-patella, pain relief, and HIV (Miller & Oberbarnscheidt, n.d). Unlike alcohol, Marijuana has 400 components with pharmacology and pharmacodynamics. The substance is absorbed in the fatty tissue and

stays in the body for an extended period. On the contrary, alcohol is a drug with a short half-life. It takes a few hours to leave the human system (Miller & Oberbarnscheidt, n.d).

Economics.

Liberia emerged from civil conflict in 2003, and it remains one of the world's poorest countries (Pullen et al., 2016). The fourteen-year conflict ravaged the country's economy, affecting the health and educational infrastructures and increasing the prevalence of chronic diseases, mental illness, and substance use disorders (Pullen et al., 2016). The country's GDP cannot support many of its interventions. Therefore, substance abuse intervention must be cost-effective. Public health officials must conduct a cost-effective analysis to address public health challenges (French et al., 2008). French and colleagues (2008) use cost-effective analysis to calculate and compare costs across various conditions. According to Bhattacharya (2013), CEA in public health seeks to compare the price of an intervention and the health outcomes. Four different therapies were used to determine the cost-effectiveness of various interventions. These interventions include (1) individual Cognitive Behavior Therapy (CBT), (2) Functional Family Therapy (FFT), (3) Integration of both Individual and family Therapies (Joint), (4) a skilled, focused Psycho-educational group intervention (Group) intervention (French et al., 2008).

With the overall cost analysis for the different intervention groups, FFT cost $ 16 887, CBT cost $ 12,830, Joint sessions cost $ 25 743, and Group sessions cost $ 9 471. Furthermore, the individual median cost per intervention was $ 1 625 for FFT, $ 1 278 for CBT, $ 2 546 for Joint, and $ 885 for Group. Therefore, in addition to accepting the

group interventions, the government must enforce the disruption of local drug markets in the communities and efforts to arrest dealers and suppliers of drugs. Furthermore, increase prices to reduce consumption and impose harsher penalties, thereby decreasing the availability of drugs paraphernalia, raising public awareness, and forming community social groups for positive social change.

Politics.

Substance abuse is a national problem needing key stakeholders to strengthen its substance abuse laws. According to (Bhattacharya, 2013), for public health professionals and advocates to succeed, they must have a working knowledge of the political process and its professional players. The Government of Liberia (GoL) has worked to reduce the impact of drugs on the population. However, public health measures and preventions are not void politics. The success of public endeavors depends on political actors to push the agenda and policies to win the hearts and minds of the population (Goldberg, 2012). Legal frameworks and laws have been enacted to enforce substance abuse prevention in the country, including "Liberia's new Controlled Drug and Substances Act and the associated Liberia Drug Enforcement Agency Act.

At the institutional level, partners in progress such as the U.S. Embassy near Monrovia, the Liberia National Police, the Drugs Enforcement Agency, the surrounding communities, and significant stakeholders in the fight against substance abuse. The proximate communities will help improve the health and well-being of the drugs with sensitization, thereby preventing harm from alcohol and other drugs (ADF, n.d). The Ministry of National Defense and the Armed Forces of Liberia has a strict zero-tolerance

policy on illegal drugs such as Marijuana, cocaine, and heroin. Therefore, prevention against substance use requires working on programs that could reduce the risk factors of consuming these substances. A study conducted by Prust et al. (2017) shows that socioeconomic status is a crucial risk factor for substance abuse.

Ethics.

Ethical issues are widely discussed because it deals with how humans are treated. Ethical problems date back to the Second World War when researchers conducted unethical experiments on vulnerable people, as was done by the Nazis, generally known as the Tuskegee syphilis study and clinical trial deaths (United Nations, 2015). Unfortunately, there is still a knowledge gap about ethics in public health (Leven & Flieshman, 2002). Ethical issues associated with drug use involve releasing personal information, which could be a potential source of harm or stigmatization against an individual, especially when it gets into the hands of a third party (United Nations, 2015). One of the significant ethical problems associated with substance abuse and being discharged from the Military for drug abuse involves the service members transitioning to society (M-VETs, 2019).

Military personnel.

Substance abuse such as drugs and alcohol hinder soldiers' discipline, physical, and mental readiness to execute their national duties within the military institutions. Units' cohesions are the recipe for winning a battle in any military organization that is drugs free. According to the National Institute on Drug Abuse (NIDA) (2019), military duties are void of stress associated with deployment in a combat zone. The stressful

environment enables soldiers to initiate smoking, unhealthy drinking, and drugs, which may lead to risky behaviors (NIDA, 2019). These risky behaviors may include unprotected sexual behaviors, injection drugs, and subsequently, HBV infections and other infectious diseases.

The University of Houston in the USA conducted a study and found that 294 (80%) active-duty soldiers met the criteria for substance abuse or dependency on alcohol and illicit drugs (Walker, 2014). In most military worldwide, alcohol and marijuana use are greatly restricted. According to Rigod et al. (2011), alcohol is consumed in moderation but must be in a mess, and Officers and enlisted who are caught with drugs are confined for 30 days or released to civil police. Moreover, random urine testing for drugs can be conducted at any time. In 2018, a behavioral survey conducted in the Armed Forces of Liberia (AFL) showed that 27% and 7.1 % of personnel abused alcohol and drugs, respectively (Liberia SABER, 2018). The Ministry of National Defense and the Armed Forces of Liberia has a strict Zero tolerance policy on the use of illegal drugs such as Marijuana, cocaine, and heroin.

Substance Use (Marijuana and Alcohol) Association with Hepatitis B Infection

There is a high prevalence of HBV among people who use drugs (PWUD). PWUDs share the same needles in most cases, which is a crucial behavioral factor for most infectious diseases such as Hepatitis B. People who inject drugs are vulnerable to HBV. Needle sharing is one of the major transmission routes, which caused about 10·08 million DALYs among HIV and HBV (Degenhardt et al., 2016). People who use drugs are vulnerable because they become homeless, incarcerated, practice unsafe sex, and have

limited access to healthcare and treatment programs (Degenhardt et al., 2016). Degenhardt et al. (2016) also mentioned that the World Health Organization (WHO) is considering this adult population as a strategy to reduce the impact of HBV by promoting harms reduction services. Many areas of focus will include preventing mother-to-child transmission (PMTCT), vaccination, treatment programs, and safe medical interventions (WHO, 2016). Controlled drugs are substances, when consumed frequently, alter most individuals' self-control.

According to Semá Baltazar et al. (2019), users of injectable drugs are at higher risk of acquiring and transmitting blood-borne viruses' diseases such as HBV, HIV through either unsafe injection practices or unprotected sexual behaviors. According to the United Nations on drugs and crime, approximately 29.5 million population are affected by drug use disorders globally, with sub-Saharan Africa accounting for about 1.4 million (Semá Baltazar et al., 2019).

A study was conducted in two Mozambique regions among People Who Inject Drugs (PWID). About 492 individuals enrolled in the study, with 95% men. The average HBsAg positivity rate was 34.25 %, and the critical risk behavior associated with the infection was unprotected sexual intercourse (Semá Baltazar et al., 2019). Some studies have shown the relationship between people who inject drugs (PWID) and HBV infection rate. A study conducted in Iran showed a 4.8% HBV prevalent rate among PWID with the previous imprisonment as the associated risk factor (Rostam-Abadi et al., 2020). A study conducted among U.S. Military personnel in Europe showed an association between substance use and hepatitis B Infection. In univariate analysis, drug use was a

significant risk factor for HBV infections among the soldiers (Prier & Cowan, 1987). Also, the multivariate analysis indicates that injection of drugs was significantly associated with HBV infection.

Substance Abuse (Alcohol) Association with Hepatitis B Infections

Alcohol abuse as a public health problem contributes to risk behaviors associated with HBV infections. Iida-Ueno et al. (2017) estimated that approximately 38% of the world population aged 15 years and above consume about 17 liters of pure alcohol annually. The researcher also mentioned that the World Health organization estimate showed that 3.3 million or 5.7% of global deaths are associated with alcohol consumption (Iida-Ueno et al., 2017). Zhou et al. (2021) mentioned that alcohol consumption is among the primary causes of liver cirrhosis resulting in HBV replications, oxidative stress increases, and a compromised immunes response. Alcohol consumption among individuals, including the military personnel, impacts decision-making and solicits riskier sexual behavior and pathways for HBV infections (Morojele et al., 2021). These pathways are not restricted to a specific population but are somewhat generalized. Rehm et al. (2017) established a causal pathway between alcohol and infectious disease (HIV, HBV) with the "intention to have condom-less sex" and the "intention to take a risk" as surrogate measures for infection.

Condom Use Association with Hepatitis B Infection

The incidence of sexually transmitted infection is attributable to a lack of condom use. In comparison with other preventive measures for Sexual Transmitted Diseases (STDs), such as Pre-Exposure prophylaxis (PrPrep), condoms use remains a necessary

measure to prevent all STIs (Farrington et al., 2016). According to Barbosa et al. (2019), the first line of individual-level prevention from sexually transmitted infection (STIs) such as HBV is condom use during sexual contact. Globally, the continuous increase in STDs incidence is due to inconsistent condom use, a significant public health problem (Farrington et al., 2016). Condom use is an individual behavioral factor that needs detailed studies, especially in the fight to reduce sexually transmitted infections.

There are many motivations associated with either condom use or condom nonuse. Farrington et al. (2016) described five motivational factors associated with condom use during HIV and STDs prevention studies. The five reasons include (a) self-protection, (b) partner protection, (c) relationship, (d) norms, and (e) lust (Farrington et al., 2016). Obviously, in most instances, individuals use a condom to protect themselves from infections, especially when they are aware of the risk associated with the infections. This behavior is mentioned as one of the health belief model constructs whereby the individual perceives the risk associated with a specific infection. On the other hand, partner protection portrays the love for a family member or spouse, which motivates to prevent of these infections. This motivation is associated with the external social constructs that allow caregivers to protect their loved ones (Farrington, Bell, & DiBacco, 2016).

Relationships associated with condom use or nonuse can be complicated and may lead to an increased spread of HBV infections and other STIs. Individuals make choices about condom use based on the kind of relationships, especially when the health status of the various partners is unknown. With this unknown status, condom use is less for

primary or long-term partners than secondary or short-term partners (Farrington et al., 2016). Additionally, other factors impact condom use in many relationships, especially when social norms are involved. Some of these factors are fear of partner reaction, intimate partner violence, fear of distrust associated with the request to use a condom, socioeconomic status, especially females who cannot afford it, and power in a relationship (Farrington et al., 2016).

Condom Use Among Military Populations

The uniform personnel are not different from the general population as it relates to the risk of contracting sexually transmitted infections. The nature of the military job is a risk factor for sexual risk behaviors. Harbertson et al. (2019) confirmed that condoms use is a meaningful way to prevent STIs. Their studies focused on condom use among US Marine and Navy deployed on the sea. They also examined condom use among the personnel during the last sexual encounter and within the previous 12 months before deployment, during deployment, and at most three months post-deployment (Harbertson et al., 2019). The researchers were concerned about how the personnel use condoms in relation to their risky behaviors such as substance use, alcohol abuse, and transactional sex (Harbertson et al., 2019). The result of this study showed condom nonuse was associated with alcohol abuse (OR 1.44) and substance use (OR 1.37) (Herbertson et al., 2019). Another study that Triplett et al. (2021) conducted among the same population showed that 16% of the study population did not use a condom during their last sexual encounters. Also, 82% of the study population consumes alcohol before sexual intercourse (Triplett et al., 2021).

A study conducted in the Cameroonian military to determine the pattern and determinants of condom use among personnel showed an alarming result. Of 323 consented male participants, only 28% used a condom during their sexual encounter, despite 85% attested to condom availability (Bain et al., 2017). The most prominent risk behaviors associated with less condom use include alcohol abuse (37.5%), trust in a sexual partner (26,5%), and substance use (11.1%) (Bain et al., 2017). Tran et al. (2019) conducted a SABERS among the Congolese military personnel from an African military perspective. The results showed that 77.2% of participants in the study consumed alcohol. About 37.6% and 21.9% mentioned that alcohol consumption influenced their decision to use a condom and had unintended sexual intercourse due to alcohol consumption, respectively (Trans et al., 2019). Condom use was also low among Thailand's young military recruits. The study conducted among the Royal Thai military recruit showed that only 12.6% ported condom use every time during sexual contact, with 19.5% of the recruits never using a condom (Surit et al., 2017). Like other studies mentioned above, alcohol abuse and substance use are among the risk behaviors associated with condom nonuse (Surit et al., 2017).

While hepatitis B virus is transmitted via other means such as percutaneous with needle stick injuries and vertical transmission from mothers to their babies, sexual transmission is the most dominant means of contracting the virus among sexually active individuals. According to Inoue and Tanaka (2016), HBV prevalence is high among homosexuals, such as men who have sex with men (MSM) because of friction associated with the intercourse and heterosexuals with multiple sexual partners who do not use

condoms. Therefore, from a public health perspective, condom health promotion is the surest way of preventing the virus in sexually active individuals. Adeyemi et al. (2021) conducted a cross-sectional study in Nigeria to determine HBV infection among MSM and transgender women (TGW). The results showed that non-condom use during the sexual intercourse was independently associated with HBV infection in these critical populations. The Brazilian military hepatitis B and C cross-sectional results showed that 42 individuals tested for HBsAg, and of the number, 89% reported non-consistent condoms use (da Motta et al., 2019).

Theoretical Framework

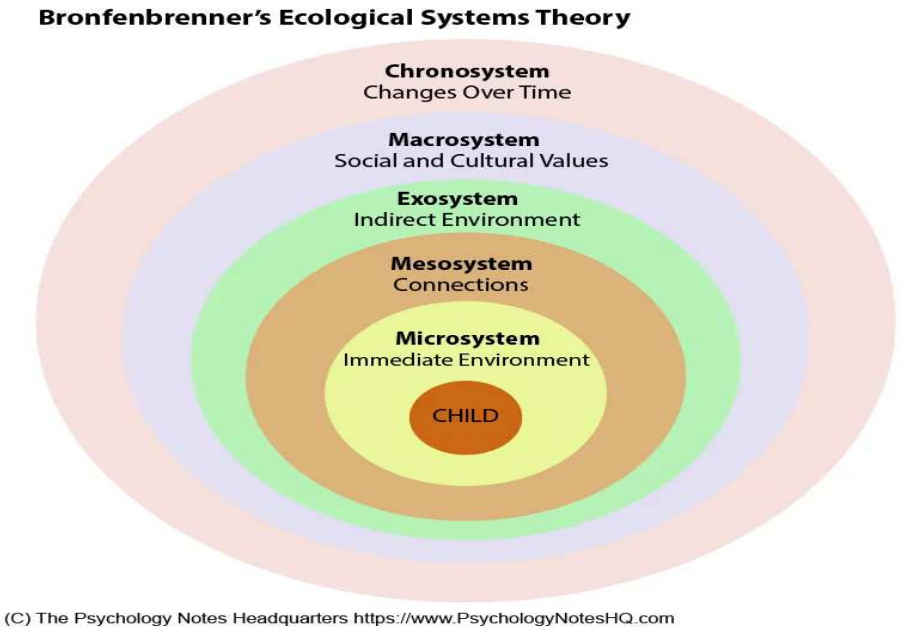
The success of every research depends on a guided theoretical framework. With the environmental complexity, only a sound conceptual framework can provide the roadmap to addressing the multiple determinants of health behaviors that may improve individual health (Bastani et al., 2010). Theory-guided research has advantages because it provides a systematic approach to specific findings and allow hypotheses to be tested and facilitates a logical connection or pathway among the independent and dependent variables. The theoretical or behavioral framework that ground this study is Urie Bronfenbrenner's (1980) SEM. This model posits that human health behavior is influenced by multiple levels of influence, including intrapersonal, interpersonal, community, and the public policy levels. Furthermore, the impact of health behaviors varies by the target behavior and context. Bronfenbrenner's initial theory places the individual at the center of his concept. He surrounds the *individual* with the various

systems such as mesosystems, exosystems, macrosystems, and chronosystems that influence his behaviors (Kilanowski, 2017).

According to Kilanowski (2017), the microsystem is the closest construct to the individual in the model because his surroundings have the most substantial influence on behaviors. The mesosystem focuses on the individual's direct interaction with others during work, school, religious affiliation program, and the neighborhood. Finally, the exosystems, macrosystem, and chronosystem focus not only on how the community impacts the individual positively or negatively but also on how culture, society, policies, and religion influence behaviors (Kilanowski, 2017). The figure below shows the origin of the SEM.

Figure 4

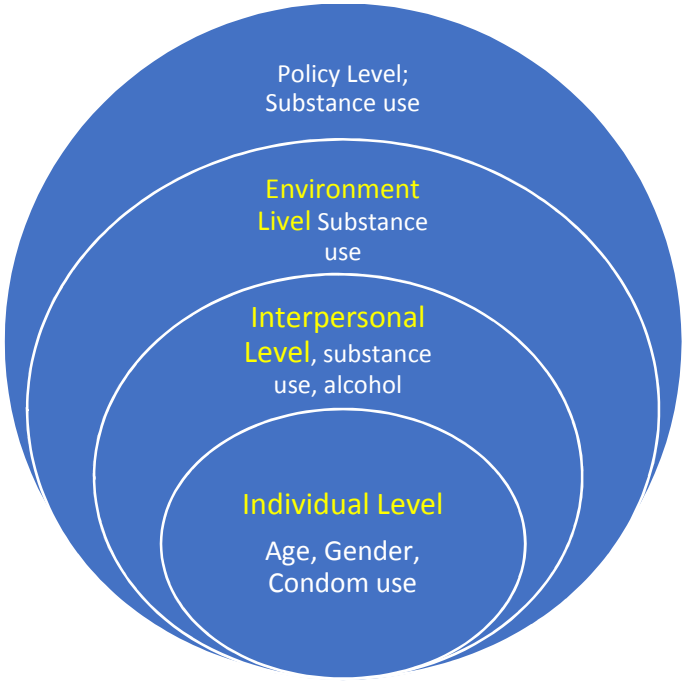
Bronfenbrenner's Initial Ecological System Theory



The Social-Ecological Model is a framework that also helps understand the multifaceted levels that society poses on an individual. The SEM's different factors and determinants promote prevention, control behaviors, and intervene to improve behavior patterns affecting every level of the individual life. Preventing risk factors requires approaching the problem simultaneously at all levels. This social-ecological model will help explain the association between the individual at the intrapersonal level (biology, demographic, knowledge, attitude, behaviors), the intrapersonal/networks (social, support, family, religion), the community/environment (military institution, deployment locations), and at the policy level (military structures and policies, laws) (Baral et al., 2013). The framework will help identify the underlying factors associated with HBV and its impact on society.

Figure 5

Socio-Ecological Model for Hepatitis B Infection



Intrapersonal Level of Influence

The SEM posits that while the intrapersonal factors are responsible for the associated disease spread, the higher order, such as the networks, community, and policy, are outside the individuals' control (Baral et al., 2013). Most interventions associated with infectious disease are done at the individual level, which is just one component to address the public health problem. The socio-ecological framework allows public health professionals to initially intervene in infectious diseases such as HBV from an intrapersonal perspective (Baral et al., 2013). The intrapersonal perspective includes the individual biological (age and gender), extensively discussed in the literature above. In addition, individual risk behavior is associated with substance use, alcohol abuse, and condom use (Surit et al., 2017). Therefore, most health promotion programs targeting human behaviors are essential to reducing the impact of HBV infections (Kilanowski, 2017).

Interpersonal Level of Influence

This level concern the interaction of an individual with relationship to others. The individual social affiliations and networks, especially with families, friends, and sexual contacts, influence the behavior (Farrington et al., 2016). At this level, the individual is bound by their socioeconomic status, religious affiliations, culture, and race. Social and sexual networks are a critical component for this level since they must deal with HBV infections that mainly spread through sexual contacts. Condom use or nonuse has become the center point for hepatitis infections (Surit et al., 2017). Social affiliation also promotes substance use and alcohol consumption. Alcohol abuse and substance use are

the gateways for sexually transmitted infection because making a sound judgment for condom use becomes a challenge due to the altered mental state (Iida-Ueno et al., 2017). Furthermore, the social engagements, the HBV prevalence, information dissemination, and intimate contacts contribute to the interpersonal level of influence.

Environmental and Community Levels of Influence

From an ecological standpoint, individual life, and work environment impact behavior. According to Kalinowski (2017), the individual's surrounding critically impact his behavior towards the future. The community structure shapes behavior and promotes healthy living that may prevent health complications such as those associated with hepatitis B infection (Baral et al., 2013). According to Baral et al. (2013), a community generally includes organizational relationships, social groups, geographical regions, and political subdivisions. The society for this research is the Armed Forces of Liberia community, which include the soldiers, their families, and surrounding communities that impact the soldiers' lives and behaviors. The military way of life and tradition, including socio-cultural norms, values, work nature, and organizational structure, influence the individual soldier and impact his behaviors (Lubens & Bruckner, 2018). At this level, health promotions for proper condom use and substance abuse are the best strategic objective to reduce the spread of the infection.

Societal and Policy Level of Influence

Laws and policies help either promote or prevent behaviors or activities at every level of the model. Policies that challenge the status quo and prevent the disease spread are essential. Making the laws and the policies is the government's responsibility with

implementation by various organizations. According to the Center for Disease Control and Prevention (CDC) (2022), more excellent societal factors such as cultures, educational, and economic policies encourage or promote behaviors. For example, tackling gender factors associated with HBV infection will require policies that promote early childhood vaccination and promote safe condom use (WHO, 2021). Policies related to substance use, such as marijuana, require more rigid guidelines that outline penalties, especially for military personnel. A stricter uniform policy that prohibits the consumption of alcohol during work hours while in military attire must be strongly discouraged. For example, the Armed Forces of Liberia has a strict zero-tolerance policy for drugs consumption.

Summary of the Literature Review

There is a clear research gap in understanding the association of gender, substance use, alcohol abuse, and condom use with hepatitis B infection in the Armed Forces of Liberia (AFL). In Liberia, no study has determined the association of these variables with HBV infection. However, the extensive literature review shows that researchers have done some work. Few studies have shown that there is an association of gender, substance abuse, and condom use with hepatitis B infections. Most studies failed to independently determine these risks factors. On the other hand, global research has understood that HBV is a public health problem requiring a focused approach to reduce its impact. The literature review showed that about 296 million people were living with the disease, 820 000 individuals died from the disease complications in 2019 (WHO, 2021). The literature also shows that HBV affects between 60-and 100 million persons in

the African region (Breakwell et al., 2017, WHO, 2021). Also, most of the countries in Africa have either intermediate (2%-7%) or high (equal or above 8%) prevalence of chronic infections (Breakwell et al., 2017). The hepatitis B prevalence in Liberia is not well understood. However, two prevalence studies showed two different prevalence rates. The Asian Liver Center at Stanford University (2019) data estimated that in 2018, Liberia's HBsAg prevalence was 17.2%. The contrary report, the Coalition for Global Hepatitis Elimination (CGHE) 2019 to 2021 report shows that in the same year (2018), the HBsAg prevalence was 10.5 on average (CGHE, 2021).

No association between the research predictor variables (gender, substance use and abuse, condom use) was associated with HBV infection in the study population. However, another study has shown that being male is a risk factor for HBV infection. Most of the results mentioned the gender disparities as multifactorial, including specific male risk behavior, metabolic or hormonal, and tumor biology (Bashir et al., 2021). On the other hand, no studies have shown an association between substance use and abuse and condom for HBV infection. Instead, they are a behavioral risk factor that leads to sexually transmitted diseases, including HBV. This study will identify whether these variables are independently associated with HBV infection, thereby bridging the literature gap. The next section is important to understanding and bridging the knowledge gaps about the association of the predictor variables and the outcome variable. The data analysis plan presented will provide graphs and tables that will clearly identify that literature gap and provide insight for public health policymakers to develop strategy to reduce the impact of the disease on the soldiers and their families.

Section 2: Research Design and Data Collection

Research Design

This study was nonexperimental, and I employed a quantitative cross-sectional research design. The predictor variables were substance use (drugs and alcohol), gender (male and female), and condom use with regular partner, while the outcome variable was HBV infection. The variables I selected as confounders were based on the literature review and infection on HBV infection (age, marital status, education, and rank). The dataset used in this study was secondary collected at one point in time from personnel of the AFL. The primary purpose of this quantitative study was to determine if gender (male and female) and risk factors (substance use, alcohol abuse, and condom use) predict Hepatitis B Infections after adjusting for age, marital status, education, and military rank among Liberia Military population. Additionally, I further investigated how these independent variables singly and when combined impacted the outcome variable.

In this non-experimental study, I used a correlational design approach which required the variables to be measured than manipulated. According to Burkholder et al. (2016), the independent or predictor variable is considered the presumed factor that causes a change or potential and significant effect on the dependent or outcome variable. At the same time, the dependent variable is the presumed outcome after manipulating the independent variable. On the other hand, the confounding variables are categories of variables or extraneous factors that have an undesired effect or influence on the results of an entire study (Burkholder et al., 2016). In this study, I used instruments that determined the reliability and validation of the study. The types of analysis that were used include

univariate, bivariate, and binomial logistics regression. Furthermore, since the data were secondary, the HIPAA regulation were considered to protect all individuals' identifiable information.

Research Methodology

Population and Sampling Strategy

The population of this study were all active-duty uniform personnel of the Armed Forces of Liberia. The size of the current force is slightly 2,000 soldiers. The United Department of Defense HIV and AIDs Program (DHAPP), under the President Emergency Preparedness for AIDS Relief (PEPFAR) initiative, conducted a Seroprevalence and Epidemiological Behavioral Risks Survey on this entire population with 1583 participants who responded to the survey. The secondary data from this survey was used to answer my research questions. All AFL members met the inclusion criteria for the study regardless of their health status. Because the data were secondary, I relied on the previous research criteria for selecting the study participants.

I used a nonprobability sampling method. The target population for the SABERS study was approximately 2000 uniform personnel, but only 1583 participants responded to the research question. In this current study, I included all 1583 participants after removing major outliers to run binomial logistic regression. The study population that I use in this study was not stratified either by age, gender, income, education, or socioeconomic status. Instead, all uniform personnel were considered. In stratification, specific characteristics of individuals such as gender (females and males) are represented

in the sample with a true proportion within-population with traits (Creswell & Creswell, 2017).

Power and Sample Size Calculation

A power calculation is essential in quantitative studies. In this cross-sectional study, my goal was to predict if gender (male and female) and risk factors (substance use, alcohol abuse, and condom use) are statistically significant with Hepatitis B Infections after adjusting for age, marital status, education, and military rank among Liberia Military population. According to Creswell and Creswell (2017), to conduct a correlational study, a sample size is needed to determine if the correlation significantly differs from zero because a possible hypothesis will show if there is significant association or not between the predictor variables and the outcome variables. Sample sized estimation requires that the researcher (a) estimate the size of the correlation (r) and (b) set a two-tailed alpha value (α) which will determine a Type I error rate, and a beta value (β) which is a Type II error (Creswell & Creswell, 2017). In Binonial logistic regression, effect size estimation for more than one independent variable will require that the researcher estimate the sample using n^* where

$$n^* = \frac{n}{1 - R^2} \quad \text{and} \quad n = \frac{(z_{1-\alpha/2} + z_{1-\beta})^2}{p_0(1 - p_0)\,b^2}$$

Where, R^2 is obtained by calculating the regression of the independent variable of interest, while the other independent variables are regress using multiple linear regression. This will require holding all the other variables set on their mean value (Zaiontz, n.d).

One of the assumptions of a binomial logistic regression is the bare minimum of cases for every predictor or independent variable should be 15 to 50 cases. The binomial regression model relies on maximum likelihood estimation (MLE) and the reliability of estimate declines to combine cases when they are few (Laerd Statistics, 2017). The logistic regression analysis output (case summary) showed that all the variables included in this study met this assumption.

Instrumentation

In this secondary research study, I utilized pre-existing secondary dataset taken from the U.S. Department of Defense HIV/AIDS prevention program. The U.S. Department of Defense HIV/AIDS Prevention Program (DHAPP), based at the Defense Health Agency (DHA) in San Diego, California, is the DoD Executive Agent for the technical assistance, management, and administrative support of global HIV prevention, care, and treatment in foreign military programs. In most partner country militaries, DHAPP conducts SABERS studies to determine the prevalence of HIV in the Military. During the survey, other infectious diseases such as HBV were included for data collection. The researchers in the primary study distributed informed consent to the military personnel as a critical instrument for inclusion in the study. The researchers used the computer-Assisted Personal Interview (CAPI) or a Computer-Assisted Self Interview (CASI) as an instrument to conduct interviewer-administered or self-administered questionnaires. The CASI process was facilitated using a tablet computer and subsequently uploaded to a storage device.

Validity and Reliability

I determined the validity of this instrument when the dataset was requested and received. I emphasized construct validity because this helped identified if the chosen instrument positively impacts the study results. According to Creswell and Creswell (2017), construct validity determines whether the item in the study measures either the hypothetical construct or concept. Construct validity is important because it helps the researchers determine whether various scores will serve valuable purposes and consequences during practical applications (Creswell & Creswell, 2017). Determining validity with specific instrument use is important because behavioral change implication determines any study's success.

I closely considered reliability of the scores gathered from the preliminary study. Reliability focuses on both the consistency and repeatability of the instrument, especially when dealing with its internal consistency (Creswell & Creswell, 2017). This aspect of reliability assessment was significant because the instrument scale items should assess the same underlying construct to have a suitable intercorrelations (Creswell & Creswell, 2017).

Data Collection

The dataset that I used in this study was secondary data. The primary researcher collected the primary data to understand the prevalence of HIV and other correlations (chlamydia, gonorrhea, syphilis, and HBV) among the AFL personnel which was "Seroprevalence and Behavioral Epidemiological Risk Survey aimed to capture all uniform personnel and families. Due to the small-sized size of the military, all active-

duty soldiers were invited to participate in the SABERS survey. All active-duty personnel in the AFL were aged 18 and above because it is a policy. That personnel on a foreign mission, hospitalized, and who refused to participate were excluded from the study. The primary researchers conducted an initial pilot study to ensure the soldier understood the questionnaire. All participants signed a consent form before enrollment into the studies. All identifiable information about the study participants were removed during the specimen collections and transferred to the national laboratory.

This intended secondary dataset fell under the United States federally funded research grants and is currently stored in the U.S. Department of Defense HIV and AIDS Program (DHAPP) data repositories. The dataset was collected at one point in time from the study participants. The Armed Forces of Liberia and Department of Defense (U.S. DoD) HIV Seroprevalence and Behavioral Epidemiology Risk Survey (SABERS) military-specific dataset has all the needed variables to answer my specific research questions. Though HBV was not the focus of the preliminary study, it gathered all the necessary behavioral factors such as substance and condom use that may determine the relationship between the variables. Since the primary research was a collaborative effort between the two institutions (AFL and DHAPP), Walden IRB requested a confirmation email from DHAPP to determine an agreement between both institutions for the data to be used.

Data Analysis

In this secondary study, I used Statistical Package of the Social Sciences Software (SPSS) V 28 for data management and all analyses. Since the primary study was a

collaborative effort between the two institutions, I requested an already clean data excel file from the DHAPP data repositories management for use in this study. To answer the below research questions, I recoded the data to satisfy the binomial logistic regression assumptions.

I categorized the main variables in the analysis into subgroup to fulfill all the requirement. The substance abuse variable included drug use and alcohol consumption; the condom use variable included condom use with regular partner, condom use with casual partner, and condom use with sex workers; the gender variable included both male and female. Furthermore, the test statistics required that the outcome variable (HBV infection) was binary. In the original data. the outcome variable had three levels. I recoded the original variable into a new binary variable before inclusion into the logistic regression model (1= HBV Positive and 0 = HBV Negative).

The predictor variables were also recoded. The substance use predictor variable was recoded into two groups of participants (*never consumed alcohol* = 0, *consumed alcohol* = 1, *consumed drug* =1, *never consumed drug* = 1); Gender (*male* = 1, *female* = 0); condom use [condom use with regular partner (*no* = 1, *yes* = 0), condom use with casual sex partner (*no* = 1, *yes* = 0), condom use with sex worker (*no* = 1, *yes* = 0). The confounding variable was also recoded. To classify the variable the mode in the frequency outputs were determined to categorize the variables. For marital status (married = 0, others = 1), military ranks (junior NCO = 1, others = 0), education (high school graduate = 1, others = 0). All the data coded [0] were considered the reference values.

Research Question 1 (RQ1): Is there an association between gender and hepatitis B infection among the Liberian military when controlling for substance use, condom use, marital status, education, age, and military ranks?

Null Hypothesis ($H_0$1): There is no significant association between gender and hepatitis B infection among the Liberian military when controlling for substance use, condom use, marital status, education, age, military ranks.

Alternative Hypothesis (H_a1): There is a significant association between gender and hepatitis B infection among the Liberian military when controlling for substance use, condom use, marital status, education, age, military ranks.

Research Question 2 (RQ2): Is there an association between substance use and hepatitis B infection among Liberian military personnel when for controlling for gender, condom use, marital status, education, age, and military ranks?

Null Hypothesis ($H_0$2): There is no significant association between substance use and hepatitis B infection among Liberian military personnel when controlling for gender, condom use, marital status, education, age, and military ranks?

Alternative Hypothesis (H_a2): There is a significant association between substance use and hepatitis B infection among Liberian military personnel when controlling for gender, condom use marital status, education, age, and military ranks.

Research Question 3 (RQ3): Is there an association between condom use and hepatitis B infection among Liberian military personnel when controlling for, gender, substance use, marital status, education, age, and military ranks?

Null Hypothesis ($H_0$3): There is no significant association between condom use and hepatitis B infection among Liberian military personnel when controlling for gender, substance use, marital status, education, age, and military ranks?

Alternative Hypothesis (H_a3): There is a significant association between condom use and hepatitis B infection among Liberian military personnel when controlling for gender, substance use, marital status, education, age, and military ranks

The main predictor variables in the above research questions and hypothesis were categorical. The binomial logistic regression model was the major statistical test used to determine the association among the variables. According to Laerd Statistics (2017), binomial logistic regression test statistics predicts the probability that an observation fall into any of the two categories of a dichotomous outcome variables. Other the other hand, there can be more than one predictor or independent variables which can be continuous or categorical (Laerd Statistic, 2017. The model was best because there was no need for a linear relationship between the independent and dependent variables. Homoscedasticity was not a concern. The independent variable can be continuous, ordinal, or nominal. In logistic regression, the covariate X is related to a binary response Y in a model log (P/1-P) = Bo +B1 x X1 where P= Probability (Y=1). I was interested in testing the null hypothesis Ho: B1=0 against the alternative hypothesis H1: B1=B* (Beta-Prime), where B* $\neq$ 0, that the covariate was related to the binary response variable.

The frequencies and percentage for the categorical predictor and outcome variables were analyze. Afterwards, descriptive statistics were performed to determine the frequencies and percentages. The covariate or confounding variables were also

analyze using the binomial logistic regression model. Aside from the main predictor variables of interest, covariates such as age, education, marital status, and socioeconomic status could have an independent effect on hepatitis B. To control for possible confounders, all the variables were included in the binomial logistics regression analysis to neutralize their effect on the outcome of interest.

The results were presented at different stages of the analysis. The results from this analysis were able to address the research questions and hypotheses through tables, graphs/figures, and sentence case analysis. A comprehensive descriptive tables statistics showing frequencies and percentage. The statistical significance test results showed whether the observed scores are a pattern rather than a chance. This study set a rejection level of "no effect," $p = 0.05$, and then determine if the regression model was properly fitted to reject the null hypotheses. The odd ratio expressed as the Exp (B) determined how one unit increase in the predictor variable affects the odds of the outcome of interest happening. The 95 % confidence interval of odd ratio indicated that 95 out of 100 times the observed scores were found between the range of values.

There were minor ethical concerns associated with the dataset used in this study. The primary study researchers obtained Institutional Review Board (IRB) approval from the Walter Reed Army Research Institute and the Liberia IRB to conduct the study. The data was stored in the DHAPP data repositories. Because the United States works in many countries worldwide, I assumed that all procedures were considered during the primary data collection and storage. Therefore, the de-identified data was requested for

analysis during this study. Before the proposal approval and the data analysis, I received IRB approval from Walden university's ethical review board.

Summary

This study was non-experimental, and it employed a quantitative cross-sectional research design. The study's independent variables were substance use, gender, and condom use and the outcome variable was hepatitis B infection. The covariates that could have independent effects on the outcome of interest were age, marital status, education, and rank (SES). The dataset used in this study were secondary collected at one point in time collected from personnel of the AFL during a SABERS study. My study population included all active-duty personnel (1500-2000) who participated in the primary study. However, about 1583 participants and their responses were included in the final analysis. This study required at least 15-50 cases per participant was require determining a medium effect size for the strength of the correlation between the predictor variables and the outcome variable. This study data management and all analyses were done using the Statistical Package of the Social Science Software (SPSS) version 28 and the results addressed the research question and hypotheses through tables, and graphs/figures, and sentence case analysis. The results were also delivered through a comprehensive descriptive tables statistic with frequency tables indicating the means, median, standard deviations for (Age variable), mode, confidence intervals, statistically significant results, effect size, and the exponential B (odd ratios).

The third and next section of the study showed a comprehensive analysis of the results. These results showed values which explained to what extent the determine the

predictor variables impacted the outcome of interest. The statistical significance test results showed whether the observed scores are a pattern rather than a chance because a rejection level of "no effect," is set $p = 0.05$, to reject the null hypotheses. Also, the effect size, which identifies the strength of the relationship representing the actual population, was established.

Section 3: Presentation of the Results and Findings

Introduction

This study was nonexperimental, and I employed a quantitative cross-sectional research design. The independent variables are substance use, gender, and condom use and the outcome variable is Hepatitis B infection. I used secondary collected at one point in time from personnel of the AFL during a SABERS study. This study population were active-duty personnel (1583) who participated in the primary SABERS study. The purpose of this quantitative study was to determine the association of the independent variables such as gender (male and female) and risk behaviors (substance use, alcohol abuse, and condom use) with the dependent variable Hepatitis B Infections after adjusting for possible confounders such as age, marital status, level of education, and military rank among Liberia Military population. To achieve this purpose, I analyzed three research questions and related hypotheses.

In this chapter, I provided an overview of the demographic situation of the target population, a general outlook of the HBV situation in the AFL, provided answers to the research questions and assessed the hypothesis in view to reject the Null Hypotheses, present a comprehensive table of the statistical analysis, and summarize and interpret all the findings.

Statistical Analysis and Assumptions

I used a secondary data collected at one point in time from personnel of the AFL during a SABERS study. Because of the secondary nature, some of the key predictor variables were recoded to meet the requirement for a binomial logistics regression

analysis. Initially, a descriptive statistic generated provided a general understanding of the dataset in terms of frequencies and percentage. Furthermore, a cross tabulation showed the interactions between the predictor and outcome variables. Lastly, I conducted a simple binary logistic regression model to understand the relationships between the variable before conducting the full Binomial logistic regression analysis.

The main predictor variables in the research questions and hypothesis were categorical and the response variable was binary. Binomial logistic regression was the required statistical test that I used to determine the association among the variables. I stratified all the assumption associated with this test. I assessed the linearity of only continuous variable (age) with the logit of the outcome variable using the Box-Tisdell (1962) procedures and was found to be linearly related. Homoscedasticity was not a concern and collinearity assumptions were also not a concern. The multicollinearity assumption which state that there are no linear relationships between the predictor variable was also satisfied.

Presentation of the Results

Descriptive Statistics

Demographic Characteristics and Results

This research study focused on the HBV status of personnel of the Armed Forces of Liberia. In most military around the world, there are more men than women. On the other hand, the military structure stratified the personnel into two major groups such as officers and enlisted. These descriptive statistics focused on understanding the age groups

of the population, gender, their military social status (military rank), marital status, and education.

Furthermore, the study's population were all active-duty military personnel with 1583 participants. Table 4 shows the age frequencies in the population. The mean age for this population was 37.17 and the deviation from the mean was 6.5 years. The median age was 36.00 years, and the mode was 38 years. The population range was 53 years while the minimum was 21 and maximum 74 years. Figure 6 showed a graphical presentation of age distribution in the population.

Table 4

Age in Year

Age		
N	Valid	1583
	Missing	0
Mean		37.17
Median		36.00
Mode		38
Std. Deviation		6.480
Range		53
Minimum		21
Maximum		74

Figure 6

Histogram for Participants Age Distributions

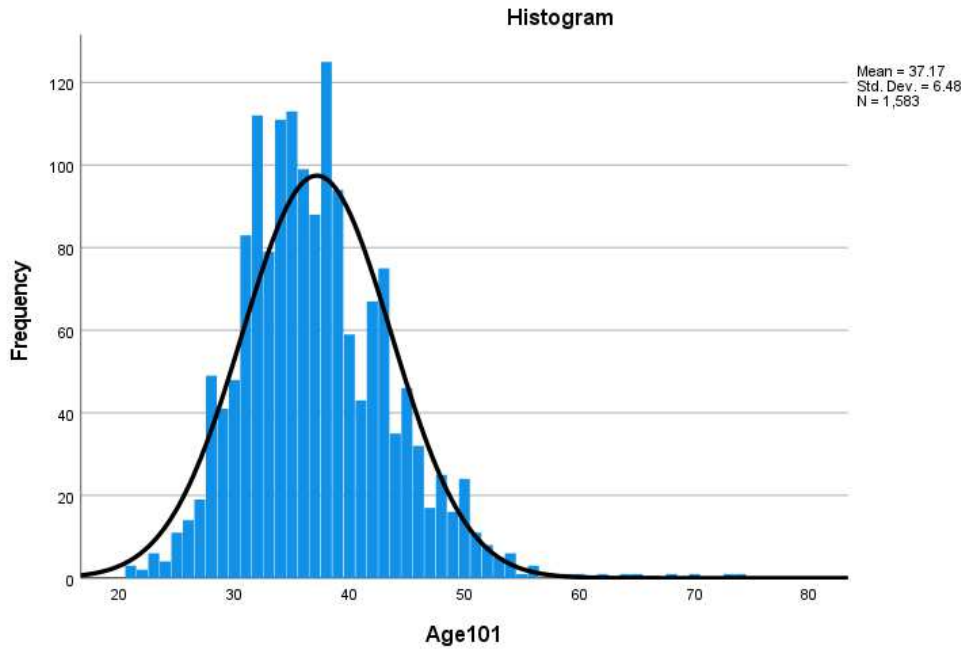


Table 5 shows the gender characteristics of the study population. Like most military organization around the world, there are more men than women. Of the 1583 participants, 1477 participants were men representing 93.3% of the total population while 106 were women representing 6.7% of the population. Table 6 shows the educational status of the military population. About 63.3% (*n*=986) of the soldiers were high school graduates; 20.8% had some college education (*n*=330); 11.6% (*n*=183) graduated from college; 2.5% (*n*=40) and 2.8% (*n*=44) had some high school education and vocational trainings, respectfully.

Table 5

Descriptive Statistics: Gender

Gender

	N	%
Male	1477	93.3%
Female	106	6.7%

Table 6 shows the participant educational status. About 62.3% (n = 986) were high school graduates; 20.8% (*n* = 330) had basic university education while 11.6 % (*n* = 183) graduated from college.

Table 6

Participants Education Status

Education

	N	%
1- Some High School	40	2.5
2- High School Graduate	986	62.3%
3- Vocational	44	2.8%
4- Some College	330	20.8%
5- College Graduate	183	11.6%

Figure 7

Participants Educational Status

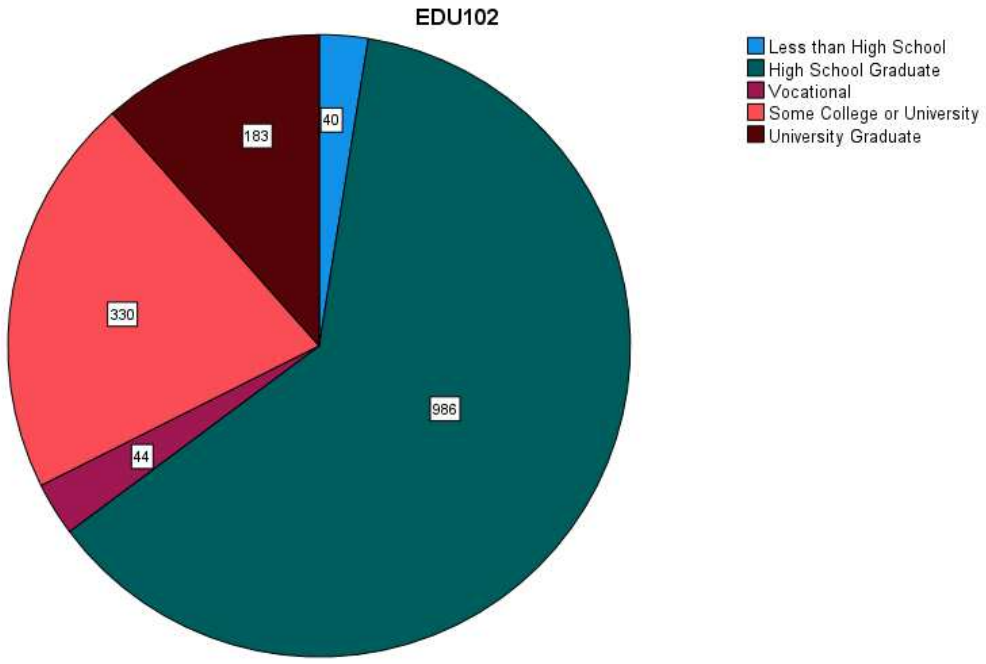


Table 7 show the marital status of the population. Most of the soldiers were not married but were living with partners; 47.9 % (*n*=758) were living with partners; 37.85 (*n*=599) were married; 13.0% (*n*=206) were single. For the rest of the population, 0.8% (*n*=12), 0.4 % (*n*=6), and 0.1% (*n*=2) were divorced or separated, in a Polygamous marriage, and widowed, respectively. Figure 6 showed a bar chart which display the marital status of the study population. The results from Table 7 show that apart from 37.8% married soldiers, the remaining 62.2% of the personnel were in an unstable relationship.

Table 7

Descriptive Statistics: Marital Status

Marital Status

	N	%
1-Single	206	13.0
2- Living with Partner	758	47.9
3- Married	599	37.8
4- Polygamous Marriage	6	0.4
5- Widowed	2	0.1
6- Divorce/Separated	12	0.8

Figure 8

Descriptive Statistics: Marital Status

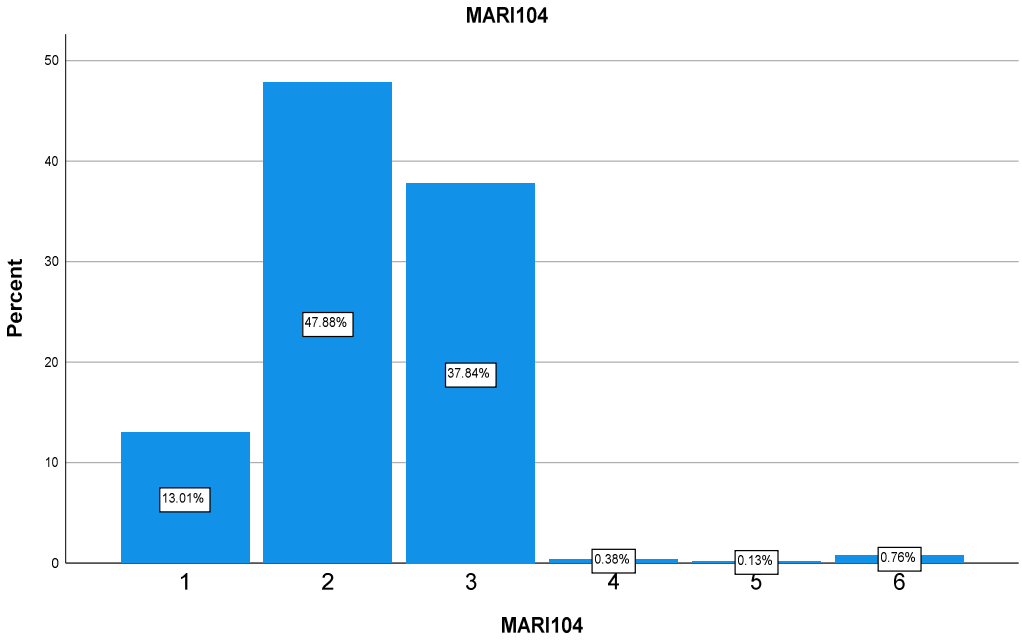


Table 8 and Figure 9 show the socioeconomic status for the population. In military organizations, the individual pay grade determines their social status and income. Personnel were either a commissioned officer or a noncommission officer (NCO). On

average, commissioned officers have better social status than the non-commissioned officer. On a larger skill, the uniform personnel were either an "officer (commissioned)" or an "enlisted (non-commissioned)". Table 8 shows that 68.1% (1078) were Junior NCOs; 19.8 % (*n*=314) were privates or private first class; 6.8% (*n*=108) were Senior NCOs; 3.3% (*n*=53) and 1.9% (*n*=30) were Junior Officers and Senior Officers, respectively. Figure 9 is a pie chart showing the number of cases per category. Both the results from Table 8 and Figure 9 indicate that most of the soldiers were under the social grade in the Liberia society. Liberia is among the poorest countries in the world. Income in this category is very low compared to the others.

Table 8

Descriptive Statistics: Military Ranks

Military Rank

	N	%
1- Private/Private First Class	314	19.8
2- Junior NCOs	1078	68.1
3- Senior NCOs	108	6.8
4- Junior Officers	53	3.3
5- Senior Officers	30	1.9

Figure 9

Participants Military Ranks Structures

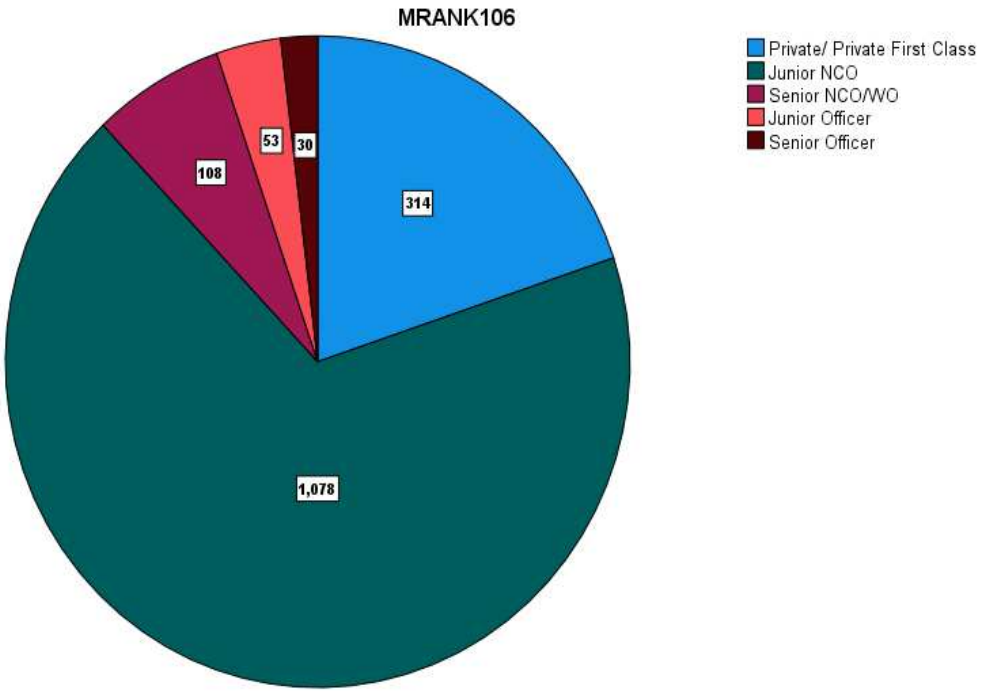


Table 9 below shows the HBV infection prevalence among the active-duty military personnel. Within the total sample size (*n*=1583), 90.1% (*n* = 1426) were HBV negative while 9.9% (*n* =157) were HBV negative. A prevalence rate of such magnitude is a serious public health concern which require serious intervention.

Table 9

Hepatitis B Infection Prevalence Among the Active-Duty Soldiers

HBV Infection Status

		Frequency	%	Valid %	Cumulative %
Valid	HBV Negative	1426	90.1	90.1	90.1
	HBV Positive	157	9.9	9.9	100.0
	Total	1583	100.0	100.0	

Bivariate Analysis

A Chi-square analysis was conducted to understand the interactions among the variables and determine if there are relationships between the predictor and outcome variables. All assumptions associated with this test were met. That is, the sample size met the assumption that the expected count for each cell were above five and the total thread-hold values are above 20%. To meet these assumptions, the original variable such as "drug use" under the "substance use" predictor variable was recoded into a new variable with two levels of measurements.

Table 10 shows the case processing summary comparing the predictor variables and the outcome variables with both sample sizes and percentages. All of the participants responded to the variable gender 100% (N=1583); condom use with casual partners 47.6% (N= 753); condom use with casual sexual partners is 47.6% (N= 753) ; condom use with sex worker partners is 15.2% (N=241); condom use with regular partners was 92.8% (N= 1469); Alcohol consumption was 87.9% (N= 1391); and after recoding drugs use into a binary options, all of the participants 100% (N= 1583) were included in the

analysis. Condom with sex-worker had more missing values 84.8% (N= 1342) but did not impact the analysis results.

Table 10

Descriptive Statistics: Cross Tabulation Summary for the Predictor Variables

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Gender HBV	1583	100.0%	0	0.0%	1583	100.0%
Alcohol * HBV	1391	87.9%	192	12.1%	1583	100.0%
Drugs Use * HBV	1583	100.0%	0	0.0%	1583	100.0%
Condom/Casual Part * HBV	753	47.6%	830	52.4%	1583	100.0%
Condom Sex Workers * HBV Status	241	15.2%	1342	84.8%	1583	100.0%
Condom Regular Partner * HBV Status	1469	92.8%	114	7.2%	1583	100.0%

Table 11 crosstab showed the relationship between gender and hepatitis B infection. This analysis met the assumption that no cell had an expected count less than five values. The table showed a descriptive analysis between male and female and the relationship with hepatitis B infection in numbers and percentage. Among the 106 females' soldiers who participated in the studies, 96.2% (n= 102) were HBV negative infection and 3.8% (n= 4) were HBV positive. On the other hand, 89.6% (n = 1324) of the males were HBV negative and 10.4 % (n= 153) were HBV positive. The chi-square value is 4.801 (df = 1, Phi = 0.06, p = 0.028). These results show that there was

statistically significant relationship between gender and HBV infection in the Armed Forces of Liberia.

Table 11

Descriptive Statistics: Relationship Between Gender and Hepatitis B Infection

Crosstab

			HBV Infection Status		
			HBV Negative	HBV Positive	Total
Gender	Male	Count	1324	153	1477
		Expected Count	1330.5	146.5	1477.0
	Female	Count	102	4	106
		Expected Count	95.5	10.5	106.0
Total		Count	1426	157	1583
		Expected Count	1426.0	157.0	1583.0

Table 12 crosstab showed the relationship between condom use with casual partners and hepatitis B infection. This analysis met the assumption that no cell had an expected count less than five values. Table 11 showed that of the total sample size (n= 753), 44.3% (n= 311) used condom. For those participants who used condom, 44.6% (n= 37) accounted for the total HBV positive cases (n= 83). On the other hand, about 58.7% (n= 442) did not use condom. In this category, 55.4% (n= 46) of the total positive case (n=83) were positive. The Pearson Chi-square value is .413 (df = 1, Phi = -.023, p = 0.520). These results showed no statistically significant relationship between "Condom Use with Casual partner" and HBV infection in the Armed Forces of Liberia

Table 12

Descriptive Statistic: Relationship Between Condom Use with Casual partner and HBV Infection.

Crosstab

			HBV Infection Status		
			HBV Negative	HBV Positive	Total
Condom Casual Partner	Condom/Casual Partner	Count	274	37	311
		Expected Count	276.7	34.3	311.0
	No Condom/Casual Partner	Count	396	46	442
		Expected Count	393.3	48.7	442.0
Total		Count	670	83	753
		Expected Count	670.0	83.0	753.0

Table 13 crosstab shows the relationship between condom use with regular partners and hepatitis B infection. This analysis met the assumption that no cell had an expected count less than five values. The table show that of the total sample size (N= 1469), 24.3. 3% (n= 311) use condom. For those participants who use condom, 20.3% (n= 30) accounted for the total HBV positive cases (n= 148). On the other hand, about 75.7% (n=1112) did not use condom. In this category, 79.7% (n= 118) of the total positive case (n=148) were positive. The Pearson chi-square value is 1.454 (df = 1, Phi = .031, p = 0.228). These results show no statistically significant relationship between condom use with regular partner" and HBV infection in the Armed

Table 13

Descriptive Statistics: Cross Tabulation Between Condom Use with Regular and HBV Crosstab

			HBV Infection Status		
			HBV Negative	HBV Positive	Total
Condom Regular Partner	Condom/Regular Partner	Count	327	30	357
		Expected Count	321.0	36.0	357.0
	No Condom/Regular Partner	Count	994	118	1112
		Expected Count	1000.0	112.0	1112.0
Total		Count	1321	148	1469
		Expected Count	1321.0	148.0	1469.0

Table 14 crosstab shows the relationship between condom use with 'Sex Workers' and hepatitis B infection. This analysis met the assumption that no cell had an expected count less than five values. The table show that of the total sample size (N= 241), 50.2% (n= 121) use condom. For those participants who use condom, 42.9% (n= 9) accounted for the total HBV positive cases (n= 21). On the other hand, about 49.8% (n=1112) did not use condom. In this category, 57.1% (n= 12) of the total positive case (n=21) were positive. The Pearson chi-square value is .497 (df = 1, Phi = .045, p = .481). These results show no statistically significant relationship between "Condom Use with 'Sex-worker" and HBV infection in the Armed

Table 14

Relationship Between Condom Use with Sex-workers and HBV Infection

Crosstab

			HBV Infection Status		
			HBV Negative	HBV Positive	Total
Condom	Condom/Sex workers	Count	112	9	121
Sex		Expected Count	110.5	10.5	121.0
Workers	No Condom/Sex workers	Count	108	12	120
		Expected Count	109.5	10.5	120.0
Total		Count	220	21	241
		Expected Count	220.0	21.0	241.0

Table 15 crosstab shows the relationship between alcohol consumption and HBV. This analysis met the assumption that no cell had an expected count less than five values. The table show that of the total sample size (N= 1391); about 31.1% (n= 433) of the participant who "never consumed alcohol" accounted for 32.2 % (n= 47) of all positive HBV infection in the category; about 27.2% (n =379) of the participant who "consumed alcohol once a month accounted for 26.7% (n=39) of all positive HBV infections; about 21.8% (n=303) of the participants who consumed alcohol at least 2-4 times a month accounted for 17.1% (n=25) for all positive HBV infection; about 11.7% (n=163) of the participants who consumed alcohol 2-3 times a week accounted for 16.4% (n=24) of all positive HBV infection; and Lastly, 8.1% (n=113) of the participants who consumed alcohol at least four or more times a week accounted for 7.5% (n=11) of all positive HBV infections. The Pearson chi-square value (χ = 24.873 df = 4, Cramer's V = .059, p = .301)

show no statistically significant relationship between “alcohol consumption” and HBV infection in the Armed Forces of Liberia.

Table 15

Descriptive Statistics: Relationship Between Alcohol Consumption and HBV Infection.

Crosstab

			HBV Infection Status		
			HBV Negative	HBV Positive	Total
Alcohol Use	Never	Count	386	47	433
		Expected Count	387.6	45.4	433.0
	Monthly or less	Count	340	39	379
		Expected Count	339.2	39.8	379.0
	2 to 4 times a month	Count	278	25	303
		Expected Count	271.2	31.8	303.0
	2 to 3 times a week	Count	139	24	163
		Expected Count	145.9	17.1	163.0
	4 or more times a week	Count	102	11	113
		Expected Count	101.1	11.9	113.0
Total		Count	1245	146	1391
		Expected Count	1245.0	146.0	1391.0

Table 16 crosstab shows the relationship between Drug use and HBV Infection. After recoding the participant response into a binary response, the analysis met the assumption that no cell had an expected count less than five values. Table 15 shows that all the participants were included in this analysis. Of 88.1 % (n=1394) total respondents who never consumed drugs, 92.4% (n= 145) out of the total positive case (n=157) were

HBV infection positive. For the participant who consumed drugs, 7.2% (n=12) of the total positive cases (n=157) were HBV infection positive. The Pearson chi-square value is 3.059 (df = 1, Phi = -.044, p = .080). These results show no statistically significant relationship between "drugs use" and HBV infection in the Armed Forces of Liberia.

Table 16

Descriptive Statistics: Cross Tabulation Between Drugs Consumption and HBV for the Substance Use Variable

Crosstab

			HBV Infection Status		
			HBV Negative	HBV Positive	Total
Drugs Consumption	Drugs Not Consumed	Count	1249	145	1394
		Expected Count	1255.7	138.3	1394.0
	Drugs Consumed	Count	177	12	189
		Expected Count	170.3	18.7	189.0
Total		Count	1426	157	1583
		Expected Count	1426.0	157.0	1583.0

Binary Logistics Regression Model

A Binomial logistic regression was conducted to determine if the predictor variable [gender, substance use, and condom use] were associated with the outcome variable [Hepatitis B infection] among Liberia's Military personnel. In the research literature, the selected confounding variable have had secondary effect on hepatitis B

infections. As previously mentioned, these confounding variables that could have effect on the results [marital status, age, military rank, and education] were included in the analysis. Both simple and binomial logistics models were conducted to determined significant association between the variables. Before the analysis, all the other variables were recoded into different binary options (two levels) variables.

A Binomial logistics regression model was conducted using SPSS version 28 to determine whether gender, substance use, and condom use were associated with the likelihood of been Hepatitis B infected. To meet the assumption that the predictor variables where not related, a multicollinearity assumption using a linear regression was assessed. The results show that this assumption that the predictor variables were not closely related was met (tolerance values > .600). On the other hand, the dataset set showed outliers which could hinder the study results. A standardized residual value revealed potential outliers (SResid > 2.000) which were misclassified. These outliers were not removed from the dataset.

Simple Binary Logistics Regression Model

In the bivariate analysis using the chi-square test, gender was significantly associated with HBV infection ($\chi 2 = 4.801$, df = 1, Phi = 0.06, p = 0.028). The other main predictor variables [substance and condom use) were not statistically significant. To confirm that gender is a predictive factor for HBV infection, a "Simple Binary Logistics Regression was conducted to confirm previous results. Table 16 shows the simple binary logistic regression results between gender and HBV infection. The logistic regression model was statistically significant. The Omnibus Test of Model showed $\chi 2$ (1)

= 6.047, p < 0.05. The model explained 0.8% (Nagelkerke R square) of very low variance in HBV infection and correctly classified 90.1% of cases. The Hosmer and Lemeshow Test was not significant indicating a good model fit. Men had 2.95 times higher odds to be infected with HBV infection than women (p = 037, 95% CI (1.070, 8.114).

Table 17

Binary Logistics Regression Between Gender and HBV Infection

Variables in the Equation

							Odds	95% CI.for Odds Ratio	
		B	S.E.	Wald	df	p	Ratio	Lower	Upper
Step 1[a]	Gender (1)	1.08	.52	4.37	1	.037	2.947	1.070	8.114
	Constant	-3.24	.51	40.37	1	<.001	.039		

a. Variable(s) entered on step 1: Gender.

A binomial logistics regression model was conducted to determine whether condom use [regular partner, casual partner, and sex workers] was significantly associated with HBV infection. The model was statistically significant χ 2 (3) = 1.687, p < .05. The model explained 2.0% (Nagelkerke R square) indicating very low variance in HBV infections and correctly classified 91.8% of the cases. The Hosmer and Lemeshow Test was not significant indicating a good model fit χ 2 (3) = 2.535, p > .05. Condom use was not statistically significant and did not contribute to the model (see Table 18).

Table 18

Binomial logistics Regression Analysis Between Condom use and HBV Infection

Variables in the Equation

								95% CI.for Odds Ratio	
		B	S.E.	Wald	df	p	Odds Ratio	Lower	Upper
Step 1[a]	Regular Partner (1)	.95	.84	1.26	1	.261	2.58	.49	13.47
	Casual Partner (1)	-.23	.68	.11	1	.737	.80	.21	3.02
	Sex Workers (1)	.12	.65	.04	1	.850	1.13	.32	4.05
	Constant	-3.11	.73	18.21	1	<.001	.04		

a. Condom Regular Partner, Condom Casual Partner, Condom Sex Workers.

A binomial logistics regression model was conducted to determine whether gender and substance use were associated with HBV infection while controlling for military rank, age, education, and marital status. The full model was statistically significant χ 2 (7) = 17.820, p = 013. The model explained 2.4 % (Nagelkerke R square) indication very low variance in HBV Infection and correctly classified 90.1% of cases. The Hosmer and Lemeshow Test was not significant indicating a good model fit χ 2 (7) = 7.980, p > .05. Only gender and marital status were found to be statistically significant and contributed to the model (p =.048, OR = 2.79, 95 % CI = 1.01, 7.72). Men had 2.79 times higher odds of been infected with HBV infection than women (as shown in Table 19). Participants who were not married had 33.7 reduced change of been HBV infected than those who were married (as shown in Table 19).

Table 19

Logistic Regression Predicting the Likelihood of Hepatitis B Infection.

Variables in the Equation

								95% CI.for Odds Ratio	
		B	S.E.	Wald	df	p	Odds Ratio	Lower	Upper
Step 1[a]	Gender (1)	1.03	.52	3.9	1	.048	2.79	1.01	7.72
	Drugs Use (1)	-.53	.31	2.9	1	.091	.59	.32	1.09
	Alcohol Use (1)	-17	.19	.86	1	.353	1.19	.83	1.72
	Education (1)	-.05	.18	.09	1	.760	.95	.67	1.34
	Marital Status (1)	.41	.19	4.68	1	.031	.66	.46	.96
	Military Rank (1)	.33	.20	2.72	1	.099	1.39	.94	2.05
	Age101	.01	.01	.23	1	.628	1.01	.98	1.04
	Constant	-3.49	.72	23.46	1	<.001	.030		

a. Variable(s) entered on step 1: Gender, Drugs Consumption, Alcohol Consumption, Education, Marital Status, Military Rank, Age101.

Discussion and Interpretation of Findings

The purpose of this quantitative study was to determine if gender (male & female) and risk factors (substance use, alcohol abuse, and condom use) predict hepatitis B

infections after adjusting for age, marital status, education, and military rank among Liberia Military population. The binomial logistic regression was the main test statistics used to answer the research questions. Before conducting the full logistics regression analysis, a description statistic, bivariate analysis, and a simple logistic regression were conducted a-priori to understand the frequencies, percentage, and the interaction among the variables, respectively.

Research Questions

Research Question 1

Research Question 1 (RQ1): Is there an association between gender and hepatitis B infection among the Liberian military when controlling for substance use, condom use, marital status, education, age, and military ranks?

Null Hypothesis ($H_0$1): There is no significant association between gender and hepatitis B infection among the Liberian military when controlling for substance use, condom use, marital status, education, age, military ranks.

Alternative Hypothesis (H_a1): There is a significant association between gender and hepatitis B infection among the Liberian military when controlling for substance use, condom use, marital status, education, age, military ranks.

A binomial logistics regression model was conducted to determine whether gender and substance use was associated with HBV infection while controlling for military rank, age, education, and marital status. The full model was statistically significant χ 2 (7) = 17.820, p = 013. The model explained 2.4 % (Nagelkerke R square) of the variance in HBV Infection and correctly classified 90.1% of cases. The Hosmer

Lemeshow test was not significant indicating a good model fit with χ 2 (7) = 7.980, p > .05. Gender was found to be statistically significant and contributed to the model. Men had 2.79 times higher odds of been infected with HBV infection that women (as shown in Table 19). So, I retained the Alternative Hypothesis (Ha1) that there is a significant relationship between Gender and HBV infection and rejected the Null Hypotheses which states that there is no significant relationship between gender and HBV infection.

Research Question 2

Research Question 2 (RQ2): Is there an association between substance use and hepatitis B infection among Liberian military personnel when for controlling for gender, condom use, marital status, education, age, and military ranks?

Null Hypothesis ($H_0$2): There is no significant association between substance use and hepatitis B infection among Liberian military personnel when controlling for gender, condom use, marital status, education, age, and military ranks?

Alternative Hypothesis (H_a2): There is a significant association between substance use and hepatitis B infection among Liberian military personnel when controlling for gender, condom use marital status, education, age, and military ranks.

A binomial logistics regression model was conducted to determine whether gender and substance use was associated with HBV infection while and controlling for military rank, age, education, and marital status. The full model was statistically significant with χ 2 (7) = 17.820, p = 013. The model explained 2.4 % (Nagelkerke R square) of the variance in HBV infection and correctly classified 90.1% of cases. The Hosmer and Lemeshow Test was not significant indicating a good model fit with χ 2 (7)

= 7.980, p > .05. The two groups of the substance use variables (drugs & Alcohol use) were not statistically significant and did not contribute to the model (as shown in Table 19). Based on these results, I retained the Null Hypothesis (Ho) that there is no significant relationship between Substance Use [Drugs and Alcohol Consumption] and rejected the Alternative Hypotheses that there is a significant relationship between substance use and HBV infection.

Research Question 3

Research Question 3 (RQ3): Is there an association between condom use and hepatitis B infection among Liberian military personnel when controlling for, gender, substance use, marital status, education, age, and military ranks?

Null Hypothesis ($H_0$3): There is no significant association between condom use and hepatitis B infection among Liberian military personnel when controlling for gender, substance use, marital status, education, age, and military ranks?

Alternative Hypothesis (H_a3): There is a significant association between condom use and hepatitis B infection among Liberian military personnel when controlling for gender, substance use, marital status, education, age, and military ranks

A binomial logistics regression model was conducted to determine whether condom use [regular partner, casual partner, and sex workers] was significantly associated with HBV infection. The model was statistically significant χ 2 (3) = 1.687, p < .05. The model explained 2.0% (Nagelkerke R square) of the variance in HBV infections and correctly classified 91.8% of the cases. The Hosmer and Lemeshow Test was not significant indicating a good model fit χ 2 (3) = 2.535, p > .05. Condom use was

not statistically significant and did not contribute to the model (see Table 17). So, I rejected the Alternative Hypothesis (Ha1) that there is a significant relationship between condom use and HBV infection; and retained the null Hypotheses that there is no significant relationship between Condom Use and HBV infection.

New Findings

A binomial logistics regression model was conducted to determine whether gender and substance use was associated with HBV infection while and controlling for military rank, age, education, and marital status. The full model was statistically significant with χ 2 (7) = 17.820, p = 013. The model explained 2.4 % (Nagelkerke R square) of the variance in HBV Infection and correctly classified 90.1% of cases. The Hosmer and Lemeshow Test was not significant indicating a good model fit with χ 2 (7) = 7.980, p > .05. Marital status was found to be statistically significant and contributed to the model. Participants who were not married had 33.7 reduced change of been HBV infected than those who were married (as shown in Table 19).

General Summary of the Findings

The data analysis and interpretation of results began with conducting a descriptive statistic which comprised of frequencies, percentage, and cross tabulation of major variables included in the analysis. I conducted a descriptive analysis for age, gender, HBV infection, marital status, military rank, to understand the data set before running a full analysis. Additionally, I also conducted a cross-tabulation to understand the interaction between the predictor variables and the outcome variables. Before analyzing

the fully data using logistic regression, the variables were re-coded in binary variables to ease the understanding of the output.

All assumptions of the binomial logistic regression were met. All the variables were analyzed to determine whether gender and substance use were associated with HBV infection while controlling for military rank, age, education, and marital status. The full model was statistically significant χ 2 (7) = 17.820, p = 013. The model explained 2.4 % (Nagelkerke R square) of the variance in HBV infection and correctly classified 90.1% of cases. The Hosmer and Lemeshow Test was not significant indicating a good model fit χ 2 (7) = 7.980, p > .05. Only gender and marital status were found to be statistically significant and contributed to the model. Men had 2.79 times higher odds of been infected with HBV infection than women (as shown in Table 19). Participants who were not married had 33.7 reduced change of been HBV infected than those who were married (as shown in Table 19).

The other predictor variables such as Substance (drugs & Alcohol) and condom use (regular, casual, and Sex-workers partners) did not achieve statistically significant results and did not contribute to the model, but the odds of HBV infection were also high (see Table 18 & 19). The new finding in this project showed that the soldiers' marital status was a significant predictor for HBV infection. This variable was recoded into either married (0) or not married (1). It was assumed that married couple were less likely to be involve into extra-marital affairs compared to those who were not married. Marital status was found to be statistically significant and contributed to the model. Participants who

were not married had 33.7 reduced change of been HBV infected and those who were married (as shown in Table 19).

The next section focused on the discussion and the interpretation of the findings in relation to finding in the research literature as described in chapter two of this project. It highlights similarities and differences in the results in confirmation with the study's conceptual framework.

Support for the Theoretical Framework

The theories, concepts, and behavioral models that grounded this study was the Urie Bronfenbrenner's (1980) SEM which posits that human health behaviors are influenced by multiple levels of influence such as the intrapersonal, interpersonal, organizational, community, and the public policy levels. Furthermore, the influence of health behaviors varies by the target behavior and context. The SEM is a framework that helps understand the multifaceted levels that society poses on an individual. The results of this study that showed gender and marital status as significantly related with HBV infection confirmed the model constructs.

The level of the model which correspond to this study results are both intrapersonal and interpersonal levels of influence. The intrapersonal level of influence focuses on the human biology. The model showed how gender impact hepatitis B infection from an intrapersonal personal perspective. Gender, as risk factor for HBV infection showed how the biological factors interplayed that allow the male gender to be susceptible to the disease. On the other hand, the soldier marital status was significantly related with HBV infection which confirms the interpersonal interplayed. The soldiers

who were not married were more likely to practice riskier sexual behaviors than those who were married. Marriage becomes a preventive factor for the infection because the married soldier become protective for their spouse.

Section 4: Application to Professional Practice and Implications for Social Change

Application to Professional Practice

The general findings indicated that there was a significant relationship between gender and HBV infection while the other variables (substance and condom use) did not contribute to the logistic model and was unable obtain statistically significant results. The descriptive statistics for the total sample size of all uniform military (n=1583) personnel showed that 90.1% (*n* = 1426) were HBV negative while 9.9% (*n* = 157) were HBV negative. The bivariate analysis case summary output showed that 100% (*n*=1583) of the participants responded to the gender and drugs consumption questionnaires. On the other hand, only 15.2 % participants responded to one of the condoms use sub-variables. The condom use variable did not meet the logistics regression model assumptions due to the extensive missing values and outliers. I removed this variable from the final logistics regression model analysis and conducted a separate bivariate logistic regression analysis. The results showed no statistically significant relationship between the variable as discuss further in this section.

The gender variable contributed to the Binomial logistic model analysis. About 93.3% (*n*=1477) all military personnel were male while 6.7% (*n*=106) participants were female. The total HBV cases among military personnel during the collection of the data was 157 cases. Among these HBV cases, men (*n*=153) and women (*n*=3) were HBV infections positive. As in most military which are considered a male dominant organization, disease prevalence is skewed to the men. In this research project, gender was a significant risk factor associated with HBV infections. Gender was found to be

statistically significant (p =0.48, OR = 2.79, 95% CI = 1.01, 7.72) and contributed to the model. men had 2.79 times higher odds of been infected with HBV infection than women (as shown in Table 19).

Gender, especially men than women has been reported in many studies as an associated risk factor for sexually transmitted disease including HBV infections and its complications. In rural Cameroon where the HBV risk factors was assessed in a female dominant participation (62%), Tadongfack et al. (2020) found that the prevalence of hepatitis B infection among the female participants was less (4.35%) than among male participants (6.31%). Ayano et al.'s (2018) systematic review and meta-analysis of gender differences in the epidemiology of HIV, hepatitis B, and hepatitis C infections in people with severe mental illness also showed that the prevalence of HBV-associated mental illness was higher in men (18.91%) than in women (12.02%). In uniform personnel, Birku et al. (2015) prevalence studies at the Bahir Dar Armed Forces General Hospital showed more men (>8%) were infected than women.

Some studies have shown why men are more susceptible to HBV infections than women. Bashir et al. (2021) found that metabolic, hormonal, and tumor biology were males specific risk factors. The researchers also mentioned that hepatitis B core promoter in men, sex hormones, and stress were also responsible for the disparity in HCC complications in men than in women. Ruggieri and Malomi (2015) discovered that responses to vaccine could be another factor associated with HBV infection in gender disparity. Compared to both sexes, the researchers found that anti-HBV antibodies tilter

was higher in women than men after vaccination because there was a predictor of unresponsiveness to HBV vaccination among males (Ruggieri & Malorni, 2015).

The predictor variable substance use' did not contribute to the Binomial logistics regression model and did not obtain a statistically significant result. Though this main predictor variable was not statistically significant, the bivariate Chi-square analysis show that substance use (drugs and alcohol use) was serious behavioral problem among the soldiers. The level of alcohol consumptions in the AFL calls for intervention. Table 14 shows that of the total sample size (*N*= 1391) for this variable; about 31.1% (*n*= 433) of the participant who never consume alcohol accounted for 32.2 % (*n*= 47) of all positive HBV infection in this category; about 27.2% (*n* =379) of the participant who consumed alcohol once a month accounted for 26.7% (*n*=39) of all positive HBV infections; 21.8% (*n*=303) of the participants who consumed alcohol at least two to four times a month accounted for 17.1% (*n*=25) for all positive HBV infection; 11.7% (*n*=163) of the participants who consumed alcohol two to three times a week accounted for 16.4% (*n*=24) of all positive HBV infection. Lastly, 8.1% (*n*=113) of the participants who consumed alcohol at least four or more times a week accounted for 7.5% (*n*=11) of all positive HBV infections. The Pearson chi-square value χ 2 (4) = 24.873 p > .05 which show no statistically significant relationship between alcohol consumption and HBV infection.

Alcohol consumption is a risk factor for contracting most STDs. Zhou et al. (2021) mentioned that alcohol consumption was among the primary causes of liver cirrhosis resulting in HBV replications, oxidative stress increases, and a compromised

immunes response. Alcohol consumption among individuals, including the military personnel, impacts decision-making and solicits riskier sexual behavior and pathways for HBV infections (Morojele et al., 2021). Rehm et al. (2017) established a causal pathway between alcohol and infectious disease (HIV, HBV) with the intention to have condom-less sex and the intention to take a risk as surrogate measures for infection. In the study, alcohol use variable did not contribute to the multiple logistic regression model (P > .05, OR .841, CI .583, 1.212).

On the other hand, the sub-predictor variable drug use also did not obtain statistically significant relationship with HBV infection with the Chi-square and multiple regression model analysis. The cross-tabulation interactions between the variable revealed information that required intervention. The results showed the 157 participants of the 1583 respondents were HBV positive. The results also showed that 12 participants of the 177 respondents were HBV positive but not statistically significant χ 2 (1) = 3.059, df = 1, p > .05. Also, the variable did not contribute the logistic model (OR = .589, C.I. = .319, 1.088; p > .05). The odds of not been infected with HBV after drugs use was approximately 41% for very unit increase in the unstandardized beta weight.

Result from this study does not correlate with previous studies on the association of drugs with HBV infections. Previous studies results showed that drug consumption was a pathway for HBV infection. People who use drugs were vulnerable because they became homeless, incarcerated, practice unsafe sex, and had limited access to healthcare and treatment programs (Degenhardt et al., 2016). According to Semá Baltazar et al. (2019), users of injectable drugs were at higher risk of acquiring and transmitting blood-

borne viruses' diseases such as HBV, HIV through either unsafe injection practices or unprotected sexual behaviors. Semá Baltazar et al. (2019) results showed a significant relationship between injection drugs use and HBV infection with 34.25 % positivity rate. The major risk factor in their study was unprotected sex. Prier and Cowan (1987) studies found that drug use was a significant risk factor for HBV infections among American soldiers deployed in Europe.

The condom use variable was subdivided into (a) condom use with regular partners, (b) condom use with casual partners, and (c) condom use with sex workers. Unfortunately, there were many missing values and outliers associated with this variable. It was excluded from the main logistics model analysis. However, the bivariate analysis result shown in Table 12 provides the interactions between all the condoms use categories and HBV infection with regular partner and HBV infections. The Chi-square test results was not statistically significant $\chi 2\ (1) = 1.454$, $p > .05$. The logistic regression model results (see Table 18) showed that condom with regular partner did not contribute to the model. Therefore, condom use was not significantly related to HBV infection among the soldiers. To the extent of my literature research, no study was able to determine if condom use was a significant risk factor for HBV infection.

The new finding in this project was showed that participant participants who were not married had 33.7% reduced change of been HBV infected than those who were married (as shown in Table 19). Marital status was considered a possible confounder. The variable marital status" contributed to the Binomial logistics regression model and obtained a statistically significant result and contributed to the logistics regression model

(OR = .663, 95% CI (.457, .962), p = .037). This result indicated that been single was a risk factor for HBV infection. The descriptive statistics showed that the study participants were in the active sexual group (Mean Age = 37.17 yrs.). So, been single at this age increase the risk for HBV infection because of the increased likelihood of practicing riskier sexual behaviors.

Limitation of the Study

In this study, I used a secondary dataset to answer my specific research questions which was a limiting factor because I had to recode the variables to meet the Binomial Logistics Regression test assumptions. The primary researcher collected the dataset to answer a specific research question involving HIV and AIDS prevalence in the Armed Forces of Liberia. Since this logistic regression required that the outcome or dependent variable had to be binary, HBV variable was recoded into a binary response to satisfy this assumption. Furthermore, this study results cannot be generalizable to the Liberian population because the sample size used was restricted to only active-duty military personnel.

The female population included in this study was limited. Most of the results were shewed to the male gender as seen in the gender descriptive statistics. The original studies included both military and non-military females. Unfortunately, my research only focused on women who are military personnel. The limited or missing values associated with the predictor variables in women could have impacted the study results. Additionally, logistic regression analysis result showed that there were many missing values and outliers. Unfortunately, due to limited sample size, these outliers were not

removed from the final analysis. Additionally, this study result cannot be compared to any national results in the literature, but to the extent of my literature review, no researcher has conducted an inferential study to determine a statistical relationship between gender, substance use, and condom use with HBV infection in Liberia.

Recommendations for Future Research

The purpose of this quantitative study was to determine the association of the independent variables such as gender (male and female) and risk behaviors (substance use, alcohol abuse, and condom use) with the dependent variable hepatitis B infections after adjusting for possible confounders such as age, marital status, level of education, and military rank among Liberia Military population. Due to the limited female population in a male dominant organization, it is important to include soldier wives in future studies to better understand the impact of HBV infection affecting the soldiers and their families.

The results of this study showed that gender was a significantly related to HBV infection. However, more intensive inferential test needs to be conducted to determine the significant risk factors associated with gender susceptibility specific to the AFL. Even though other studies establish that male biology, condom use, alcohol, and drugs were associated risk factors for HBV infection, the results showed a no statistically significant result. On the other hand, future research should explore marital risk factors as discovered in this study.

Another recommendation for future research is to understand the national trend on HBV infections associated with my study predictor variables. The Ministry of Health

(MOH) and the National Public Health Institute of Liberia (NPHIL) should use the result from this study to conduct a national survey and understand various risk factors associated with HBV infection since the disease is a public health problem.

Finally, the Ministry of National Defense (MoD) and the head of the Military Leadership (AFL) should use the results from this project to engage local and international partners to solicit resources for further recommended research projects and health promotion programs. Funding is needed to conduct more primary studies to specific variables that will establish the relationship between gender, substance abuse, and other social and behavioral risk factors.

Implications for Positive Social Change

The purpose of this study was to determine if gender, substance use, and condom use was associated with HBV infection controlling for age, education, marital status, and military rank. The study result shown above established that gender as a major predictor variable was significantly associated with HBV infection. On the other hand, the covariate marital status was also statistically significant. These two variables are social determinant for many diseases and has bridged the knowledge gap for HBV infection for the military health professionals. It is important that public health authorities critically examine these results and develop strategy and policy to impact positive social change.

Positive social change begins with dissemination of results to the public. Liberia has limited research databases especially for inferential studies. The first for positive social change in the country starts with disseminating the study results within Armed Forces of Liberia to all military installations—nationally through the MoH, NPHIL—

through public health undergraduate and graduate institution, and international during public health conferences.

Another implication for social change is health promotion programs. Public professional should focus health education on gender risk factor for HBV infection and other sexually transmitted infection. Health promotion strategies that will focus on gender risk factors especially in males must be prioritized. Armed Forces are male dominant organizations, so risk factors such sexual behaviors, alcohol, and drug use must be the major topic for the educational programs. The results of this study have shown the definite answer to years of knowledge gaps on the impact of HBV infection among Liberian military personnel.

Conclusion

The increasing number of Hepatitis B-related death in the Armed Forces of Liberia was due to the lack of understanding of the associated risks with the disease. Gender and other risk behaviors such as substance use, and condom use have been researched in other literature as related factors to the disease spread. The World Health Organization 2021 report on Africa shows that chronic hepatitis B affects over 60 million people, with 90% of the infected population lacking the much-needed care. The purpose of this study was to determine the association between gender and risk behaviors for hepatitis B among the Liberia Military population.

Among the three sets of predictor variable (gender, substance use, and condom use), gender was significantly associated with HBV infection. A new finding among the other covariates showed that marital status was also a significant predictor for HBV

infection among the soldiers. In this study, I addressed the knowledge gaps for military health public health professionals about specific factors associated with HBV infections. Therefore, I recommended that policymaker sponsor further research that will help better understand other specific gender and marital risk factor for HBV infections. For positive social change, results from these studies must be disseminated to local and international bodies and engage in health promotion programs.

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