

**SCHOOL OF PUBLIC HEALTH
COLLEGE OF HEALTH SCIENCES
UNIVERSITY OF GHANA**



**FACTORS ASSOCIATED WITH HEPATITIS B VIRUS INFECTION
AMONG SOLDIERS IN THE SOUTHERN PART OF THE GHANA
ARMED FORCES- A CASE-CONTROL STUDY**

BY

THEOPHILUS PWASE BALINIA-ADDA

(10636391)

**A DISSERTATION SUBMITTED TO THE UNIVERSITY OF GHANA
IN PARTIAL FULFILMENT OF THE REQUIREMENT FOR THE
AWARD OF MASTERS OF PUBLIC HEALTH DEGREE**

JULY, 2018

DECLARATION

I, THEOPHILUS PWASE BALINIA-ADDA hereby declare that apart from references to other people's works which have been duly acknowledged, this dissertation has been written independently by me and has not been submitted for the award of any degree in any institution.

.....

.....

THEOPHILUS PWASE BALINIA-ADDA
(STUDENT)

DATE



.....

.....

PROF. COL. EDWIN AFARI (RTD)
(ACADEMIC SUPERVISOR)

DATE

DEDICATION

This dissertation is dedicated to my lovely and amazing wife Mrs Nana Yaa Wenawute Balinia-Adda and wonderful and blessed children Weyipe Nana Kofi Ntiamoah Balinia-Adda, Weperi Nana Afia Ntiamoah Balinia-Adda and Wedaga Ohene Kwame Pwase Balinia-Adda (Jnr.), my blessed mothers, Mrs Kawalla Charity Balinia and mother-in-law Reverend Vida Tano, the great Navro-Pio Adda family, all personnel of the Ghana Armed Forces and finally but not the least to God and Country.



ACKNOWLEDGEMENT

My first and foremost praise and thanks are lifted to the Almighty God for His unfailing love and undeserved blessings of good health, guidance and protection from birth, now and beyond.

I would also appreciate my supervisor Prof Col Edwin Afari (Rtd) for his immense fatherly and timely guidance, support, knowledge and expertise without which this study would not have been possible. My heartfelt gratitude also goes to Drs Donne Ameme and Basil Benduri Kaburi for their priceless and crucial critic, suggestions and assistance as my ‘Shadow’ supervisors. My profound appreciation also goes to all the lecturers in the School of Public Health for the great wealth of knowledge, skills and experience which were imparted to me and my colleagues during the course. My special thanks goes to Prof Phillip Baba Adongo, Prof. Bawa Ayaga and Dr Patricia Akweongo for their guidance and mentorship before and during my studies at the school. I am very grateful and anticipate your continued wise counsel in this chosen career and life.

It is important to have a spiritual father since prayer and is the key and God’s hand in one’s life cannot be taken for granted. In this regard, I say a big thank you to the Major Prophet Louis Akwase Hemmans-Cobbinnah Macaiah and all the Pastors of Christ Vision Sanctuary International for their incessant prayers and counsel that has seen me through it all. May I also acknowledge Mr. Clement Twumasi, my Biostatistician whose help was not only limited to my thesis but throughout both semesters of the course.

Finally, but not the least, I would extend my sincerest love and warmest appreciation to my lovely and ever caring, understanding, supportive soul mate Wenawute Nana Yaa Balinia-Adda and my 3 children Weyipe, Weperi and Wedaga for their unconditional, unflinching

support and endurance of my regular absence from home due to either school or travels. I could not have asked for any better wife or children.

Once again, a big thank you to all above and others who were not mentioned for one reason or the other. May the Almighty God the Father, the Son and the Holy Spirit bless you all abundantly.



ABSTRACT

Background: Military personnel are high-risk people for parenteral and sexually transmitted diseases such as hepatitis B virus (HBV). Hepatitis B is one of the most common infectious diseases globally. The burden of Chronic Hepatitis B infection in the Ghana Armed Forces is not known. As part of the Ghana Armed Forces Hepatitis Programme, the Forces Liver Health Protection (FLiHP) Project is implementing interventions aimed at reducing the estimated burden of viral hepatitis by 50% by the year 2020 within the Ghana Armed Forces.

Objectives: To determine the factors associated with Hepatitis B infection in soldiers of the Southern Command of the Ghana Armed forces.

Methods: A secondary data was obtained among military personnel from the FLiHP Project of the Ghana Armed Forces (GAF) across military units in the Southern part of Ghana. A random sample of 306 was selected for this study with half tested positive of Hepatitis B (HB) serving as cases; whereas, those tested negative only served as control cases. Bivariate analysis and logistic regression analysis was used to determine the association between Hepatitis B infection and Socio-demographic factors, Medical related factors and Behavioural factors and P value < 0.05 was considered statistically significant using STATA 15.

Results: It was revealed that the most significant risk factors that influenced Hepatitis B positive cases among the selected military personnel were sexual intercourse with prostitutes (AOR=12.76, 95% C.I=1.11-14.31), those with history of HB immunization (AOR=11.82, 95% C.I=1.11-14.31), soldiers from the northern ethnic groups (AOR=3.72, 95% C.I=1.22-11.29), possession of scarification marks (AOR=1.95, 95% C.I=0.63-6.07) and ages of soldiers between 28 and 37 years (AOR=1.48, 95% C.I=0.51-4.57).

Conclusions: From the foregone, I conclude that a small proportion of the military personnel screened in the southern part of the GAF by the FLiHP project tested positive to HBV infection. This proportion is half that of the nationwide but higher than the proportions of other militaries in the world. Secondly, only age and ethnicity were the significant socio-demographic factors associated with Hepatitis B infection while bisexual orientation, sexual intercourse with irregular sexual companions such as prostitutes and possession of scarification marks were the behavioral risk factors that had significant effect on positive HBV infection status. Finally, having HBV vaccination prior to the screening was the only medical risk factor associated with HBV infection among the selected military personnel.



TABLE OF CONTENTS

Content	Page
DECLARATION	i
DEDICATION	ii
ACKNOWLEDGEMENT	iii
ABSTRACT	v
TABLE OF CONTENTS	vi
LIST OF FIGURES	ix
LIST OF TABLES	x
LIST OF ACRONYMS	xi
DEFINITION OF OPERATIONAL TERMS	xiii
CHAPTER ONE	1
INTRODUCTION	1
1.1 Background	1
1.2 Problem statement	3
1.3 Conceptual Framework of Factors associated with Hepatitis B Virus infection	6
1.4 Narrative of the Conceptual Framework	6
1.5 Justification of the Study	8
1.6 Rationale of Study	9
1.7 Research Questions	9
1.8 Objectives of this study	10
1.8.1 General objective	10
1.8.2 Specific Objectives	10
CHAPTER TWO	11
LITERATURE REVIEW	11
2.1 Global Prevalence of Hepatitis B	11
2.2 Hepatitis Epidemiology in Africa and Ghana	12
2.3 Hepatitis B and its importance	14
2.4 The Proportion of the Military with Hepatitis B Infection	16
2.5 Socio Demographic Factors	17
2.5.1 Age and Sex	17
2.5.2 Ethnicity and Religion	18
2.5.3 Education and Occupation	18

2.5.4 Marrital Status	19
2.6 Medical Factors	20
2.6.1 Blood Transfusion and Organ Donation.....	20
2.6.2 Dental Procedures or Surgeries in unorthodox health facilities.....	20
2.6.3 Needles or Sharp Instruments injury	21
2.6.4 Perinatal	21
2.6.5 Vaccination against HBV	22
2.7 Behavioural Factors	22
2.7.1 Unprotected Sex, Numerous Sexual Companions and Men Having Sex with Other Men (MSM)	22
2.7.2 Intravenous Drug Users (IDUs)	23
2.7.3 Tattoos/Body Piercing and Scarification marks.....	24
2.7.4 Sharing of Blades, Needles and Domestic Effects	24
CHAPTER THREE.....	26
METHODS.....	26
3.1 Study Design	26
3.2 Study Area.....	26
3.3 Study Variables.....	28
3.4 Study Population.....	29
3.5 Criteria for Selection.....	29
3.5.1 Inclusion Criteria for Cases	29
3.5.2 Exclusion Criteria for Cases	29
3.5.3 Controls.....	29
3.6 Sample Size and Sampling Technique.....	30
3.6.1 Sample size calculation.....	30
3.6.2 Sampling Method	30
3.7 Data Collection Techniques and Tools.....	31
3.7.1 Data Extraction.....	31
3.7.2 Structured Questionnaire	31
3.8 Data Analysis.....	32
3.9 Ethical Considerations	32
3.9.1 Risks and benefits.....	33
3.9.2 Anonymity and confidentiality	33
3.10 Quality Control	33

3.11 Conflict of Interest	33
CHAPTER FOUR.....	34
RESULTS	34
4.1 Socio-demographic characteristics of selected Military Personnel	34
4.2 Proportion of military personnel screened and tested positive for HBV infection ...	36
4.3 Behavioral Risk Factors of selected Military Personnel	36
4.4 Medical Risk Factors of Military Personnel.....	37
4.5 Risk factors of Hepatitis B infection among soldiers of the Southern Command of the Ghana Armed forces	38
4.5.1 Logistic regression of significant risk factors of Hepatitis B infection.....	41
CHAPTER FIVE.....	44
DISCUSSION	44
5.1 Proportion of Military personnel with Hepatitis B Viral Infection	44
5.2 Socio-demographic risk factors of HBV Infection.....	45
5.3 Behavioral risk factors associated with HBV infection	47
5.4 Medical risk factors associated with HBV Infection	48
5.5 Strength and Limitations of the study	50
CHAPTER SIX.....	51
CONCLUSIONS AND RECOMMENDATIONS	51
6.1 Conclusion.....	51
6.2 Recommendations.....	51
6.2.1 Military High Command.....	51
6.2.2 The GAF Medical Directorate and 37 Military Hospital Command.....	52
6.2.3 The FLiHP Project Coordinator	52
6.2.4 Military Personnel	53
6.2.5 Stakeholders like Ministry of Health, Ghana Health Service, Non-Governmental Organizations in Health.....	53
REFERENCES	54
APPENDICES	61
Appendix 1: Questionnaire	61
Appendix 2: Consent Form	63
Appendix 3: Data Extraction Sheet	65

LIST OF FIGURES

Figure 1. 1 Conceptual Framework of Factors associated with Hepatitis B Infection 6

Figure 2.1: Geographic distribution of chronic hepatitis B infection, shown as HBsAg prevalence.....11

Figure 3.1: A map of the Southern part of Ghana with Military Units.....27

Figure 4.1: Proportion of Military Personnel screened and tested positive for HBV infection in the Southern part of the Ghana Armed Forces 2017 (n=306).....36



LIST OF TABLES

Table 2.1: Estimated Prevalence of Hepatitis B Virus Infection by WHO Regions	12
Table 2.2: HBsAg prevalence in the general population in the WHO African Region (8.83%).....	13
Table 3.1: Study Variables	28
Table 4.1: Socio-demographic characteristics of selected Military Personnel in the Southern part of the Ghana Armed Forces 2017 (n=306).....	35
Table 4.2: Behavioural Risk Factors of selected Military Personnel in the Southern part of the Ghana Armed Forces 2017 (n=306).....	37
Table 4.3: Medical Risk Factors of Military Personnel in the Southern part of the Ghana Armed Forces 2017 (n=306)	38
Table 4. 4: Socio-Demographic risk factors of HBV Infection in the Southern part of the Ghana Armed Forces 2017 (n=306)	39
Table 4.5: Behavioral risk factors associated with HBV infection in the Southern part of the Ghana Armed Forces 2017 (n=306).....	40
Table 4.6: Medical risk factors associated with HBV Infection in the Southern part of the Ghana Armed Forces 2017 (n=306)	41
Table 4.7: Logistic regression of significant risk factors associated with HBV Infection in the Southern part of the Ghana Armed Forces 2017 (n=306).....	42



LIST OF ACRONYMS

AIDS	Acquired Immuno Deficiency Syndrome
AOR	Adjusted odds ratio
CDC	Centre for Disease Control & Prevention
FLiHP	Forces Liver Health Protection Project
GAF	Ghana Armed Forces
GHS	Ghana Health Service
GHQ	General Headquarters
HBV	Hepatitis B Virus
HCV	Hepatitis C Virus
HCW	Health Care Workers
HIV	Human Immunodeficiency Virus
IDUs	Intravenous Drug Users
MRS	Medical Reception Station
MSM	Men who have Sex with Men
NGO	Non-Governmental Organization
NSI	Needle Stick Injury
NSSI	Needle Stick and Sharps Injury
OR	Odds ratio
PWID	People Who Inject Drugs



SI	Sharp Instrument
STI	Sexually Transmitted Infections
TB	Tuberculosis
WHO	World Health Organisation



DEFINITION OF OPERATIONAL TERMS

ITEM	DEFINITION
Health Care Worker	All people engaged in the promotion, protection or improvement of the health of the population.
Incidence	Refers to the number of new cases that develop in each period
Prevalence	Refers to the number of cases of disease including old and new that are present in a population at a given time.



CHAPTER ONE

INTRODUCTION

1.1 Background

Hepatitis simply is the swelling of the liver, principally precipitated by a virulent disease, significant alcohol abuse, toxins, certain medications, as well as a few medical conditions (CDC, 2016). There are varieties of hepatitis like viral hepatitis A, B, C, D, E, F and G. Viral hepatitis A and D are more prevalent in European, Middle Eastern, Central Asian, Siberian and American geographical regions. Hepatitis B and C are more prevalent in East Asia whereas E is commonly found in the African continent. Hepatitis F is additionally found in Central America and G within the United States of America and France (Dongdem et al., 2012).

Viral hepatitis is amongst the common diseases worldwide. However, the most dangerous and fast killing among them is the hepatitis B viral (HBV) infection originally called serum hepatitis (WHO, 2015). Hepatitis B Virus (HBV), an enclosed DNA virus causes Hepatitis B infection. It affects the hepatic cells inflicting hepatocellular death and swelling. HBV infection may be subtle or persistent linked with unhealthiness travelling in severity from well to emblematic continuous malady. Chronic viral hepatitis B (CHB) is outlined as persistent viral hepatitis B surface antigen (HBsAg) for 6 months or additional (Alexopoulou & Karayiannis, 2014).

In 2015, worldwide, about 257 million people depicting 3.5% of the general populace have chronic HBV infection. Out of the persons born prior to the Hepatitis B vaccine being offered, the percentage of people alive with chronic HBV infection is still huge. The predominance was topmost in Africa (6.1%) and West Pacific (6.2%) (Global Hepatitis Report, 2017). Viral hepatitis led to 1.34 million deaths in 2015, which is worthy of comparison to deaths due to Tuberculosis and above those due to HIV. Still, the amount of

deaths attributed to hepatitis is rising over time, whereas deaths due to tuberculosis and HIV is reducing. Nearly all viral hepatitis deaths in 2015 were attributed to chronic hepatic disease (720 000 deaths caused by cirrhosis) and primal hepatic disease (470 000 deaths caused by hepatocellular carcinoma (HCC)) (Global Hepatitis Report, 2017).

According to Trépo et al., 2014 and (Global Hepatitis Report, 2017), the geographical endemicity of HBV Infection differs very much throughout the world from high (>8%), intermediate (2-7%) to low (<2%) prevalence. The predominance of HBV infection is calculable at 8% in West Africa and 5%–7% in Central, Eastern and Southern Africa. The incidence of the sickness in East Asia and Africa ranges from (5-10%) (Mueller et al., 2015). More than 8% of the African populace have the chronic variety of the HBV infection (Rufai & Mutocheluh, 2014). According to Mutocheluh & Owusu, (2014), in Ghana the incidence of HBV infection in Ghana varies from 8-15%.

Globally, as part of the recruitment or enlistment process of persons into the military, it is mandatory for a person to be medically screened and one of the key requirements is to be seronegative for Hepatitis. This presupposes that military personnel should not have hepatitis; however, this is not the case. This may be because the personnel are in constant interaction with the general population and as such are not insulated from the rest of the population.

As part of the Ghana Armed Forces Hepatitis Programme, the Forces Liver Health Protection (FLiHP) Project is implementing interventions intended at decreasing the estimated load of viral hepatitis by 50% by the year 2020 within the Ghana Armed Forces. The Forces Liver Health Protection (FLiHP) Project, a social intervention project designed to educate, screen, vaccinate and treat HBV and HCV infection among an estimated

beneficiary population of 100,000 soldiers, civilian employees and their dependents with a prospective replication for the whole country.

The World Health Assembly in May 2016 adapted the Global Health Sector Strategy (GHSS) on Viral Hepatitis for 2016–2021. Which consists five crucial instructions: (i) information for centered action; (ii) interventions for impact; (iii) delivering for equity; (iv) finance for viability; and (v) novelty for acceleration (Health, Strategy, Ending, & Hepatitis, 2016). The 194 Constituent States of World Health Organisation (WHO) dedicated to eradicating Viral Hepatitis as a public health threat by 2030 (outlined as a 65% decrease in mortality and a 90% decrease in occurrence as to the 2015 level (Health et al., 2016).

1.2 Problem statement

The WHO in the Global Hepatitis Report (2017) indicates that viral hepatitis B is amongst the commonest infectious diseases worldwide with a calculable 257 million persons alive having HBV infection (outlined as positive HBsAg). In 2015, HBV caused 887 000 deaths, principally from serious sequelae (inclusive of liver cirrhosis and HCC) in step with a similar report. The WHO Fact Sheet on Hepatitis B (2017) classifies Sub-Saharan Africa as a highly endemic region with prevalence rate of above 8%. According to the Ghana National Policy on Viral Hepatitis (2015), approximately four million of Ghana's 28 million people have the disease, a national rate greater than 8 per cent, which is about four times the national prevalence of HIV. Conferring from a systemic review and meta-analysis of prevalence studies from 1995 to 2015, the nationwide prevalence of Viral hepatitis B measured using Hepatitis B surface Antigen seropositive was 12.3% and a spread of 10.2% to 17.3% (Ofori-Asenso R and Adum Agyeman A, 2016).

Several studies of hepatitis in military populations have been conducted and have found out that the aetiological agent for most non-outbreak associated infections is the hepatitis B

virus (HBV)(Prier & Cowan, 1987). According to Petrauskas et al, 2017 the prevalence of Viral Hepatitis B infection is totally varying within armies in various nations (0.3–3.9%). Incidence of Hepatitis B Virus infection amongst the military in NATO nations differs and correlates to population patterns. In the United States Army, 0.3% of soldiers have Hepatitis B surface Antigen, in Greece 1.1%, in Italy 0.7%, and in Spain 0.48%.

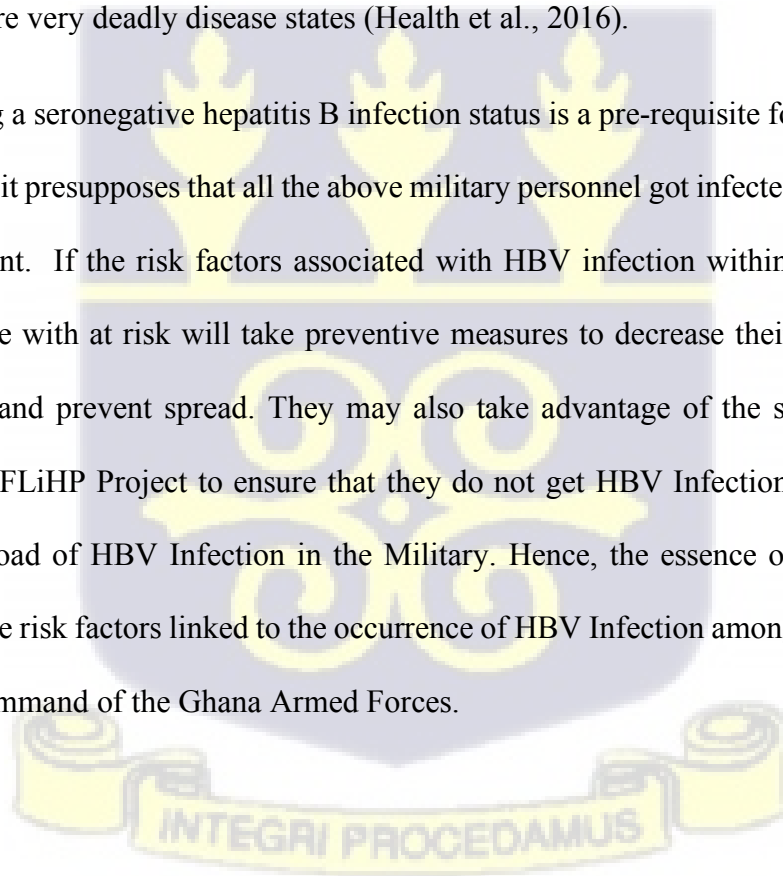
There is a perceived increase in mortality due to viral hepatitis amongst soldiers and civilian employees of the Ministry of Defence (MOD) who report to the 37 Military Hospital, the referral hospital for target population. The threat of infection and subsequent transmission within the military establishment remains high estimated to be about 8%.

Studies have established that transmission of HBV occurs as a result of both environmental and behavioural factors (Prier & Cowan, 1987). Behavioural issues have been examined for the military in various population-based studies. Lemon et al, 1982 reported that the specific behavioural factor most frequently reported in Germany was illicit self-injection of drugs, while in Korea sexual activity was most important(Prier & Cowan, 1987). The factors contributing to the occurrence of Hepatitis B infection generally and in the military have been broadly classified as Socio-demographic factors, Medical factors and Behavioural factors. The Medical factors include blood transfusion, blood or organ donation, dental or other surgeries in unorthodox health facilities or use of unsterilized instruments, perinatal or not being vaccinated against HBV while the sexual and other percutaneous modes of routes of transmission are having unprotected sex, Men having Sex with other Men (MSM), having numerous sexual companions, Intravenous Drug Usage (IDUs), Tattoos/Body Piercing, sharing of domestic effects, blades and needles and Scarification marks have been grouped as behavioural associated risk factors.

As part of the Ghana Armed Forces Hepatitis Programme, the Forces Liver Health Protection (FLiHP) Project is implementing interventions intended at decreasing the estimated load of viral hepatitis by 50% by the year 2020 within the Ghana Armed Forces. The Forces Liver Health Protection (FLiHP) Project, a social intervention project designed to educate, screen, vaccinate and treat HBV and HCV infections among an estimated beneficiary population of 100,000 soldiers, civilian employees and their dependents with a prospective replication for the whole country.

Untreated chronic viral hepatitis will lead to critical complications. Reckoning to life span, 20% or additional of these with chronic infection progress to end-stage chronic disease, like cirrhosis of the liver or HCC. Coexisting factors such as HIV infection and alcohol abuse will hasten advancement to end-stage disease. Cirrhosis of the liver and hepatocellular carcinoma are very deadly disease states (Health et al., 2016).

Since having a seronegative hepatitis B infection status is a pre-requisite for enlistment into the military, it presupposes that all the above military personnel got infected after enlistment or recruitment. If the risk factors associated with HBV infection within the Military are known, those with at risk will take preventive measures to decrease their exposure to the risk factors and prevent spread. They may also take advantage of the services available through the FLiHP Project to ensure that they do not get HBV Infection and in so doing reduce the load of HBV Infection in the Military. Hence, the essence of this study is to determine the risk factors linked to the occurrence of HBV Infection amongst soldiers in the Southern command of the Ghana Armed Forces.



1.3 Conceptual Framework of Factors associated with Hepatitis B Virus infection

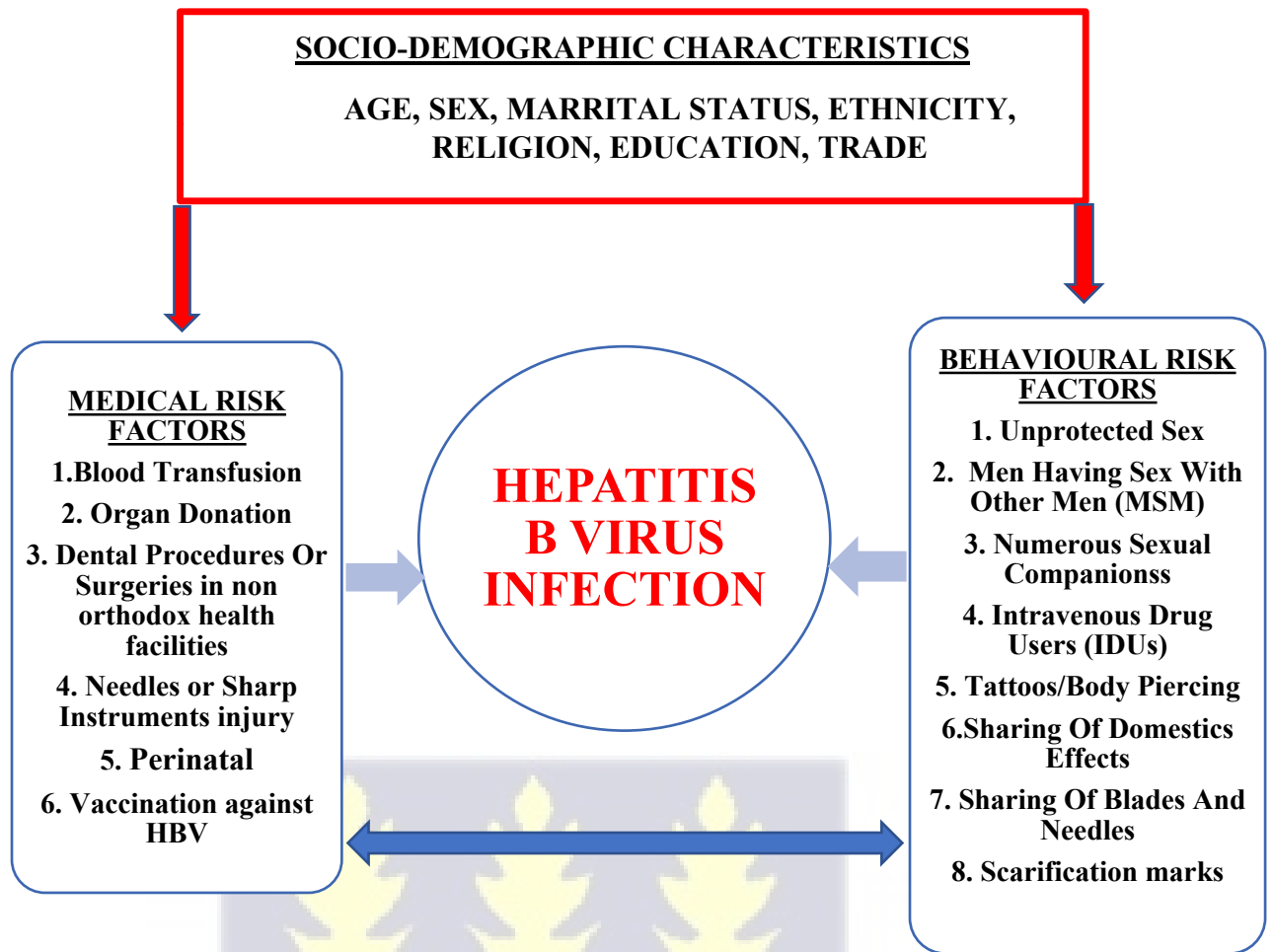


Figure 1.1: Conceptual Framework of Factors associated with Hepatitis B Infection

1.4 Narrative of the Conceptual Framework

Any outcome's research study usually relies on a hypothesis correlating to the outcome, e.g., someone having been infected with HBV, a variable or group of variables on which the outcome is hypothesized to be dependent e.g. unprotected sex with an infected person. The variables above are classified into 1) a dependent or outcome variable or 2) a predictor or independent variable, on which the outcome variable is dependent. Therefore, the framework comprising sets of variables and the links to each other (i.e. with labelling as dependent or independent variables) in Figure 2. This Conceptual Framework has three

categories of variables: 1) socio-demographic factors, 2) Medical factors, 3) Behavioural factors and 4) outcome of Hepatitis B Virus status after screening.

In the framework above, the classification “outcomes of screening for Hepatitis B Virus” is referred to as the eventual dependent or outcome variable which is binary (Negative or Positive). The other categories of variables are either indirectly or directly predictors of the outcome variable. The socio-demographic factors influence how a person may be exposed to the risk factors for instance a young person is more likely to indulge in risky sexual activities than an older person, which is a predictor of outcome of HBV status. The Perinatal events may lead to the outcome either directly or indirectly through an assisted mode of delivery in a mother who is not already infected to HBV before delivery.

The other associated factors have been broadly classified as medical factors such as blood transfusion, blood or organ donation, dental or surgeries in unorthodox health facilities or use of unsterilized instruments, perinatal or not being vaccinated against HBV while the sexual and other percutaneous modes of routes of transmission have been grouped as behavioural associated risk factors.

The large blue line showing bi-direction between medical risk factors and behavioral risk factors shows the vice versa nature of linkage between the two groups of risk factors. For instance, there could be a needle or sharp instrument injury during the process of making tattoos or body piercing which can lead to hepatitis B infection.

In conclusion, the increase in HBV infection status among the soldiers is dependent on the sociodemographic, medical and behavioural factors of the soldiers of the Ghana Armed Forces.

1.5 Justification of the Study

The Military's role in the country cannot be over emphasized. It protects and maintains the territorial integrity of the country by land, sea and air. As well as supporting the civil Police to maintain law and order and assist the National Disaster Management Organisation in performing their duties. These supplementary tasks are carried out in peace time role. To effectively and efficiently perform its roles, the soldiers need to be healthy and fit however, this silent killer is stealthily infecting the personnel. The cases of HBV are increasing within the military. There is the need to analyse the data collected by the FLiHP project to ascertain the factors associated with the HBV infection. The findings will inform policy direction in the management of the project to achieve its goals. Developing countries and other resource constraint countries including Ghana have high prevalence of hepatitis B, therefore military who part take in various United Nations Peacekeeping operation are at greater risk of infection from these countries.

It will therefore be very important to study the risk factors attributable to HBV Infection in the military. Findings from this study would highlight factors responsible for HBV Infection. It will also help the managers of the FLiHP Project in planning and targeting appropriate measures/interventions to minimize or control the incidence of the infection within the military and their families. Findings and recommendations of the study will also be useful to the GAF High Command to ensure that measures are put in place to minimize or control this silent and devastating infection. Recommendations emerging from this study will be useful to the nation since what pertains in the military is not far from what pertains in the public. Therefore, the ultimate beneficiary of these interventions because of the findings will be the gallant soldier.

1.6 Rationale of Study

The effects of viral hepatitis on the Ghana Armed Forces as identified by the FLiHP Project are:

1. Increased medical costs for management of viral hepatitis and its complications e.g. cirrhosis, liver failure and hepatocellular carcinoma.
2. Death of some personnel due to late diagnosis of viral hepatitis due to lack of routine screening and management of disease when diagnosed.
3. Exclusion of some identified skilled personnel with symptomatic viral hepatitis from national duties and international military operations.
4. Cost of training to replace skilled personnel lost to hepatitis estimated at \$150,000 per individual replacement. This is an additional strain on the budget of the military.
5. Demotivation and drop in morale amongst personnel who loose colleagues to hepatitis due to the lack of policy which provides assurance of care when infected with viral hepatitis which is preventable.
6. Destabilization of family units due to morbidity and mortality of personnel from viral hepatitis.
7. Economic challenges faced by the family of deceased staff lost to viral hepatitis.

If the risk associated factors associated with HBV in the Military are known intervention measures will be put in place to reduce infection by implementing effective measures to forestall the spread of HBV and protect the livers of our gallant men and women in uniform to continue performing their vital role in protecting the country's territories.

1.7 Research Questions

- What proportion of the Military personnel in the southern part of the GAF screened have Hepatitis B infection?
- What are socio-demographic characteristics of the soldiers in the southern part of the GAF are associated with HBV Infection?

- What behavioral risk factors are linked to HBV infection amongst soldiers in the southern part of the GAF?
- What are the medical risk factors that are attributable to HBV infection in soldiers of the Southern Command of the GAF?

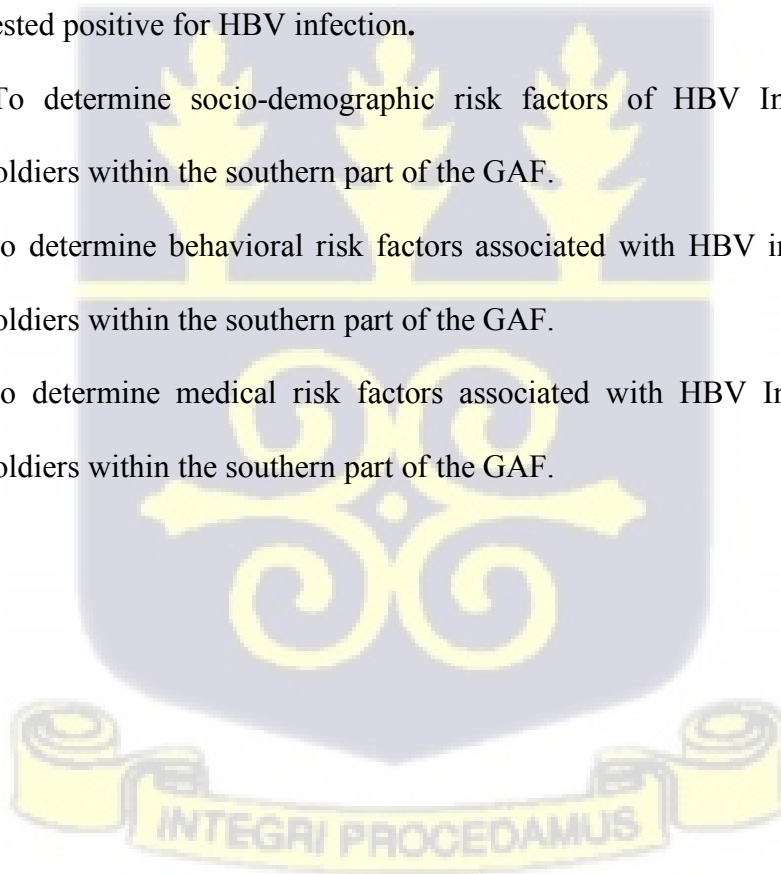
1.8 Objectives of this study

1.8.1 General objective

To determine the associated risk factors of HBV infection among soldiers of the Southern part of the Ghana Armed forces.

1.8.2 Specific Objectives

1. To determine proportion of military personnel screened in the southern part that tested positive for HBV infection.
2. To determine socio-demographic risk factors of HBV Infection amongst soldiers within the southern part of the GAF.
3. To determine behavioral risk factors associated with HBV infection amongst soldiers within the southern part of the GAF.
4. To determine medical risk factors associated with HBV Infection amongst soldiers within the southern part of the GAF.



CHAPTER TWO

LITERATURE REVIEW

2.1 Global Prevalence of Hepatitis B

Worldwide, in 2015, about 257 million persons were alive with chronic Hepatitis B Viral infection (Global Hepatitis Report, 2017). The widespread disease due to HBV infects mainly the WHO African Region and the Western Pacific Region. Viral hepatitis led to 1.34 million deaths in 2015, which is worthy of comparison to mortality due to Tuberculosis and above those due to HIV (Global Hepatitis Report, 2017). Still, the amount of deaths resulting from hepatitis is rising with time, whereas deaths resulting from Tuberculosis and HIV is reducing. Nearly all deaths from viral hepatitis in 2015, were as a result of chronic hepatic disease (720 000 deaths caused by cirrhosis) as well as primal liver disease (470 000 deaths caused by HCC) (Global Hepatitis Report, 2017).

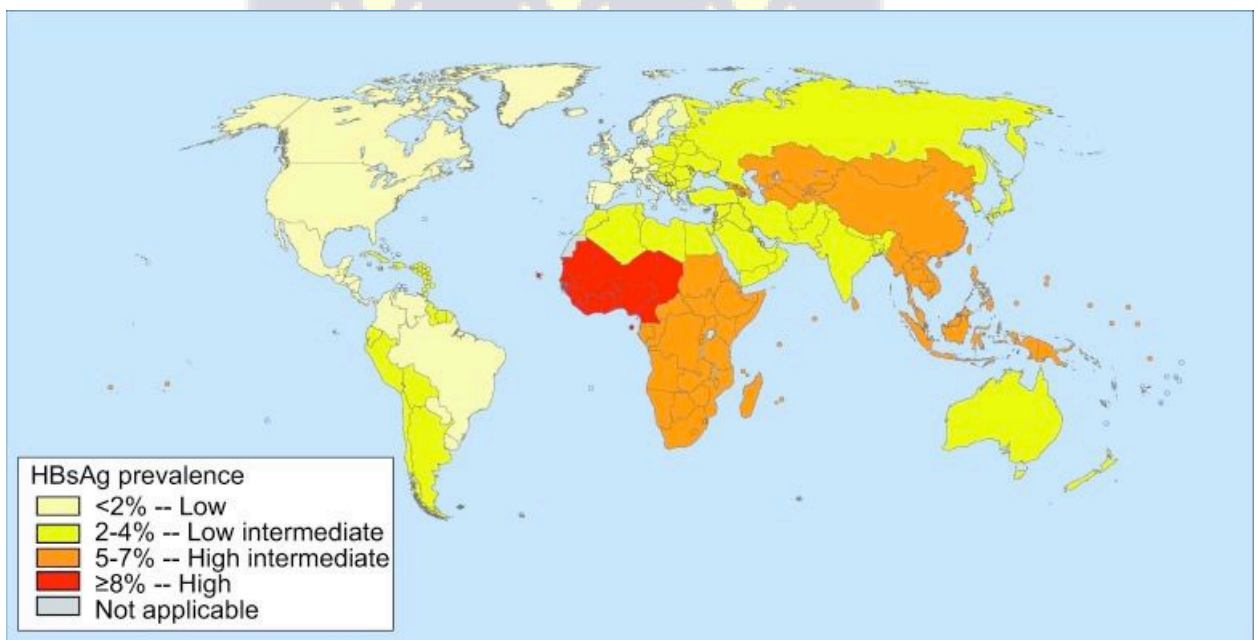


Figure 2.1: Geographic distribution of chronic hepatitis B infection, shown as HBsAg prevalence.

Source of Figure: available on request from D. Lavanchy, World Health Organization, Communicable Diseases Surveillance and Response (CSR).

Endemicity of HBV infection is thought-out to be huge in certain areas in the globe like Africa and parts of Asia where at minimum, 8% of the populace is hepatitis B surface antigen (HBsAg)-positive. Within such parts, 70–90% of the populace typically possess serological proof of former Hepatitis B Virus infection. Nearly all these infections happen while in perinatal period or initial infancy that explains the soaring rates of chronic Hepatitis B Viral infection in such populace. The risk of HBV infection progresses post the initial 5 years of life, however, its consequent addition to the big rate of chronic infection is minimally significant. Chronic infection with Hepatitis B Virus is greatly linked to Hepatocellular Carcinoma (HCC), and parts of the world that have huge endemicity of chronic Hepatitis B Viral infection possess the topmost death proportions due to this neoplasm (Trépo et al., 2014).

Table 2.1: Estimated Prevalence of Hepatitis B Virus Infection by WHO Regions
Based on a systematic review of data published between 1965 and 2013 (WHO)

Regions	Prevalence estimated (%)
African Region	8.83
The Americas	0.81
Eastern Mediterranean Region	3.01
European Region	2.06
South East Asian Region	1.90
Western Pacific Region	5.26

*Source: Schweitzer A, **Het I. LANCET 2015.***

2.2 Hepatitis Epidemiology in Africa and Ghana

The WHO Fact Sheet on Hepatitis B (2017) classifies Sub-Saharan Africa as a highly endemic region with prevalence rate of above 8%. According to the Ghana National Policy on Viral Hepatitis (2015), approximately four million of Ghana’s 28 million people have the disease, a national rate greater than 8 per cent, which is about four times the national prevalence of HIV. The nationwide incidence of Hepatitis B Virus as ascertained using HBsAg seropositive was 12.3 % and a range of 10.2% to 17.3% from a systematic review

and meta-analysis of prevalence studies beginning 1995 to 2015 (Ofori-Asenso R and Adum Agyeman A, 2016).

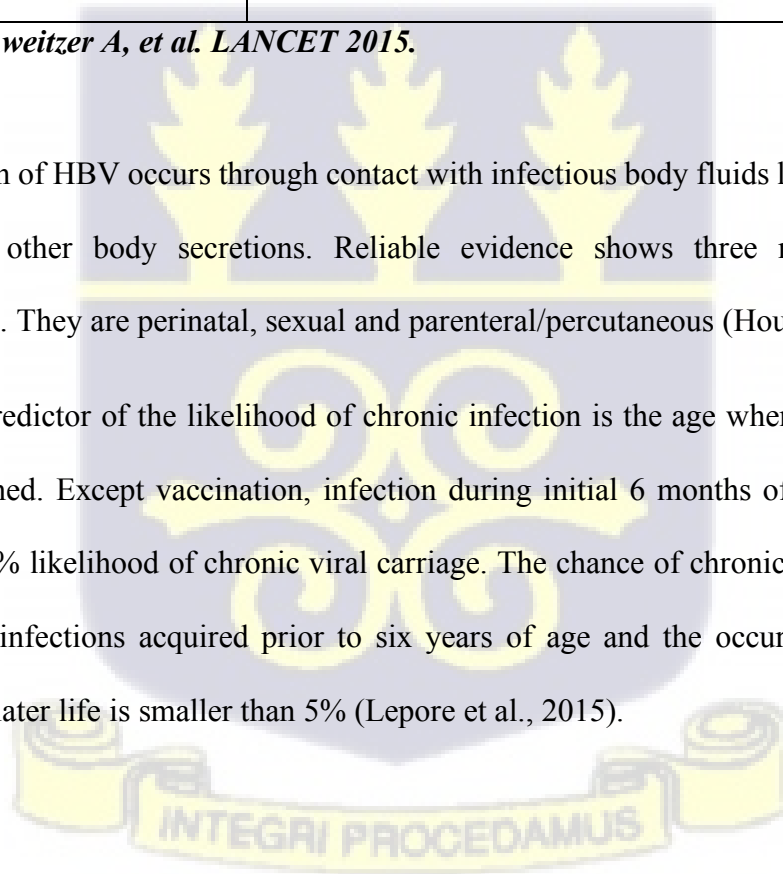
Table 2.2: HBsAg prevalence in the general population in the WHO African Region (8.83%)

The prevalence of chronic HBV infection	The WHO African Region
High (>8%)	Angola, Benin, Burkina Faso, Burundi, Cameroon, Cape Verde, Central African Republic, Congo, Côte d'Ivoire, Equatorial Guinea, Gabon, Gambia, Ghana, Guinea, Liberia, Malawi, Mali, Mauritania, Mozambique, Namibia, Niger, Nigeria, Senegal, Sierra Leone, South Sudan, Swaziland, Togo, Uganda, Zimbabwe
Intermediate (2–8%)	Algeria, DR Congo, Eritrea, Ethiopia, Kenya, Madagascar, Rwanda, South Africa, Tanzania, Zambia
Low (<2%)	Seychelles

Source: Schweitzer A, et al. LANCET 2015.

Transmission of HBV occurs through contact with infectious body fluids like blood, saliva, semen and other body secretions. Reliable evidence shows three major modes of transmission. They are perinatal, sexual and parenteral/percutaneous (Hou et al., 2005).

A leading predictor of the likelihood of chronic infection is the age when exposure to the virus happened. Except vaccination, infection during initial 6 months of life is linked to about 80-90% likelihood of chronic viral carriage. The chance of chronic carriage reduces to 30% for infections acquired prior to six years of age and the occurrence of chronic infection in later life is smaller than 5% (Lepore et al., 2015).



2.3 Hepatitis B and its importance

The importance of Hepatitis B Virus infection cannot be overemphasized both globally and countrywide. Repetitions of the Global Burden of Disease (GBD) project from the 2000s enhanced predictions of the actual load of deaths from viral hepatitis. Subsequently, it was evident that cirrhosis and HCC were responsible for much of the load from viral hepatitis (Perz JF, 2006). Preventive interventions advanced more, including innovations on blood safety (F. W. H. Assembly, World, & Assembly, 2004), health-care injection safety (Hutin & Chen, 1999), infection control, and hazard decrease for persons who inject drugs. Nonetheless, the earlier medicines for the management of viral hepatitis B and C possessed minimal efficacy with poor tolerance and high cost. The subsequent absence of therapeutic choices implied that minimal or no progression was achieved with the treatment of persons having chronic hepatitis infection. There was rising general knowledge of the communal health load of viral hepatitis by 2010. Notwithstanding, there were huge shortcomings with regards to the response and deaths were rising. In 2010, the World Health Assembly adapted the premier resolution on viral hepatitis (Sixty-third World Health Assembly, 2010), later resulting in the formulation of WHO's Global Hepatitis Programme in 2011. Research and development resulted in novel revolutionary therapies for Hepatitis C Viral infection, which greatly enhanced therapeutic results. A second resolution in 2014 (Sixty-seventh World Health Assembly, 2014) furthermore outlined the communal health significance of viral hepatitis and elevated the likelihood and hopes of eradicating HBV and HCV.

The availability to cost-effective hepatitis screening or testing is inadequate. Only a small number of persons infected with viral hepatitis have been diagnosed {22 million (9%) of HBV-infected people and 14 million (20%) of HCV-infected people}. Furthermore, only a small proportion of persons diagnosed have treatment. In 2015, 1.7 million persons

representing 8% of those diagnosed with Hepatitis B Virus infection were taking medications to treat the infection (WHO GLOBAL HEPATITIS REPORT, 2017).

Since adults chronically infected may include about 65 million women of childbearing age who make up 25.3% of the world's population (United Nations data), there is a potential threat of transmitting HBV to the babies (Summary, 2017).

The main ways of HBV spread involves contact with to infected blood, from mother to child while giving birth and having sexual activity. There have been vaccines for hepatitis A and B since for twenty years now. Hepatitis D is preventable by taking hepatitis B vaccines. As of now, the only types of hepatitis that cannot be prevented using vaccine are C and E hepatitis. The topmost alarming thing regarding the worldwide epidemic rest on the case that the acute clinical signs and symptoms of the various forms of viral hepatitis are alike notwithstanding the causative organism and could be high temperature, malady, tiredness, anorexia, nausea, abdominal discomfort, dark urine, and jaundice (CDC, 2006). Albeit, the total mortality due to viral hepatitis is rising, incidence of HBV infections is dropping, gratitude to growing inclusion of HBV vaccination amongst children. Worldwide, 84% of children birthed in 2015 had the three recommended dosages of hepatitis B vaccine. From the pre-vaccine period (which, going by the year of initiation may range beginning in the 1980s to the early 2000s) and 2015, the fraction of children below five years of age having new infections dropped from 4.7% to 1.3%.

Untreated chronic viral hepatitis will get to critical complications. Reckoning to life span, 20% or additional of these with chronic infection progress to end-stage chronic disease, like cirrhosis of the liver or HCC. Coexisting factors such as HIV infection and alcohol abuse will hasten advancement to end-stage disease. Cirrhosis of the liver and hepatocellular carcinoma are very deadly disease states (Health et al., 2016).

When the infection is not treated, HBV and HCV infection may result in cirrhosis (720 000 deaths) and hepatocellular carcinoma (470 000 deaths). The life-long sequelae are fatal and responsible for 96% of the mortality arising from viral hepatitis. Deaths due to viral hepatitis has risen by 22% after the year 2000. Except that persons having Hepatitis B Viral and Hepatitis C Viral infection are screened and therapy given, the mortality figures resulting from viral hepatitis will continuously assume an upward trend (“GLOBAL HEPATITIS REPORT 2017,” n.d.).

2.4 The Proportion of the Military with Hepatitis B Infection

A number of studies of hepatitis in military populations have been conducted and have found out that the aetiological agent for most non-outbreak associated infections is the hepatitis B virus (HBV) (Prier & Cowan, 1987). According to Major Gilbert R. I (2015) recent studies of an outbreak at Fort Hood, Texas by showed that while highly specific tests for HBsAg in the serum were positive in only 35% of 394 military patients with viral hepatitis during the first 7-14 days after onset of jaundice, supplementary tests for antibody vs the core antigen (HB_e) and vs HBsAg indicated that about 90% of all cases were hepatitis B.

The prevalence of Viral Hepatitis B infection is totally varying within armies in various nations (0.3–3.9%). Incidence of Hepatitis B Virus infection amongst the military in NATO nations differs and correlates to population patterns. In the United States Army, 0.3% of soldiers have Hepatitis B surface Antigen, in Greece 1.1%, in Italy 0.7%, and in Spain 0.48% (Petrauskas, Kupcinskis, Petrauskas, Petrenkiene, & Saulius, 2017).

In a study conducted in Lithuanian military subunits in 2003 to evaluate the prevalence of hepatitis B serological markers (hepatitis B virus (HBV) superficial antigen (HBsAg)) and risk factors for HBV infection among Lithuanian Army soldiers. Out of the 1,830 soldiers,

36 (2.0%) tested positive to HBsAg. The prevalence of infection was different in various units of the Lithuanian Army. The topmost rates (4.2%) of HBsAg were evident within the Naval personnel. A small fraction 4 (11%) of 36 of HBsAg carriers had elevated ALT. Majority of the HBsAg-positive soldiers (58.8%) worked 4 to 6 months ($p < 0.05$) (Petrauskas et al., 2017).

2.5 Socio Demographic Factors

2.5.1 Age and Sex

Jimenez et al., (2009) from Community transmission of hepatitis B virus in Egypt: results from a case-control study in Greater Cairo observed in a large age spectrum of sick persons highest prevalence of HBV infection to be ranging from 36 to 50 years (29.47% of the populace) and males possess comparably topmost prevalence of HBV infection than females (Uddin Pk et al., 2014). Abdallah, Mohamed, & Ali, (2011) proved that Hepatitis B Virus infection is commoner within males compared to females which correlates with results obtained in sub-Saharan African countries just as that of Burnett et al., 2005. This may be due to what pertains in a nation such as Bangladesh where men are the major work resource; men take trips to the various sections of the nation for job purposes or conduct business, drink unclean water from restaurants or water provided by a modest tea shop by the way. Hence men are more prone to come in contact with the pollution compared to women (Uddin Pk et al., 2014).

Also from a study by Michaelcaleywarwickshirensuk, Fowler, Greatrex, & Wood, (2012) they found out that majority, 347/595 (58%), of cases of Hepatitis B infection existed within the persons of 25–34 years-old ages.

2.5.2 Ethnicity and Religion

In a study to determine the variations in hepatitis B virus infection proportion among ethnic groups in antenatal females in Birmingham, an overall of 407(68%) of 595 cases of Hepatitis B virus infection happened in ‘black Africans’, Pakistani and Chinese ethnic categories (Michaelcaleywarwickshirensuk et al., 2012). Females of ‘black African’, Pakistani, ‘white other’ and ‘other’ ethnicities in total possessed a significantly greater proportion of infection in comparison to the English moderate proportion of 350 per 100,000 antenatal investigations. Females of ‘black African’ and ‘white other’ ethnicity possessed greatly raised hazards (relative risk (RR): 11.25 and 5.87 respectively) comparable to the England averages. Females of ‘white British’ ethnicity possessed undoubtedly smaller relative risks of infection (RR: 0.01)(Michaelcaleywarwickshirensuk et al., 2012)

Race was stated as an independent risk factor for Hepatitis B Viral infection in current accounts in Uganda (Nakwagala and Kagimu, 2002). The existing linkage of race to Hepatitis B Virus infection in the study could be justified by the peculiar culture of the Rashiada tribe, one of the dominant ethnic group in the east of Sudan and amongst them there existed a huge incidence proportion of Hepatitis B Virus infection in comparison to different tribes (P value 0.001), because they routinely permit early coupling and peculiar forms of taboos(Abdallah et al. 2011).

2.5.3 Education and Occupation

The level of schooling was significant for the distribution of HBsAg. An overall of 41.7% of HBsAg-positive military personnel attained the basic level schooling ($p < 0.05$, compared to different educational categories), 33.3% attained secondary grade, and 25% attained the college grade. Every military personnel having a tertiary level education was negative for Hepatitis B surface Antigen (Petrauskas et al., 2017).

The entire Hepatitis B Virus incidence in the Female Sex Workers (FSWs) was 17.1%. FSWs within the ages of 31 and 35 years (20.5%) and 'age-at-first-sex' less than 10 years of age (28%) were the ones mostly infected (Forbi et al., 2008). Intravenous drug injection and anal sex have been reported as hazardous factors for Hepatitis B Virus infection especially in FSWs. Forbi et al., (2008) also disclosed that the incidence of Hepatitis B Virus infection was greatest within Nigerian FSWs with 'age-at-first-sex' less than 10 years (28%, $p < 0.05$). This compares well to researches from Mexico that younger age of sexual intercourse raises the risk of HBV infection. Also, studies in South Africa as well as North America have demonstrated that females who have endured child sexual abuse have more likelihood of engaging in hazardous sex.

A study of Chinese migrants in New York City with reduced levels of income and schooling realized that only 37% of people disclosed having been tested and only 31% received vaccinations against HBV infection (Cotler, Cotler, Xie, Luc, & Layden, 2012).

2.5.4 Marital Status

Jimenez et al., (2009) also found out that effect modification by sex was observed with marriage, with a greater margin of the attributable risk for females (OR¹/₄8.0, 95% CI¹/₄3.1–20.7) in comparison to males (OR¹/₄1.2, 95% CI¹/₄0.6–2.5) (P-value for the interaction term ¹/₄ 0.007). After separating marriage into groups by length of coupling, the raised hazard of acute hepatitis B virus infection was specifically raised with respect to females married for <1 year (OR¹/₄49.4, 95% CI¹/₄4.3–562.0), in comparison to that of unmarried. A similar effect modification by gender was observed with marriage, with a greater margin of the attributable hazard for females (OR¹/₄8.0, 95% CI¹/₄3.1–20.7) in comparison to males (OR¹/₄1.2, 95% CI¹/₄0.6–2.5) (P-value for the interaction term ¹/₄ 0.007).

2.6 Medical Factors

2.6.1 Blood Transfusion and Organ Donation

Post haemotransfusion, 45 beneficiaries (91.8%) did not have HBV infection meaning their test results were negative for HBsAg and HBV Di-ribonucleic acid (DNA) while 4 (8.2%) of the beneficiaries were positive for HBV DNA. In 3 beneficiaries, 83%–86% identity and remote ethnological congruence with their benefactor HBV eliminated transmission via haemotransfusion. The remaining beneficiary HBV contained 95% sequence homology with her benefactor HBV, in harmony with acquiring HBV infection through the haemotransfusion. Soaring anti-HBs quantities in 7 different beneficiaries indicates current transfusion-linked HBV immune reaction (Yuen et al., 2011).

From a cross-sectional research by Noubiap et al., (2015) to determine the prevalence and factors linked with HBV infection, and the infectivity of no urban expectant females within the Far North Region of Cameroon, it was realized that previous haemotransfusion and HIV infection were greatly linked to Hepatitis B Virus infection.

2.6.2 Dental Procedures or Surgeries in unorthodox health facilities

Jimenez et al., (2009) also found that generally, women encountered higher recurrent intrusive medical operations compared to men. Notwithstanding, not one of these operations was linked to a high-level HBV infection hazard but baby delivery (OR¹/43.3, 95% CI¹/41.1–9.8). Assisted forms of delivery like Episiotomy, Forceps and Caesarean section were not separately linked to a raised HBV infection hazard, but the figures were small for each operation. Dental and gingival therapies have been formerly illustrated as hazardous factors for HBV transmission according to Stroffolini et al (2000) and Akhtar et al (2005), however Jimenez et al., (2009) found that no dental operation (gum therapy, tooth filling or removal and dental anaesthesia) was linked to a rise in HBV hazard.

2.6.3 Needles or Sharp Instruments injury

Inadvertent sharps or needle stick injuries are also a major consent for medical personnel when rendering care to HBV infected people. The likely consequence linked to these injuries involve possibility of transmitting of blood borne disease causing like human immunodeficiency virus (HIV), hepatitis B virus, (HBV) and hepatitis C virus (HCV)(Bhardwaj et al., 2014). From one World Health Organisation research, the yearly worldwide calculable rate of medical personnel at risk of contracting these diseases were 0.5% for HIV, 2.6% for HBV and 5.95% for HCV(Bhardwaj et al., 2014).

2.6.4 Perinatal

Spanish investigators analyzed military personnel having Hepatitis B Virus infection and demonstrated that half of Hepatitis B Virus infections are transmitted during childbirth (Petrauskas et al., 2017). In total, as ample as 40% of males and 15% of females with perinatally acquired HBV infection will suffer death from cirrhosis of the liver or HCC(Trépo et al., 2014). Stopping perinatal transmission of Hepatitis B Virus is critical, since the likelihood of advancing from subtle to persistent Hepatitis B Viral infection is 90% if infection happens children. Notwithstanding the employment of inactive–active immunoprophylaxis with Hepatitis B Virus immunoglobulin and Hepatitis B Virus vaccine, enfants delivered to mothers having raised Hepatitis B Viral DNA titres ($>10^7$ copies per mL) still possess a considerable possibility of infection.

Noubiap et al., (2015) found a relatively small proportion of females positive to both Hepatitis B surface Antigen and Hepatitis B “e” Ag which indicates that perinatal transmission of Hepatitis B Virus may not be the existing route of Hepatitis B Virus transmission in that location.

2.6.5 Vaccination against HBV

Hepatitis B viral infection is among the highly rated endemic blood borne diseases that can easily be transmitted through cross infection among HCW'S in our various health facilities (Ziraba et al., 2010). Vaccination could help individuals build an immunity against the disease. Thus, an individual body produces the antibodies that fight against the hepatitis B virus hence reducing the spread of the disease among the nursing students but when students are not vaccinated the more they are predisposed to the infection. A paltry 36% disclosed that they had received vaccination against Hepatitis B Virus(Cotler et al., 2012).

2.7 Behavioural Factors

2.7.1 Unprotected Sex, Numerous Sexual Companions and Men Having Sex with Other Men (MSM)

Several literatures suggest that, sexual intercourse must be considered as an important potential mode of transmission among several other pathways that do not involve "needle sticks." Promiscuous sexual intercourse has been a way of Army life, especially for young soldiers, for a very long time (Sabin, 1976). Based on the history and clinical examination, obviously no hazardous factor arose in their research. Which is contrary to other records discovering unprotected sexual intercourse, tattooing and intravenous injection as risky factors in Gezira state, Central Sudan, and Nyala, Western Sudan, nonetheless, a bigger fraction of sero-positive participants volunteered previous medical history of icterus. More so, HBV is readily transmitted via sexual intercourse. Actually, sexual exposure is the topmost route of HBV transmission throughout the U.S.A. HBV has 50-100 times highly contagious compared to Human Immunodeficiency Virus (People, n.d.). A Statistically link of Hepatitis B Virus infection to hazardous factors was observed among subjects, who were engaging unprotected sexual activities with numerous companions [AoR= 6.4, 95% CI, 2 to

21, $P= 0.03$]. For persons with Hepatitis B Virus infected people within the household family [AoR=8, 95% CI, 1 to 58, $P=0.02$] while for people who had surgical operations [AoR=6.8, 95% CI, 1 to 32), $P= 0.022$]. The typical figure of various sexual companions within the previous year stood at 1.59 (SE, 0.07); typical figure for their entire life span stood at 5.86 (SE, 0.63). there was no link noticed between number of varying sexual companions and Hepatitis B Virus infection(Petrauskas et al., 2017).

2.7.2 Intravenous Drug Users (IDUs)

Seal et al., (2000) decided to concentrate on intravenous drug abusers less than 30 years since within the U.S.A. the greatest occurrence of novel HBV infection occurred amongst intravenous drug abusers between the ages of 15 to 29 years. The findings indicate that younger intravenous drug abusers have greater possibility of engaging in highly risky conducts compared to more grown abusers. Albeit most of youthful intravenous drug abusers noted making latest contact with medical workers, they still highly underrated their possibility of contracting HBV, a little number were tested, and further little number were completely their vaccination.

Intravenous drug abusers less than 30 years had a 2 times likelihood of those above 30 years of age to indicate sharing needles in the previous 30 days (36/135 [27%] vs 12/96 [13%]). Intravenous drug abusers aged below 30 years had a 2 times likelihood of reporting possession of greater than 2 sexual companions in the previous six months (80/135 [59%] vs 29/96 [30%]). Albeit 88 out of 135 (68%) younger intravenous drug abusers declared engaging with healthcare workers in the previous six months, a paltry 13 out of 135 (10%) had taken the full hepatitis B vaccine dosage regimen while a few 16 out of (13%) thought they had a great possibility of being infected by this virus(Seal et al., 2000).

The regularity of alcohol intake (17% of controls) and drug abuse (13% of controls) was greater than anticipated. Alcohol usage (OR 2.7, 95% CI 1.5–4.8) and Intravenous Drug Usage (OR 4.2, 95% CI 1.4–13.9) were linked to subtle hepatitis B (Jimenez et al., 2009).

In a study conducted in Lithuanian military subunits in 2003 to evaluate the prevalence of hepatitis B serological markers (hepatitis B virus (HBV) superficial antigen (HBsAg)) and risk factors for HBV infection among Lithuanian Army soldiers. In overall, 12.3% of the personnel observed that drugs were ever given to them previously. Amongst those who had been given drugs previously, the incidence of Hepatitis B surfaces Antigen was 4.3%, however, within the remaining groups, it was 1.9% about 53% of participants gave data concerning their sexuality. No link was noticed linking other risk factors for HBV infection (surgical interventions, blood transfusions, hospitalizations, jaundice) and prevalence rate of hepatitis B markers (Petrauskas et al., 2017).

2.7.3 Tattoos/Body Piercing and Scarification marks

Results of a systematic review suggested a raised hazard for both HBV and HCV among people who have body piercing. Overall, risk effect of body piercing on both HBV and HCV is significant with OR equals to 1.79 and 1.83, respectively (based on the smaller one of pooled crude or adjusted), this risk effect was consistent through almost all of the stratified subgroups, for hepatitis B, strongest risk of body piercing was found in students/community-based sample population, while for hepatitis C, the effect of risk among former soccer/veterans reached as large as 4.63 (Yang et al., 2015).

2.7.4 Sharing of Blades, Needles and Domestic Effects

According to Jimenez et al., (2009) it is worthy to note an outcome that shaving at barbershops raise the hazard of Hepatitis B Virus transmission (OR 2.4, 95% CI 1.3–4.4) as it is a very frequent behaviour amongst Egyptian men (64.4% of controls). The risk of

transmitting the virus could occur via the use and reuse of needles, sharps and syringes whether in medical facilities or amongst people injecting drugs. More so, infection may happen in the process of having surgical, dental, and medical operations, via having tattoos, or via the usage of razors and other like instrument or equipment which may be contaminated with infected blood(“WHO | Hepatitis B,” 2017).



CHAPTER THREE

METHODS

3.1 Study Design

A case-control study was conducted using HBV positive military personnel from a screening by the Forces Liver Health Protection (FLiHP) Project as cases and controls selected from those found negative. Socio-demographic, behavioral and medical data was collected from all personnel screened using questionnaire, and available data was reviewed, and checklist used to extract data to determine the proportion of soldiers screened and assess the distribution of HBV infection in the arms of service. Analysis was done to determine risk factors associated with Hepatitis B Virus Infection amongst soldiers in the Southern Command of The Ghana Armed Forces (GAF).

3.2 Study Area

There are three Garrisons in the southern part of Ghana made up of the Navy, Army and Air Force personnel with a population of about 3,500 personnel. They live in barracks with their families in the Greater Accra, Western, Eastern and Volta regions of the country. Their major functions are to protect the territorial space of Ghana by land, sea and air including peace keeping in countries such as Lebanon, Liberia, Democratic Republic of Congo, Mali, Chad, South Southern and The Gambia. They cooperate with The Ghana Police for Internal Security operations all over the country. Every military Unit has a Medical Reception Station (MRS) with a Medical Officer in-charge while more serious cases requiring Specialist care are referred to the 37 Military Hospital in Accra. The main diseases that affect the personnel are Malaria, Respiratory tract infections, musculoskeletal pains and non-communicable diseases like Hypertension and Diabetes Mellitus. In recent times,

Hepatitis B infections are increasingly being recorded and assuming worrying trends since all personnel are seronegative before enlistment or recruitment into the service.



Figure 3.1: A map of the Southern part of Ghana with Military Units.



3.3 Study Variables

The variables in this study are as shown below. (Sixty-ninth World Health Assembly, 2016)

Table 3.1: Study Variables

Variables	Characteristics	Scale of measurements
INDEPENDENT VARIABLES		
Age	Numerical	Interval
Sex	Categorical	Ordinal
Marrital Status	Categorical	Nominal
Ethnicity	Categorical	Nominal
Religion	Categorical	Nominal
Educational Level	Categorical	Ordinal
Occupation	Categorical	Nominal
Blood Transfusion	Categorical	Nominal
Needles or Sharp Instruments injury	Categorical	Nominal
Perinatal	Categorical	Nominal
No HB Vaccination	Categorical	Ordinal
Organ Donation	Categorical	Ordinal
Dental Procedures or Surgeries in unorthodox health facilities	Categorical	Ordinal
Unprotected Sex	Categorical	Nominal
Men Having Sex with Other Men (MSM)	Categorical	Nominal
Numerous Sexual companions	Numerical	Discrete
Intravenous Drug Users (IDUs)	Categorical	Nominal
Tattoos/Body Piercing	Categorical	Nominal
Sharing of Domestic Effects	Categorical	Nominal
Scarification marks	Categorical	Nominal
Sharing of Blades and Needles	Categorical	Nominal
DEPENDENT VARIABLE		
Hepatitis B Infection Status	Categorical	Ordinal

3.4 Study Population

A total of 3,343 personnel representing about 80% of the total personnel available for the screening were screened for HBV infection by the FLiHP Project from 28 July 2016 to 30 September 2017. Out of which 243 representing 7.3% were sero-positive for HBsAg. The cases will be randomly selected from personnel who tested positive while the controls will be selected from the same unit as each of the cases in a ratio of 1:1. The ages of the personnel is from 18 years to 72 years which are the minimum age for recruitment into the military and the highest age of compulsory retirement depending on the rank respectively.

3.5 Criteria for Selection

3.5.1 Inclusion Criteria for Cases

1. A male or female soldier having HBV infection.
2. Soldiers within any Military Unit in the Southern part of Ghana.
3. Diagnosed at least 1 year ago during the screening by the FLiHP Project of the GAF.

3.5.2 Exclusion Criteria for Cases

1. Soldiers with Hepatitis C or Co-infection of HBV and HCV.
2. Soldiers who were not screened by the FLiHP Project of the GAF.
3. Soldiers in any Military Unit outside the Southern part of Ghana.
4. Soldiers who are severely ill and cannot go through the interview.

3.5.3 Controls

Any soldier who was screened by the FLiHP Project and tested negative for HBV or HCV or Co-infection of Hepatitis B Virus and Hepatitis C Virus and has not been vaccinated against HBV.

3.6 Sample Size and Sampling Technique

3.6.1 Sample size calculation

The Sample size formular
$$n = \frac{r+1}{r} \frac{(p^*)(1-p^*)(z_{\beta}+z_{\alpha/2})^2}{(p_1-p_2)^2}$$

where n= sample size

r = Ratio of controls to cases

P* = Average proportion of exposed = proportion of + proportion of controls/2

Z_β = standard normal variation of power

Z_{α/2} = Standard normal variate for level of significance (LOS)

P₁ -P₂ = Effect size or different in proportion expected based on previous studies (P₁ = Prevalence of disease within cases and P₂ = Prevalence of disease within controls)

From the above formula, the calculated sample size of 306 (153 cases and 153controls) having 80% power at a 0.05 significance level (two tailed), and an exposure prevalence of 35% and 20% in cases and controls respectively. The sample size was raised approximately by 10% to enable evaluation of less prevalent forms of exposure and adjustment for confounding variables during multivariate analyses.

3.6.2 Sampling Method

All soldiers in Military units in the Southern part of Ghana who meet the inclusion criteria were eligible to partake in the study. Stratified random sampling technique was employed to select the 153 cases out of the 243 personnel who were seropositive from the screening

done by the FLiHP Project. In the same vain, the controls were also randomly selected from the pool of negative cases.

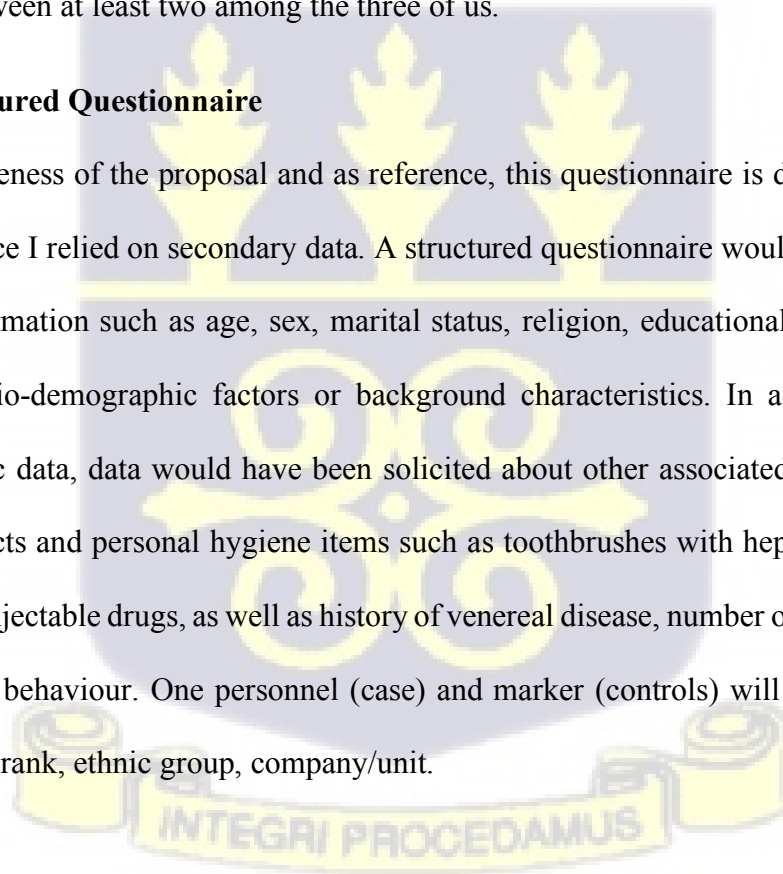
3.7 Data Collection Techniques and Tools

3.7.1 Data Extraction

Review of available data using checklist to extract data of the soldiers who tested sero-positive for HBV infection and their units. The HBsAg test results and the various responses to the associated risk factors were extracted from screening records unto a data capture sheet which was entered electronically for analysis. The assistance of the professional data managers of the Public Health Division was solicited in capturing the data. Two different research assistants performed the data extraction. I then examined the data, and a consensus reached between at least two among the three of us.

3.7.2 Structured Questionnaire

For completeness of the proposal and as reference, this questionnaire is described but was not used since I relied on secondary data. A structured questionnaire would have been used to take information such as age, sex, marital status, religion, educational status and other data on socio-demographic factors or background characteristics. In addition to socio-demographic data, data would have been solicited about other associated risk factors like social contacts and personal hygiene items such as toothbrushes with hepatitis cases, drug use, use of injectable drugs, as well as history of venereal disease, number of sexual contacts, homosexual behaviour. One personnel (case) and marker (controls) will also be selected, matched for rank, ethnic group, company/unit.



3.8 Data Analysis

A secondary data was obtained among military personnel from the FLiHP Project of the Ghana Armed Forces (GAF) across military unit in the Southern part of Ghana. A random sample of 306 was selected for this study with half tested positive of Hepatitis B (HB); whereas, those tested negative only served as control cases. STATA version 15 was used for the analysis of the secondary data obtained. An in-depth descriptive analysis of data conducted using frequencies, percentages and other graphical summaries (bar charts) of variables under consideration to obtain the proportion of HBV positive with respect to the various demographic characteristics. Additionally, bivariate analysis was carried out to assess significant demographic, medical and behavioral factors (risk factors) that could influence the occurrence of HBV infection among soldiers of the Southern Command of the Ghana Armed forces (GAF) using Chi-square test of association. Moreover, a logistic regression model was fitted to further measure the strength of the significant variables from the bivariate analysis by estimating the crude and adjusted odds ratios from both a simple and multiple logistic model respectively. This helped me to determine the most significant risk factors from the bivariate analysis. All analysis in this study was set at 5% significance level with 95% confidence interval.

3.9 Ethical Considerations

This proposal was submitted to the 37 Military Hospital Institutional Review Board (37 MH-IRB) for clearance before the conducting this study. I also obtained permission from the Military High Command, The GAF Medical Directorate and the Command of the 37 Military Hospital. Consent was sought from the FLiHP Coordinator for access to the data.

3.9.1 Risks and benefits

No risk to participants. Benefits include finding the factors associated with HBV infection among soldiers which may help change policies of the GAF and assist FLiHP to achieve its aim in protecting the livers of soldiers.

3.9.2 Anonymity and confidentiality

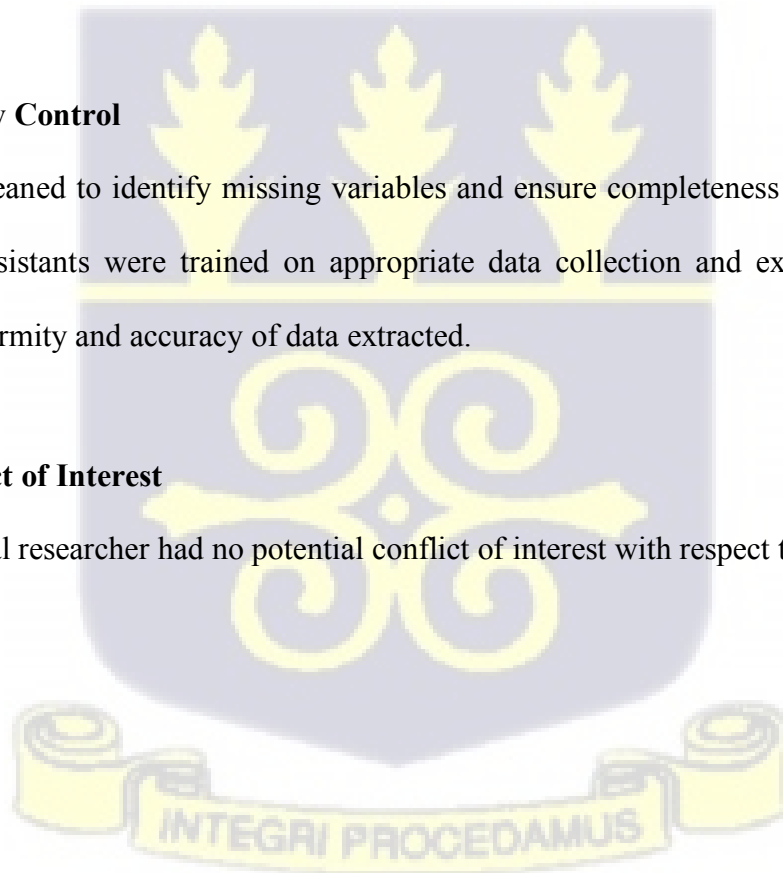
Assurance was given to the FLiHP Project Coordinator since I did not interact with the participants. All identifiers in the data were removed to ensure anonymity of the personnel. All information accessed was used purely for research and treated with utmost confidentiality. Names were not used in the report, but ideas and suggestions will help us to design programmes or policies that will improve the liver health of all soldiers in the Ghana Armed Forces.

3.10 Quality Control

Data was cleaned to identify missing variables and ensure completeness and consistency. Research assistants were trained on appropriate data collection and extraction skills to ensure uniformity and accuracy of data extracted.

3.11 Conflict of Interest

The principal researcher had no potential conflict of interest with respect to the study.



CHAPTER FOUR

RESULTS

4.1 Socio-demographic characteristics of selected Military Personnel

Table 4.1 presents the socio-demographic characteristics of the 306 soldiers sampled. Among the controls, 16(10.5 %) officers with 137 (89.5%) being other ranks while among the cases, there were 9 (5.9%) officers and 144(94.1%) other ranks. The controls had 63(41%) aged between 28-37 years while the cases had 101(66%) within the same age range. 128(83.7%) were males among the controls with 127(83.0%) also being males. Both the controls and cases had 144(94.1%) being Christians and 9(5.9%) practicing Islam. For the educational levels, 80(52.3%) of the controls attained Senior High Secondary education in contrast to 101(66.0%) of the cases attaining the same level of education.



Table 4.1: Socio-demographic characteristics of selected Military Personnel in the Southern part of the Ghana Armed Forces 2017 (n=306)

Characteristics	Controls n (%)	Cases n (%)
Ranking		
Other ranks	137(89.5)	144(94.1)
Officers	16(10.5)	9(5.9)
Age		
18-27years	38(24.8)	24(15.7)
28-37years	63(41.2)	101(66.0)
38-47years	40(26.2)	23(15.0)
48-57years	8(5.2)	3(2.0)
≥58years	4(2.6)	2(1.3)
Sex		
Male	128(83.7)	127(83.0)
Female	25(16.3)	26(17.0)
Education		
Basic/JHS	8(5.2)	3(2.0)
SHS	80(52.3)	101(66.0)
Technical/Vocational/Training	16(10.5)	15(9.8)
Tertiary	44(28.8)	32(20.9)
Others	5(3.2)	2(1.3)
Religion		
Christianity	144(94.1)	144(94.1)
Islam	9(5.9)	9(5.9)
Marital status		
Single	52(34.0)	55(35.9)
Married	96(62.7)	93(60.8)
Co-habitation		2(1.3)
Divorced	4(2.6)	3(2.0)
Widowed	1(0.7)	
Ethnicity		
Akan	82(53.6)	77(50.3)
Ewe	39(25.5)	24(15.7)
Ga-Adangme	13(8.5)	13(8.5)
Northerners (Dagaati/Gonja/Mamprusi/Dagomba)	19(12.4)	39(25.5)

Source: FLiHP Project of the GAF (Military Unit in the Southern part of Ghana)

4.2 Proportion of military personnel screened and tested positive for HBV infection

The overall proportion of military personnel screened and tested positive for Hepatitis-B Viral infection during the FLiHP Project of GAF was estimated as presented by Figure 1. Out of about 18,494 soldiers screened, approximately 809 (4.0%) confirmed positive cases were recorded in the entire project within the study period.

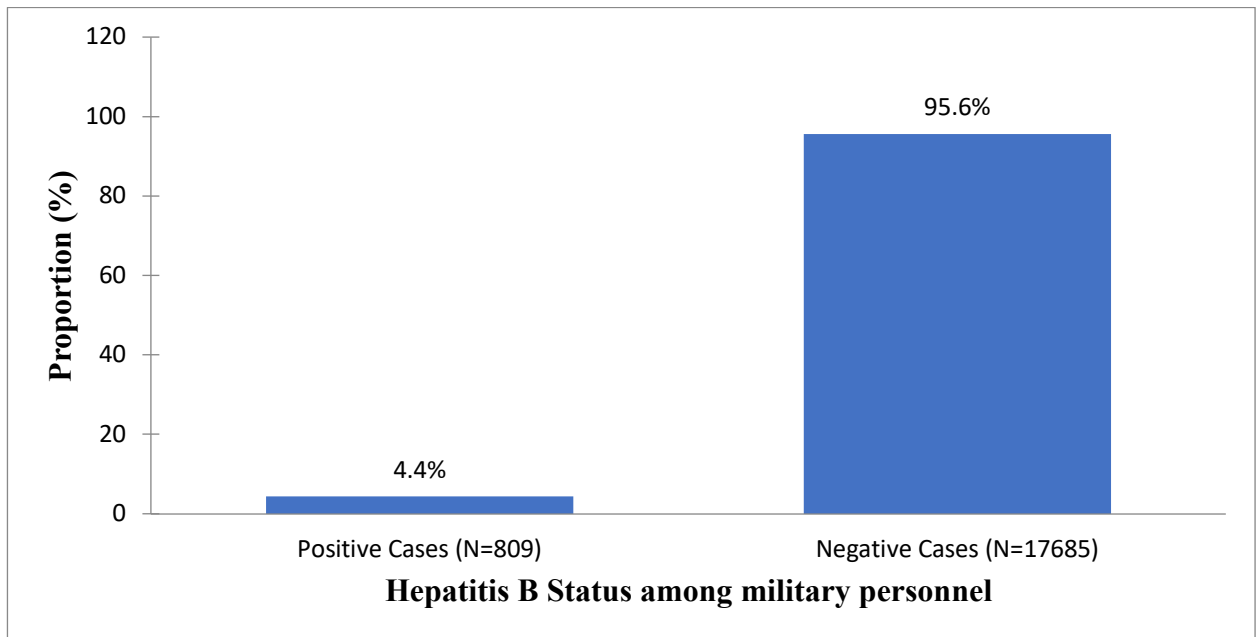


Figure 4.1: Proportion of Military Personnel screened and tested positive for HBV infection in the Southern part of the Ghana Armed Forces 2017 (n=306)
Source: FLiHP Project of the GAF (Military Unit in the Southern part of Ghana)

4.3 Behavioral Risk Factors of selected Military Personnel

144(94.1%) and 9(5.9%) of the controls were sexually active and not sexually active respectively while 146(95.4%) of the cases were sexually active with 7(4.6%) not sexually active. Among those sexually active controls, 144(99.3%) were heterosexual and 1(0.7%) bisexual as opposed to 142(97.9%) bisexual cases and 3(2.1%) heterosexual cases. However, there were 150(98.0%) of the controls without a history of Intravenous drug usage (IDU) and 3(2.0%) having a history of IDU. 40.8% (Table 4.2)

Table 4.2: Behavioural Risk Factors of selected Military Personnel in the Southern part of the Ghana Armed Forces 2017 (n=306)

Characteristic	Controls n (%)	Cases n (%)
Sexual activity		
Not sexually active	9(5.9)	7(4.6)
Sexually active	144(94.1)	146(95.4)
Sexual orientation		
Bisexual	1(0.7)	142(97.9)
Heterosexual	144(99.3)	3(2.1)
Sexual intercourse with someone other than your regular partner		
No sex other than with regular partner	92(60.1)	89(58.2)
Had sex other than with regular partner	61(39.9)	64(41.8)
Had sex other than with regular partner		
Casual partner	61(98.4)	56(88.9)
Prostitute	1(1.6)	7(11.1)
Uses condoms during sex other than with regular partner		
No condom use	28(46.7)	36(56.3)
Used condoms	32(53.3)	28(43.7)
History of intravenous drug usage (IDU)		
No history of IDU	150(98.0)	152(99.3)
Has history of IDU	3(2.0)	1(0.7)
History of tattoo or body piercing		
No tattoo or body piercing	150(98.0)	147(96.1)
Has tattoo or body piercing	3(2.0)	6(3.9)
Scarification marks		
No scarifications	139(90.9)	120(78.4)
Has scarifications	14(9.1)	33(21.6)

Source: FLiHP Project of the GAF (Military Unit in the Southern part of Ghana)

4.4 Medical Risk Factors of Military Personnel

There were 148(96.7%) of both the selected controls and cases never received haemotransfusion and 5(3.3%) similarly ever received haemotransfusion. However, 151(99.3%) of the controls did not have HBV vaccination and 1(0.7%) received Hepatitis

B immunization just like 132(86.3%) and 21(13.7%) of the cases who were never vaccinated against HBV and those vaccinated respectively. (Table 4.3)

Table 4.3: Medical Risk Factors of Military Personnel in the Southern part of the Ghana Armed Forces 2017 (n=306)

Characteristics	Controls n (%)	Cases n (%)
History of having blood transfusion		
Never had blood transfusion	148(96.7)	148(96.7)
Ever had blood transfusion	5(3.3)	5(3.3)
History of Dental Procedures and surgeries at Non-orthodox Medical Facility		
No operations in Non-orthodox facility	151(98.7)	150(98.0)
Ever had operations in Non-orthodox facility	2(1.3)	3(2.0)
Ever had Hepatitis B Immunization		
No HBV immunization	151(99.3)	132(86.3)
Had HBV immunization	1(0.7)	21(13.7)
Hepatitis B status before screening		
Negative	23(15.0)	21(13.8)
Positive	0(0.0)	9(5.9)
Intermediate	130(85.0)	0(0.0)
Unknown	0(0.0)	122(80.3)

Source: FLiHP Project of the GAF (Military Unit in the Southern part of Ghana)

4.5 Risk factors of Hepatitis B infection among soldiers of the Southern Command of the Ghana Armed forces

The socio-demographic, behavioral and medical risk factors of Hepatitis B infection among the soldiers were determined from bivariate analyses using chi-square tests. It was revealed that age ($p<0.01$) and ethnicity ($p<0.05$) were the significant socio-demographic factors that were associated with Hepatitis B infection (Table 4.4). Among the behavioral risk factors, sexual orientation ($p<0.001$), sexual intercourse with irregular partner ($p<0.05$) and possession of scarification marks ($p<0.01$) had significant effect on Hepatitis B infection among the selected soldiers (Table 4.5). Additionally, history of HBV immunization

($p < 0.001$) and Hepatitis B status before screening were the significant medical risk factors that were associated with HBV infection (Table 4.6).

Table 4. 4: Socio-Demographic risk factors of HBV Infection in the Southern part of the Ghana Armed Forces 2017 (n=306)

	Hepatitis B status		χ^2
	Negative	Positive	P-value
Ranking			
Other ranks	137(48.8)	144(51.2)	0.144
Officers	16(64.0)	9(36.0)	
Age			
18-27years	38(61.3)	24(38.7)	0.002**
28-37years	63(38.4)	101(61.6)	
38-47years	40(63.5)	23(36.5)	
48-57years	8(72.7)	3(27.3)	
≥ 58 years	4(66.7)	2(33.3)	
Sex			
Male	128(50.2)	127(49.8)	0.878
Female	25(49.0)	26(51.0)	
Education			
Basic/JHS	8(72.7)	3(27.3)	0.094
SHS	80(44.2)	101(55.8)	
Technical/Vocational/Training	16(51.6)	15(48.4)	
Tertiary	44(57.9)	32(42.1)	
Others	5(71.4)	2(28.6)	
Religion			
Christianity	144(50.0)	144(50.0)	1.000
Islam	9(50.0)	9(50.0)	
Marital status			
Single	57(48.7)	60(51.3)	0.724
Married	96(50.8)	93(49.2)	
Ethnicity			
Akan	82(51.6)	77(48.4)	0.014*
Ewe	39(61.9)	24(38.1)	
Ga-Adangme	13(50.0)	13(50.0)	
Northerners (Dagaati/Gonja/Mamprusi/Dag omba)	19(32.8)	39(67.2)	

*** $p < 0.001$, ** $p < 0.01$, * 0.05

Table 4.5: Behavioral risk factors associated with HBV infection in the Southern part of the Ghana Armed Forces 2017 (n=306)

Variable	Hepatitis B status		χ^2
	Negative	Positive	P-value
Sexually active			
Not sexually active	9(56.3)	7(43.7)	0.608
sexually active	144(49.7)	146(50.3)	
Sexual orientation			
Bisexual	1(0.7)	142(99.3)	0.000***
Heterosexual	144(98.0)	3(2.0)	
Sexual intercourse with someone other than your regular partner			
No sex other than with regular partner	92(50.8)	89(49.2)	0.727
Had sex other than with regular partner	61(48.8)	64(51.2)	
Irregular Sexual partner			
Casual partner	61(52.1)	56(47.9)	0.030*
Prostitute	1(12.5)	7(87.5)	
Uses condoms during sex other than with regular partner			
No condom use	28(43.8)	36(56.2)	0.286
Used condom	32(53.3)	28(46.7)	
History of tattoo or body piercing			
No tattoo or body piercing	150(50.5)	147(49.5)	0.310
Has tattoo or body piercing	3(33.3)	6(66.7)	
Scarification marks			
No scarifications	139(53.7)	120(46.5)	0.003**
Has scarifications	14(29.8)	33(70.2)	
History of intravenous drug usage (IDU)			
No history of IDU	150(50.0)	152(50.3)	0.314
Has history of IDU	3(75.0)	1(25.0)	

***p<0.001, **p<0.01, *0.05



Table 4.6: Medical risk factors associated with HBV Infection in the Southern part of the Ghana Armed Forces 2017 (n=306)

Variable	Hepatitis B status		χ^2
	Negative	Positive	P-value
History of blood transfusion			
Never had blood transfusion	148(50.0)	148(50.0)	1.000
Ever had blood transfusion	5(50.0)	5(50.0)	
History of Dental Procedures and surgeries at Non-orthodox Medical Facility			
No operations in Non-orthodox facility	151(50.2)	150(49.8)	0.652
Ever had operations in Non-orthodox facility	2(40.0)	3(60.0)	
Ever had Hepatitis B Immunization			
No HBV immunization	152(53.5)	132(46.5)	0.000***
Had HBV immunization	1(4.5)	21(95.5)	
Hepatitis B status before screening			
Negative	23(52.3)	21(47.7)	0.000***
Positive	0(0.0)	9(100.0)	
Indeterminate	130(100.0)	0(0.0)	
Unknown status	0(0.0)	122(100.0)	

***p<0.001, **p<0.01, *0.05

4.5.1 Logistic regression of significant risk factors of Hepatitis B infection

Table 4.7. Both the crude and adjusted odds ratios were estimated for each significant factor. These ratios were computed by also employing the forward-inclusion and backwards-elimination procedure since not all the factors (Hepatitis B status before screening) had converging odds ratios due to possibility of sparseness and multicollinearity in the regression model. It was revealed that the most significant risk factors that influenced Hepatitis B positive cases among the selected military personnel were sexual intercourse with prostitutes (AOR=12.76, 95% C.I=1.11-14.31), those with history of HB immunization (AOR=11.82, 95% C.I=1.11-14.31), soldiers from the northern ethnic groups (AOR=3.72, 95% C.I=1.22-11.29), possession of scarification marks (AOR=1.95, 95% C.I=0.63-6.07) and ages of soldiers between 28 and 37 years (AOR=1.48, 95% C.I=0.51-4.57).

Table 4.7: Logistic regression of significant risk factors associated with HBV Infection in the Southern part of the Ghana Armed Forces 2017 (n=306)

Variable	Crude OR (95% C.I)	P-value	Adjusted OR (95% C.I)	P-value
Age				
18-27years	1			
28-37years	2.54(1.39-4.63)	0.002**	1.48(0.49-4.47)	0.016*
38-47years	0.91(0.44-1.88)	0.799	0.53(0.15-1.86)	0.320
48-57years	0.59(0.14-2.46)	0.472	0.70(0.08-6.25)	0.753
Ethnicity				
Akan	1			
Ewe	0.66(0.36-1.19)	0.165	0.52(0.17-1.63)	0.264
Ga-Adangme	1.06(0.46-2.440)	0.882	2.48(0.46-3.29)	0.290
Northerners	2.19(1.16-4.11)	0.015**	3.72(1.22-11.29)	0.021*
Sexual partner				
Casual partner	1			
Prostitute	7.63(0.91-8.94)	0.061	12.76(1.11-14.31)	0.041*
Scarification marks				
No scarifications	1			
Has scarifications	2.73(1.40-5.34)	0.003**	1.95(0.63-6.07)	0.007**
HB Immunization				
No HBV immunization	1			
Has HBV immunization	24.18(3.21-28.21)	0.002**	11.82(1.32-12.21)	0.027*

***p<0.001, **p<0.01, *0.05; Reference category of dependent variable: No HBV infection; OR=Odds ratio; CI=Confidence Interval

Interpretation of significant odds ratios among the risk factors

Age (ref: 18-27years)

It was revealed by the logistic regression analysis that soldiers aged between 28 and 37 years (AOR=1.48, 95% C.I=0.51-4.57) were approximately 48% more likely to have Hepatitis B infection that those aged between 18 and 27 years.

Ethnicity (ref: Akan)

Soldiers from the northern ethnic groups (AOR=3.72, 95% C.I=1.22-11.29) were approximately 4 times more likely to have HBV infection as compared to those belonging to the Akan ethnic groups.

Sexual partner (ref: Casual partner)

Military personnel who had irregular sexual intercourse with prostitutes (AOR=12.76, 95% C.I=1.11-14.31) were approximately 13 times more susceptible to HBV infection as opposed to those who had sex with casual partners.

Scarification marks (ref: No)

Soldiers with scarification marks (AOR=1.95, 95% C.I=0.63-6.07) were found to be almost 2 times more likely to be infected with HBV than those without the marks.

HB Immunization (ref: No)

Soldiers who claimed to have HB immunization (AOR=11.82, 95% C.I=1.11-14.31) were approximately 12 times more susceptible to Hepatitis B infection as compared those without HB immunization.



CHAPTER FIVE

DISCUSSION

5.1 Proportion of Military personnel with Hepatitis B Viral Infection

Hepatitis B virus infection at the chronic stage can be extremely infectious and considered as the main risk factor associated with deaths from cirrhosis as well as liver cancer (Ott, Stevens, Groeger, & Wiersma, 2012). The project dubbed “Forces Liver Health Protection Project (FLiHP) was conducted among military personnel of the Ghana Armed forces (GAF) so as to reduce current rate of deaths attributable to Hepatitis B and C and devise possible remedies to minimize its prevalence by reducing its burden of viral hepatitis by 50% by the year 2020 (“Project to prevent hepatitis among GAF personnel launched - Graphic Online,” n.d.). Additionally, the motivation for the FLiHP project was established based on the topmost priority of the Ministry of Health (2015) as part of its National Hepatitis Policy, to make available possible comebacks to the burden of hepatitis in the country. The study revealed that only 809 out of 18494 (4.0%) were confirmed positive for Hepatitis B infections among military units in the southern part of Ghana. Thus, this finding suggests that the need to develop military HBV prevalence data. This is because, Schweitzer, Horn, Mikolajczyk, Krause, and Ott (2015) in their study to quantify the burden of HBV infection, discovered that the prevalence of the disease among any general population necessitates good knowledge of the disease which is mostly not the case. Consequently, such health data are not routinely available. According to the Ghana News Agency (2016), about four million out of Ghana’s 28 million citizens have HBV infection which intend is greater than national prevalence of 8.83 per cent estimated from the year 1965 to 2013 by WHO. However, the HBV prevalence of 4.0% among the military personnel from the FLiHP project further suggests that the prevalence of this infection is relatively lower than the national rate. Nonetheless, the HBV prevalence among the soldiers

in the southern part of Ghana was relatively higher as compared to findings from other researchers where hepatitis prevalence was at its nadir among military troops (Hyams et al., 2001). The prevalence of HBV infection from other studies brought to light that there is wide variation regarding its prevalence among countries and thus, advocates for the need to develop control strategies and regular gathering of reliable epidemiological data (Schweitzer et al., 2015).

5.2 Socio-demographic risk factors of HBV Infection

A random sample of 306 cases was selected from the FLiHP project for this study. This sample comprised of equal number of positive and negative cases. Among the various socio-demographic factors considered (sex, educational level, ranks, religion and marital status); only age ($p < 0.01$) and ethnicity ($p < 0.05$) of military personnel had significant association with the status of Hepatitis B infection. This finding is in consonance with other studies where age at infection with Hepatitis B was found to be a significant risk factor (Pearce, Milne, & Moyes, 1988). According to them, age of an individual determines whether the infection would be self-limited or leads to chronic carrier state as well as become severe acute infection. Even though acute HBV infection is more prevalent in adults, infections among younger individuals could result in much greater risks of chronic carriage; which can consequently increase the chances of primary hepatocellular carcinoma as well as cirrhosis in some future time. In addition, Bertolotti and Hong (2014) asserted that the level of immunity to the infection may change across the life time of an individual. According to Kolou et al. (2017), HBV infection however, can affect all women and men irrespective of age. Nonetheless, it was revealed from this study that soldiers aged between 28 and 37 years (AOR=1.48, 95% CI=0.51-4.57) were approximately 48% more likely to have Hepatitis B infection than those aged between 18 and 27 years. The above finding is quite similar to that

from a study by Michaelcaleywarwickshirensuk, Fowler, Greatrex, & Wood, (2012). They found out that majority, 347/595 (58%), of cases of Hepatitis B infection were in the 25–34 years-old age groups. A major reason could be the performance of the T-cells that provides strong immunity in the human body against infectious diseases including HBV. This is because, Haynes and Maue (2009) in their study discovered that age-related reduction in immune function due to these underlying T-cells render older individuals more susceptible to infectious diseases as compared to younger individuals. Also, the efficacy of most vaccinations to infections is significantly minimized in the elderly as opposed to the younger ones and thereby, limiting the preventative prophylaxis. Thus, aging could affect the impact of T-cell functioning and consequently diminishes the immune response to infectious diseases like Hepatitis B.

Moreover, ethnicity had significant impact on the status of HBV infection; such that soldiers from the northern ethnic groups (AOR=3.72, 95% C.I=1.22-11.29) were approximately 4 times more likely to have HBV infection as compared to those belonging to the Akan ethnic groups. Lack of public awareness and superstitious beliefs among most of these northern ethnic groups could be a major rationale behind their high prevalence (Odhiambo, 2007). This is because, despite the public health concern on Hepatitis B globally, Odhiambo (2007) discovered that some people in rural areas in the northern part of Ghana believe it is a form of witchcraft or victims are just poisoned by their enemies. In view of that, less attention is given to HBV infection relatively as compared the Akans in terms of its symptoms and the need to receive proper medications. Such misconceptions about this infectious disease might have been the predominate reasons that have helped increase its spread in the sub-Saharan African countries. The bivariate analysis also supported this finding since proportion of HB infected soldiers from the northern ethnic groups (67.2%) was more than those from the

Akan ethnic group (48.4%). However, the odds ratios corresponding to the Ewes and the Gas were insignificant.

5.3 Behavioral risk factors associated with HBV infection

Moreover, behavioral risk factors that could be associated with Hepatitis B infection were examined by considering the selected military personnel. It was revealed that sexual orientation of soldiers ($p < 0.001$), type of irregular sexual partners ($p < 0.05$) and possession of scarification marks ($p < 0.01$) significantly influenced the status of HBV infection. The Centers for Disease Control and Prevention (2016) revealed that gays, bisexuals and other men who usually engage in sexual intercourse with men have a greater risk of getting viral hepatitis including Hepatitis B. This is like their findings in the United States where about 20% of all new Hepatitis B infections were among gays and bisexual men. Their findings on the high prevalence among bisexuals agreed with this study; since it was brought to light that approximately 99.3% of bisexual military personnel were infected with HBV as opposed to only 3.0% of heterosexuals infected at the end of the FLiHP project. Consequently, the Advisory Committee on Immunization Practices (ACIP) and CDC recommended routine Hepatitis B vaccination as well as HB Surface Antigen (HbsAg) testing for men who have sex with men.

Also, this study revealed that military personnel who had irregular sexual intercourse with prostitutes (AOR=12.76, 95% C.I=1.11-14.31) were approximately 13 times more susceptible to HBV infection as opposed to those who had sex with casual partners. Prostitutes mostly engage in unprotected sex and in view of that, they are highly susceptible to getting infectious diseases of any kind including HBV infection as opposed to other casual sex partners. Forbi et al. (2008) in their study conducted in Nigeria found that high prevalence of Hepatitis B infection can be attributed to the fact that most sex workers are

not subjected to preventive control of HBV infection. They discovered also that among 720 sex workers, 17.1% were confirmed positive for HBV infection. Mak et al. (2003) in their study carried in Belgium also found that HBV was naturally among approximately 11.9% of 1096 sex workers. The bivariate analysis also revealed among the military personnel who had sex prostitutes about 87.5% were tested positive of HBV as opposed to those had sex with casual partners (47.9%). These findings support why the soldiers who mostly had sex with prostitutes were more prone to getting infected of Hepatitis B.

Military personnel with scarification marks (AOR=1.95, 95% C.I=0.63-6.07) on the other hand were found to be approximately 2 times more susceptible to HBV infection than those without the marks. This could be due to the use of unsterilized accoutrements involved in the scarification process. The bivariate association also supported this finding since 70.2% of soldiers with scarification marks were found to be HBV infected as compared to about 46.5% of those without these marks. Thus, transmission may occur indirectly via the use of contaminated equipment in the process of making scarification marks among the military personnel.

5.4 Medical risk factors associated with HBV Infection

Several other medical risk factors associated with Hepatitis B infection were investigated among the selected military personnel. It was revealed that history of Hepatitis B immunization ($p<0.001$) and status before HBV screening ($p<0.001$) significantly influenced their infection status. The bivariate association among the selected soldiers showed that all military personnel who knew they were HB positive before screening were indeed positive after the FLiHP project. However, it was revealed that soldiers who claimed to have HB immunization (AOR=11.82, 95% C.I=1.11-14.31) were almost 12 times more susceptible to Hepatitis B infection as compared those without HB immunization. This

could be due to the ineffective performance of some of the methods of immunization. Villeneuve et al. (2000) in their study on ineffectiveness of hepatitis B vaccination among cirrhotic patients waiting for liver transplantation revealed that, it is common to immunize individuals against HBV, but its efficacy is not always guaranteed. There are cases of adverse reaction which sometimes questions the performance of HBV vaccinations and thus, the mechanisms of immune response to HB surface antigen as well as lack of long term follow-ups of immunized individuals might be a major reason why most of the soldiers with immunity rather had a greater risk of HBV infection. In view of this finding, it suggests the need to properly immunize all soldiers in military units at the southern part of Ghana with regular follow-ups. The recommended Hepatitis B vaccine is Recombivax HB which must be provided in three doses. Moreover, the second dose must be taken a month later; whereas the third dose and final dose taken six months after the first dose (Bruce et al., 2016). However, the Center for Disease Control and Prevention recommends that even though the HB vaccine is generally safe, individuals with serious allergic reactions to previous dose, history of hypersensitivity to yeast or any other vaccine components as well as those experiencing a moderate or severe acute illness are advised against receiving the Hepatitis B vaccine. Previous study showed that the Hepatitis B immunization provides protection for at least 30 years among healthy vaccinated individuals who started the HB vaccination before they were six months old (Bruce et al., 2016). The bivariate association revealed also that 21 (95.5%) out of 22 previously immunized military personnel (among the 306 selected soldiers) were tested positive for HBV infection. Nonetheless, CDC concluded that the potential risks associated with the HBV are much greater than the risks the vaccine poses.

5.5 Strength and Limitations of the study

This study is one of the first to analyze the FLiHP project data among military personnel from the southern part of Ghana by examining the various risk factors associated with HBV infection. Even though interesting findings were attained, there were few limitations that need to be uncovered. Since about 306 samples were selected, it is highly possible that other relevant findings could have been obtained with an increase in sample sizes. Thus, the findings can only be generalized among the selected military personnel. In addition, the data could not distinguish the various arms of service (Army, Navy and Air Force) as well as high-risk professional groups like medical personnel within the armed forces so as to compare their risks of having HBV infections. Moreover, the data did not include military personnel's travelling history such peacekeeping operations and other courses.



CHAPTER SIX

CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusion

From the foregone, I conclude that a small proportion of the military personnel screened in the southern part of the GAF by the by FLiHP project tested positive to HBV infection. This proportion is half that of the nationwide but higher the proportions of other militaries in the world. Secondly, only age and ethnicity were the significant socio-demographic factors significantly associated with Hepatitis B infection while bisexual orientation, sexual intercourse with irregular sexual companions such as prostitutes and possession of scarification marks were the behavioral risk factors that had significant effect on positive HBV infection status. Finally, having HBV vaccination prior to the screening was the only medical risk factor associated with HBV infection among the selected military personnel.

6.2 Recommendations

The following recommendations are suggested based on the finding of the study conducted.

6.2.1 Military High Command

1. A Command Policy Guideline should be formulated and implemented to give backing to the FLiHP Project to work assiduously to reverse the proportion of military personnel who test positive for HBV infection. This document should include measures targeted at reducing the proportion of the age group greatly at risk.
2. The necessary financial support should be offered to the FLiHP project to extend the screening to the cover Military personnel in the Northern sector of the GAF so that a wholistic analysis will be made to help the project achieve its mission.
3. High Command should show more interest in efforts aimed at combating this silently dangerous infection within the military personnel through making it possible to

- implement a Policy to offer HBV vaccination to all personnel who are negative and check for immunity to prevent the spread of the infection in the forces.
4. Support the Medical Corps through training opportunities to Sub-specialize in Hepatology to treat and manage the anticipated burden of chronic hepatitis in the near now and the near future.
 5. An opportunity to organize nationwide durbar to disseminate the findings of this study to all military personnel help in combating this menace.

6.2.2 The GAF Medical Directorate and 37 Military Hospital Command

6. The Hepatitis Clinic should be given the necessary support to manage cases of Viral Hepatitis in terms of logistics especially pharmacological since the medications are quite expensive.
7. Institute measures like mandatory assessment of the development of immunity for all military personnel who have been vaccinated against HBV infection.
8. Ensure the strict implementation of infection prevention measures in the delivery of health care to personnel to prevent further transmission of the infection since the proportion of positive cases is high.

6.2.3 The FLiHP Project Coordinator

9. Efforts should be intensified to increase the disease awareness, screening, vaccination and counselling of military to avoid high risk behaviour like bisexuality and having unprotected sex with commercial sex workers (CSWs) and advice persons who have been vaccinated not to throw caution to the wind.
10. Assess the immunity status of persons who have been vaccinated against HBV to ascertain their true preventive status.
11. To analyze the data collected so far since possible revealing findings could be realized which could be immensely helpful in achieving the mission of the project.

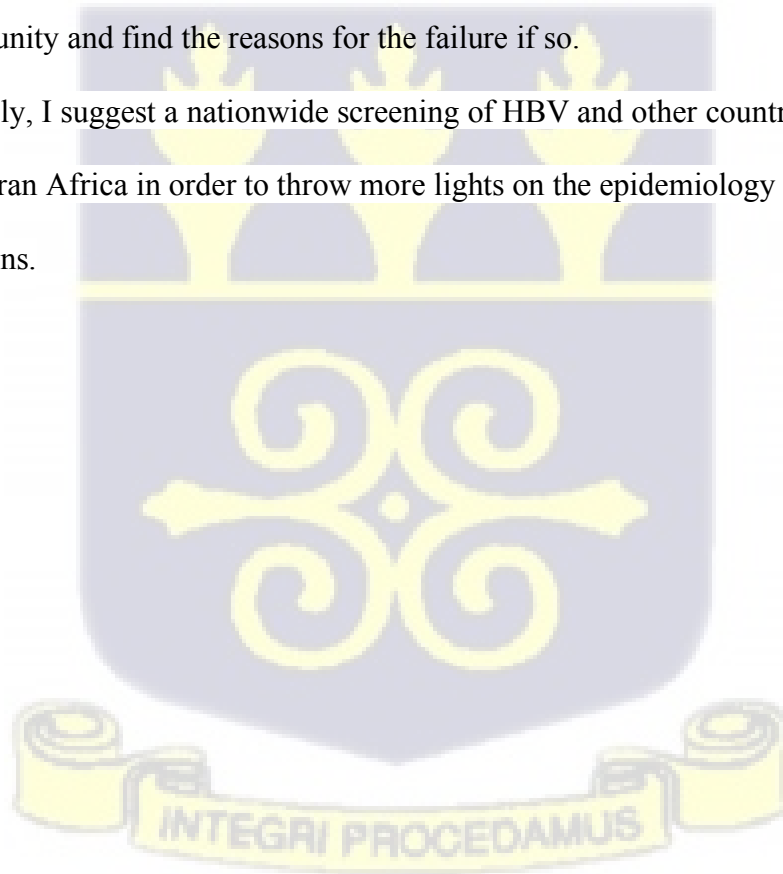
12. To conduct further studies to determine the reasons for the high rate of HBV vaccine failure among the selected persons in the study.

6.2.4 Military Personnel

13. Troops should have safer sexual practices such as faithfulness to their single regular sexual partners, condom use and minimize or stop patronizing CSWs.
14. Personnel who have received the Hepatitis B vaccine should not assume automatic immunity and be very cautious in preventing the disease as well as take personal efforts to check their immunity status.

6.2.5 Stakeholders like Ministry of Health, Ghana Health Service, Non-Governmental Organizations in Health

15. Conduct a study to investigate whether the HBV vaccine is really achieving immunity and find the reasons for the failure if so.
16. Finally, I suggest a nationwide screening of HBV and other countries in the sub-Saharan Africa in order to throw more lights on the epidemiology of HBV in these regions.



REFERENCES

- Abdallah, T. M., Mohamed, M. H., & Ali, A. a. (2011). Seroprevalence and epidemiological factors of hepatitis B virus (HBV) infection in Eastern Sudan. *International Journal of Medicine and Medical Sciences*, 3(7), 239–241.
- Akhtar, S., Younus, M., Adil, S., Hassan, F., & Jafri, S. H. (2005). Epidemiologic study of chronic hepatitis B virus infection in male volunteer blood donors in Karachi, Pakistan. *BMC Gastroenterology*, 5, 26. <https://doi.org/10.1186/1471-230X-5-26>
- Alliance, W. H. (n.d.). Viral Hepatitis : Global Policy Foreword.
- Aminu, M., & MD, V. (2014). *HEPATITIS B INFECTION IN NIGERIA: A REVIEW*.
- Assembly, F. W. H., World, T. F., & Assembly, H. (2004). Blood safety: proposal to establish World Blood Donor Day, (4), 84–85.
- Assembly, S. W. H. (2010). Viral hepatitis, (May), 1–4.
- Assembly, S. W. H. (2014). Hepatitis, (March), 12–16. [https://doi.org/10.1016/S0140-6736\(12\)61728-0.2](https://doi.org/10.1016/S0140-6736(12)61728-0.2)
- Assembly, S. W. H. (2016). Draft global health sector strategies, (April), 1–44.
- Bertoletti, A., & Hong, M. (2014). Age-Dependent Immune Events during HBV Infection from Birth to Adulthood: An Alternative Interpretation. *Frontiers in Immunology*, 5, 441. <https://doi.org/10.3389/fimmu.2014.00441>
- Bhardwaj, A., Ortho, M. S., Sivapathasundaram, N., Ortho, M. S., Mf, Y., Ortho, M. S., & Ah, M. (2014). The Prevalence of Accidental Needle Stick Injury and their Reporting among Healthcare Workers in Orthopaedic Wards in General Hospital Melaka , Malaysia, 8(2).
- Bruce, M. G., Bruden, D., Hurlburt, D., Zanis, C., Thompson, G., Rea, L., ... McMahon, B. J. (2016). Antibody Levels and Protection After Hepatitis B Vaccine: Results of a 30-Year Follow-up Study and Response to a Booster Dose. *Journal of Infectious Diseases*, 214(1), 16–22. <https://doi.org/10.1093/infdis/jiv748>
- Centers for Disease Control and Prevention. (2016). Viral Hepatitis | Gay and Bisexual Men's Health | CDC. Retrieved July 16, 2018, from <https://www.cdc.gov/msmhealth/viral-hepatitis.htm>
- Cotler, S. J., Cotler, S., Xie, H., Luc, B. J., & Layden, T. J. (2012). Characterizing hepatitis B stigma in Chinese immigrants, 147–152. <https://doi.org/10.1111/j.1365-2893.2011.01462.x>

- Easterbrook, P., Platt, L., Gower, E., Razavi, H., Sabin, K., & Vickerman, P. (2012). Global systematic review and metaanalysis of the seroprevalence of HBV and HCV infection in HIV-infected persons. [TUPEB 254 abstract]. 8th IAS Conference on Pathogenesis, Treatment and Prevention, 19–22 July 2015, Easterbrook P, Sands A, Harmanci H. Challenges and priorities in the management of HIV/HBV and HIV/HCV coinfection in resource-limited settings. *Semin Liver Dis.*;32(2):147–57. doi: 10.1055/s-0032-1316476.
- Forbi, J. C., Onyemauwa, N., Gyar, S. D., Oyeleye, A. O., Entonu, P., & Agwale, S. M. (2008). High prevalence of hepatitis B virus among female sex workers in Nigeria. *Revista Do Instituto de Medicina Tropical de São Paulo*, 50(4), 219–221. <https://doi.org/10.1590/S0036-46652008000400006>
- Ghana rated high risk for Hepatitis B, C | Health News 2013-07-28. (n.d.). Retrieved July 15, 2018, from <https://www.ghanaweb.com/GhanaHomePage/health/Ghana-rated-high-risk-for-Hepatitis-B-C-280781>
- Global Health Sector Strategy on viral hepatitis, 2016–2021. Geneva: World Health Organization; 2016 [WHO/HIV/2016.06] (<http://apps.who.int/iris/bitstream/10665/246177/1/WHO-HIV-2016.06-eng.pdf?ua=1>, accessed 10 March 2017).
- Global Hepatitis Report, 2017. (n.d.).
- Haynes, L., & Maue, A. C. (2009). Effects of aging on T cell function. *Current Opinion in Immunology*, 21(4), 414–417. <https://doi.org/10.1016/j.coi.2009.05.009>
- Health, G., Strategy, S., Ending, T., & Hepatitis, V. (2016). Viral hepatitis 2016–2021, (June).
- Hutin, Y. J. F., & Chen, R. T. (1999). Editorial Injection safety : a global challenge, 77(10), 787–788.
- Hutin, Y., & Chen, R.T. (1999). Injection safety: a global challenge: *Bull World Health Organ.*, 77 (10), 787–8.
- Hyams, K. C., Riddle, J., Rubertone, M., Trump, D., Alter, M. J., Cruess, D. F., ... Bailey, S. (2001). Prevalence and Incidence of Hepatitis C Virus Infection in the US Military: A Seroepidemiologic Survey of 21,000 Troops. *American Journal of Epidemiology*, 153(8), 764–770. <https://doi.org/10.1093/aje/153.8.764>
- Jimenez, A. P., El-Din, N. S., El-Hoseiny, M., El-Daly, M., Abdel-Hamid, M., El Aidi, S., ... Fontanet, A. (2009). Community transmission of hepatitis B virus in Egypt:

- results from a case-control study in Greater Cairo. *International Journal of Epidemiology*, 38(3), 757–765. <https://doi.org/10.1093/ije/dyp194>.
- Kolou, M., Katawa, G., Salou, M., Gozo-Akakpo, K. S., Dossim, S., Kwarteng, A., & Prince-David, M. (2017). High Prevalence of Hepatitis B Virus Infection in the Age Range of 20-39 Years Old Individuals in Lome. *The Open Virology Journal*, 11, 1–7. <https://doi.org/10.2174/1874357901710011001>.
- Lange, W.R., Cone, E.J., & Snyder, F.R. (1990). The association of hepatitis delta virus and hepatitis B virus in parental drug abusers, 1971 to 1972 and 1986 to 1987. *Arch.intern. Med.*, 150, 365-368.
- Lepore, M., Njai, H. F., Garside, D. A., Shimakawa, Y., Crossey, M. M. E., Njie, R., & Lemoine, M. (2015). Hepatitis B: The view from West Africa. *South Sudan Medical Journal*, 8(2).
- Mak, R., Traen, A., Claeysens, M., Van Renterghem, L., Leroux-Roels, G., & Van Damme, P. (2003). Hepatitis B vaccination for sex workers: do outreach programmes perform better? *Sexually Transmitted Infections*, 79(2), 157–159. <https://doi.org/10.1136/STI.79.2.157>
- Michaelcaleywarwickshirensuk, M. C., Fowler, T., Greatrex, S., & Wood, A. (2012). Differences in hepatitis B infection rate between ethnic groups in antenatal women in Birmingham , United Kingdom , May 2004 to December 2008, (December 2008), 1–6.
- Mueller, A., Stoetter, L., Kalluvya, S., Stich, A., Majinge, C., Weissbrich, B., & Kasang, C. (2015). Prevalence of hepatitis B virus infection among health care workers in a tertiary hospital in Tanzania. *BMC Infectious Diseases*, 15(1), 386. <http://doi.org/10.1186/s12879-015-1129-z>
- Mutocheluh, M., & Owusu, M. (2014). Risk factors associated with hepatitis B exposure and the reliability of five rapid kits commonly used for screening blood donors in Ghana. *BMC Research* Retrieved from <http://www.biomedcentral.com/1756-0500/7/873>.
- Mutocheluh, M., Owusu, M., Kwofie, T. B., Akadigo, T., Appau, E., & Narkwa, P. W. (2014). Risk factors associated with hepatitis B exposure and the reliability of five rapid kits commonly used for screening blood donors in Ghana. *BMC Research Notes*, 7, 873. <http://doi.org/10.1186/1756-0500-7-873>
- Nikolopoulos, G.K., Paraskevis, D., Hatzitheodorou, E., Moschidis, Z., Sypsa, V., Zavitsanos, X., Et Al. (2009). Impact of hepatitis B virus infection on the progression

- of AIDS and mortality in HIV-infected individuals: a cohort study and meta-analysis. *Clin Infect Dis.*, 48, 1763–71.
- Noubiap, J. J. N., Nansseu, J. R. N., Ndoula, S. T., Bigna, J. J. R., Jingi, A. M., & Fokom-Domgue, J. (2015). Prevalence, infectivity and correlates of hepatitis B virus infection among pregnant women in a rural district of the Far North Region of Cameroon. *BMC Public Health*, 15, 454. <https://doi.org/10.1186/s12889-015-1806-2>.
- Odhiambo, R. (2007). *Hepatitis B spreading in Ghana due to lack of awareness | Africa | DW | 03.08.2017*. Retrieved from <https://www.dw.com/en/hepatitis-b-spreading-in-ghana-due-to-lack-of-awareness/a-39946701>
- Ott, J. J., Stevens, G. A., Groeger, J., & Wiersma, S. T. (2012). Global epidemiology of hepatitis B virus infection: New estimates of age-specific HBsAg seroprevalence and endemicity. *Vaccine*, 30(12), 2212–2219. <https://doi.org/10.1016/J.VACCINE.2011.12.116>
- Pearce, N., Milne, A., & Moyes, C. (1988). Hepatitis B virus: the importance of age at infection. *The New Zealand Medical Journal*, 101(858), 788–790. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/2973569>
- People, H. B. (n.d.). HEPATITIS B & SEXUAL HEALTH What are the symptoms of.
- Perz, J.F., Armstrong, G.L., Farrington, L.A., Hutin, Y.J., & Bell, B.P. (2006). The contribution of hepatitis B virus and hepatitis C virus infections to cirrhosis and primary liver cancer worldwide. *J. Hepatol.*, 45, 529–38.
- Petrauskas, D., Kupcinskas, L., Petrauskas, D., Petrenkiene, V., & Saulius, M. K. (2017). Prevalence of Hepatitis B Virus Chronic Carriers and Risk Factors for Hepatitis B Virus Infection among Lithuanian Army Soldiers, 172(June 2007), 625–627.
- Petrauskas, D., Kupcinskas, L., Petrauskas, D., Petrenkiene, V., & Saulius, M. K. (2018). Prevalence of Hepatitis B Virus Chronic Carriers and Risk Factors for Hepatitis B Virus Infection among Lithuanian Army Soldiers, 172(February), 625–627.
- Prier, R. E., & Cowan, D. N. (1987). Risk factors for hepatitis B virus infection in US Army soldiers in Europe. *Journal of Epidemiology and Community Health*, 41, 229–232.
- Project to prevent hepatitis among GAF personnel launched - Graphic Online. (n.d.). Retrieved July 15, 2018, from <https://www.graphic.com.gh/news/general-news/project-to-prevent-hepatitis-among-gaf-personnel-launched.html>

- Prüss-üstün, A., Prüss-üstün, A., Campbell-lendrum, D., Corvalán, C., & Woodward, A. (2003). Sharps injuries Global burden of disease from sharps injuries to health-care workers, (3).
- Rapiti, E., Prüss-üstün, A., Prüss-üstün, A., Campbell-lendrum, D., Corvalán, C., & Woodward, A. (2005). Sharps injuries Assessing the burden of disease from sharps injuries to health-care workers at national and local levels, (11).
- Resolution WHA58.13. Blood safety: proposal to establish World Blood Donor Day. In: Fifty-Eighth World Health Assembly, Geneva, 16–25 May 2005. Resolutions and decisions, annexes. Geneva: World Health Organization; 2005 (http://www.who.int/bloodsafety/WHA58_13-en.pdf?ua=1, accessed 10 March 2017).
- Resolution WHA63.18. Viral hepatitis. In: Sixty-Third World Health Assembly, Geneva, 17–21 May 2010. Resolutions and decisions, annexes. Geneva: World Health Organization; 2010 [Agenda item 11.12] (http://apps.who.int/gb/ebwha/pdf_files/WHA63-REC1/WHA63_REC1-en.pdf, accessed 10 March 2017).
- Resolution WHA67.6. Hepatitis. In: Sixty-Seventh World Health Assembly. Geneva, 19–24 May 2014. Resolutions and decisions, annexes. Geneva: World Health Organization; 2014 [Agenda item 12.3] (http://apps.who.int/gb/ebwha/pdf_files/WHA67/A67_R6-en.pdf, accessed 10 March 2017).
- Rosenblum, L., Darrow, W., Witte, J., ET Al. (1992). Sexual practices in the transmission of hepatitis B virus and prevalence of hepatitis delta virus infection in female prostitutes in the United States. *J. Amer. med. Ass.*, 267, 2477-2481,
- Rufai, T., Mutocheluh, M., & K. K. (2014). The prevalence of hepatitis B Virus E antigen among Ghanaian blood donors. *Pan African Medical Journal*, 17, 53. [http://doi.org/10.11604/pamj.17\(53\),3390](http://doi.org/10.11604/pamj.17(53),3390)
- Sabin, A. B. (1976). Viral hepatitis: problems of incidence and control in military personnel. *Yale Journal of Biology and Medicine*, 49(3), 259–266.
- Seal, K. H., Ochoa, K. C., Hahn, J. A., Tulsy, J. P., Edlin, B. R., & Moss, A. R. (2000). Risk of hepatitis B infection among young injection drug users in San Francisco: opportunities for intervention. *The Western Journal of Medicine*, 172(1), 16–20. Retrieved from <http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=1070710&tool=pmcentrez&rendertype=abstract>

- Schweitzer, A., Horn, J., Mikolajczyk, R. T., Krause, G., & Ott, J. J. (2015). Estimations of worldwide prevalence of chronic hepatitis B virus infection: a systematic review of data published between 1965 and 2013. *The Lancet*, 386(10003), 1546–1555. [https://doi.org/10.1016/S0140-6736\(15\)61412-X](https://doi.org/10.1016/S0140-6736(15)61412-X)
- Stevens, C.E., Beasley, R.P., Tsui, J., Lee, W.C. (1975). Vertical transmission of hepatitis B antigen in Taiwan. *N Engl J Med.*, 292, 771–74.
- Stroffolini, T., Mele, a., Tosti, M. E., Gallo, G., Balocchini, E., Ragni, P., ... Moiraghi, a. (2000). The impact of the hepatitis B mass immunisation campaign on the incidence and risk factors of acute hepatitis B in Italy. *Journal of Hepatology*, 33(6), 980–5. [https://doi.org/10.1016/S0168-8278\(00\)80132-4](https://doi.org/10.1016/S0168-8278(00)80132-4)
- Sulkowski, M.S. (2008). Viral hepatitis and HIV coinfection. *J Hepatol.*, 48, 353–67.
- Summary, E. (2017). GLOBAL HEPATITIS REPORT.
- Thio, C.L. (2009). Hepatitis B and human immunodeficiency virus coinfection. *Hepatology*, 49(5 Suppl): S138–S145. doi: 10.1002/hep.22883.
- Trépo, C., Chan, H. L. Y., & Lok, A. (2014). Hepatitis B virus infection. *The Lancet*. [https://doi.org/10.1016/S0140-6736\(14\)60220-8](https://doi.org/10.1016/S0140-6736(14)60220-8).
- Uddin Pk, M., A, R., SMK, N. B., Y, K., M, R., & N, A. (2014). Hepatitis B Viral Load (HBV-DNA) with Age and Sex Stratifications in Bangladeshi People. *Journal of Medical Microbiology & Diagnosis*, 3(3). <https://doi.org/10.4172/2161-0703.1000144>
- Vancouver, Canada. Forbi, J. C., Onyemauwa, N., Gyar, S. D., Oyeleye, A. O., Entonu, P., & Agwale, S. M. (2008). High prevalence of hepatitis B virus among female sex workers in Nigeria. *Revista Do Instituto de Medicina Tropical de São Paulo*, 50(4), 219–221. <https://doi.org/10.1590/S0036-46652008000400006>
- Villeneuve, E., Vincelette, J., & Villeneuve, J. P. (2000). Ineffectiveness of hepatitis B vaccination in cirrhotic patients waiting for liver transplantation. *Canadian Journal of Gastroenterology = Journal Canadien de Gastroenterologie*, 14 Suppl B, 59B–62B. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/10938507>
- Wen, W.H., Chang, M.H., Zhao, L.L., Et Al. (2013). Mother-to-infant transmission of hepatitis B virus infection: significance of maternal viral load and strategies for intervention. *J Hepatol.*, 59, 24–30.
- WHO | Hepatitis B. (2017). *WHO*. Retrieved from <http://www.who.int/mediacentre/factsheets/fs204/en/>

- Yang, S., Wang, D., Zhang, Y., Yu, C., Ren, J., Xu, K., ... Li, L. (2015). Transmission of Hepatitis B and C Virus Infection Through Body Piercing. *Medicine*, 94(47), e1893. <https://doi.org/10.1097/MD.0000000000001893>.
- Yuen, M.-F., Ka-Ho Wong, D., Lee, C.-K., Tanaka, Y., Allain, J.-P., Fung, J., ... Lai, C.-L. (2011). Transmissibility of Hepatitis B Virus (HBV) Infection through Blood Transfusion from Blood Donors with Occult HBV Infection. *Clinical Infectious Diseases*, 52(5), 624–632. <https://doi.org/10.1093/cid/ciq247>



APPENDICES

Appendix 1: Questionnaire

FACTORS ASSOCIATED WITH HEPATITIS B INFECTION AMONG SOLDIERS OF THE SOUTHERN COMMAND OF THE GHANA ARMED FORCES

Personal Profile.

ID No..... date.....

Name of respondent.....

Sociodemographic characteristics

1. Age at last birthday
2. Sex: male Female 3. Place of residence..... 4. Unit.....
5. Arm of Service: Army Navy Air Force
6. Ethnicity: Akan Ewe Ga Hausa Grussi Dagbani other.....
7. Marital status single Married Co-habiting Separated divorced widowed
8. Religion: Moslem Christian Traditional Other(specify).....
9. Educational level: Primary/Elementary JSS/ O level SSS/Secondary/ A level
Vocational/Commercial Tertiary
10. Trade: Infantry Recce Engineer Legal Medical Transport Signal Cook

Assessment of Medical Risk Factors

1. Have you ever had a Blood Transfusion? Yes No
2. Have you ever received an Organ Transplant? Yes No
3. Have you ever had any Dental Procedures Or Surgeries in non-orthodox health facilities? Yes No
4. Have you ever had Needles or Sharp Instruments injury? Yes No
5. Have you ever had Vaccination against HBV? Yes No

Assessment of Behavioural Risk Factors

1. Are you sexually active? Yes No
2. If yes do you engage in any of these sexual behaviours?
 - a. Unprotected Sex? Yes No

- b. 2. Men Having Sex with Other Men (MSM) or Lesbianism? Yes [] No []
- c. 3. Multiple Sexual Partners? Yes [] No []
- d. Sex with a Prostitute? Yes [] No []
- 3. Have you ever had engaged in Intravenous Drug Usage (IDUs)? Yes [] No []
- 4. Have you ever had Tattoos/Body Piercing? Yes [] No []
- 5. Do you engage in sharing of Domestic Effects? Yes [] No []
- 6. Do you engage in sharing of Blades And Needles? Yes [] No []
- 7. Have you ever had Scarification marks? Yes [] No []



Appendix 2: Consent Form

Form Number []

Project title

FACTORS ASSOCIATED WITH HEPATITIS B INFECTION AMONG SOLDIERS OF THE SOUTHERN COMMAND OF THE GHANA ARMED FORCES

Name and address of Principal Investigator

Theophilus Pwase Balinia-Adda, Department of Epidemiology and Disease Control, University of Ghana, Accra, Legon or 37 Military Hospital, Public Health Division.

Mobile: 0243301570

Email Address: tpbalinia-adda@st.ug.edu.gh

Institution affiliated: School of Public Health, University of Ghana, Legon, Accra

Introduction

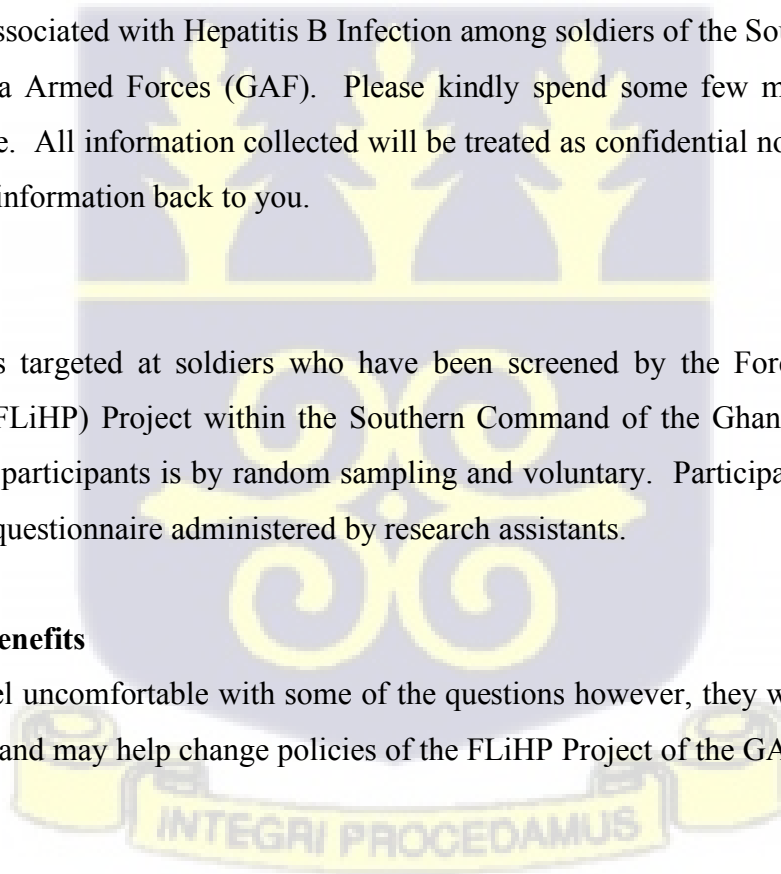
I am a student from the School of Public Health, University of Ghana conducting a research on Factors associated with Hepatitis B Infection among soldiers of the Southern Command of the Ghana Armed Forces (GAF). Please kindly spend some few minutes to fill the questionnaire. All information collected will be treated as confidential no one will be able to trace any information back to you.

Procedure

The study is targeted at soldiers who have been screened by the Forces Liver Health Protection (FLiHP) Project within the Southern Command of the Ghana Armed Forces. Selection of participants is by random sampling and voluntary. Participants will be made to answer a questionnaire administered by research assistants.

Risks and benefits

You may feel uncomfortable with some of the questions however, they will be helpful for the research and may help change policies of the FLiHP Project of the GAF.



Right to refuse

Your consent to participate in this study is voluntary, you are not under any obligation to participate, and you are at liberty to withdraw from this study at any point in time. However, I will appreciate it if you can complete it.

Anonymity and confidentiality

Be assured that any information given will be used purely for research. Any information given will be treated with utmost confidentiality. Your name will not be used in any report, but your ideas and suggestions will help us to design programmes or policies that will improve prevention of HBV infection among soldiers and the consequences of it.

Your rights as Participant

This research has been reviewed and approved by the Institutional Review Committee (IRB) of the 37 Military Hospital. If you have any questions about your rights as a research participant, you can contact the IRB Coordinator Dr. Asumanu of 37 MH (Mob: +233 27 758 8088). Do you have any questions to ask me? (If yes, note questions below).

Voluntary agreement forms for Soldiers

The above document describing the benefits, risks and procedures for the research topic “Factors associated with Hepatitis B Infection among soldiers of the Southern Command of the Ghana Armed Forces (GAF)” I have read and understood. I have been given an opportunity to ask any questions about the research. I agree to participate as a participant.

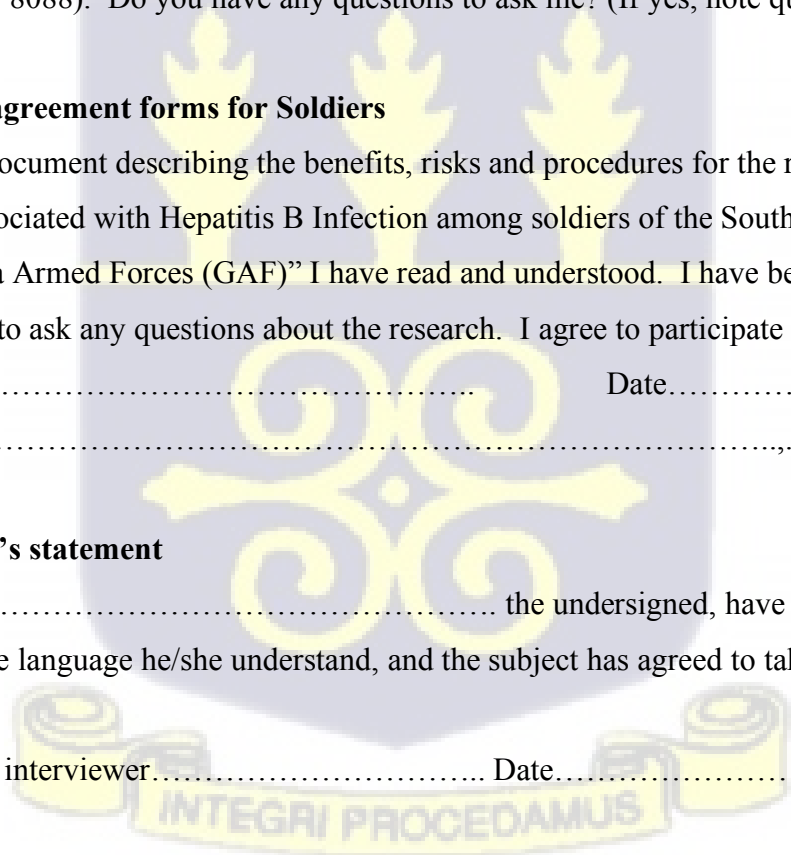
Name..... Date.....

Signature.....,

Interviewer’s statement

I..... the undersigned, have explained to the subject in the language he/she understand, and the subject has agreed to take part in the study.

Signature of interviewer..... Date.....



Appendix 3: Data Extraction Sheet

YEAR

TOTAL NUMBER

OF PERSONNEL

SCREENED

NO. OF POSITIVE

CASES

PREVALENCE

UNIQUE ID	AGE	SEX	EDUC	PROFESSION	HBsAg RESULTS	ASSOCIATED FACTORS
------------------	------------	------------	-------------	-------------------	--------------------------	-------------------------------

Case/001

Control/001

Case/002

Control/002

Case/003

Control/003

Case/004

Control/004

Case/005

Control/05

