COLLEGE OF MEDICINE AND HEALTH SCIENCES

SCHOOL OF PUBLIC HEALTH

PREVALENCE AND GEOGRAPHICAL DISTRIBUTION OF HEPATITIS C AMONG BLOOD DONORS IN RWANDA:SECONDARY DATA ANALYSIS OF NATIONAL CENTER FOR BLOOD TRANSFUSION 2018

By

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A dissertation submitted to UR in Partial Fulfilment of the Requirements for the degree of **Masters in Public Health**, in the School of Public Health

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October 2019

DECLARATION

I, **UFITINEMA SYLVIE** do hereby declare that this research dissertation titled "PREVALENCE AND GEOGRAPHICAL DISTRIBUTION OF HEPATITIS C AMONG BLOOD DONORS IN RWANDA submitted to UR in partial fulfillment of the requirements for the degree of Masters of Public Health at the University of Rwanda/ College of Medicine and Health Sciences, is my original work and has not previously been submitted elsewhere. Also, I do declare that a complete list of references is provided indicating all the sources of information quoted or cited.

Signature ……../……/…...

UFITINEMA SYLVIE

Date

DEDICATION

This work is dedicated to my lovely husband UWACU BENI HUBERT who never failed to give me a financial and moral support, to my children U. INEMA BESSIE, U. ISHEJA JESSIE, and U.IMPANO LIZZIE for their moral support.

ACKNOWLEDGEMENTS

The completion of this dissertation was due to the team effort of numerous people who took their time and efforts to support me. I deeply give thanks to the Almighty God for granting me the gift of life and good health. I am highly indebted to My able supervisors Pr.NYIRAZINYOYE LEATITIA and Mr HABAGUSENGA Jean D'AMOUR for sparing their time to guide me until the completion of the study. My sincere gratitude is expressed to UR(CMHS/SPH) for granting me the privilege to undertake my studies.

I am highly indebted to my husband UWACU BENI HUBERT and who has supported me throughout my academic life.

RBC(NCBT) team for their support,without their critical help I wouldn't have achieved this degree of education

My Mum KANKUYO Eugenie who made the endless prayers and moral support.

I also also acknowledge my classmates and friends for their moral support.

Be blessed

ABSTRACT

Background Infection with Hepatitis C Virus is one of the primary health concerns in developing countries. About 3% of the population in the world is infected with the virus, and 71 million, which is 1% of the global population are chronically infected. The rate of infection in Sub-Saharan regions is a bit higher. In Rwanda, the current HCV prevalence is estimated to be 4-5% among the general population. The main of the study was to
assess the prevalence and socio demographic factors associated with HCV and his geographical distribution among blood donors in Rwanda.

Methods A total of 44,520 tested and recorded Blood donors from January to December20 referring to 5 regional for blood transfusion centers were reviewed.Bivariate and multivariable models were used in assessing potential HCV infection association. Other variables used in bivariate analysis were to be included in the multivariate regression model on the condition that their inclusion was theoretically logical. A P-value < 0.05 produced a final model in determining an independent link among variables and HCV infection was used to remove insignificant variables through the backward stepwise technique.

Results HCV prevalence among Blood donors was 2.5% .high prevalence rate was recored in five districts: Ngoma 5.8%, Nyanza 5.2%, Bugesera 4.8%, Ruhango 4.2%, and Kayonza 4.7% .age between 31-40 years [aOR = 1.264, 95%CI: (1.086-1.471) and 41-50 years [aOR = 1.250, 95%CI: (1.028-1.520)were associated with high HCV infection compared to those in the age category of 18 – 30. Burera OR=7.324, CI: (74.211-12.740),GakenkeOR=8.876 CI4.(593-17.153), and Ngororero OR=7.099 CI(3.769-13.372) districts were more likely associated with HCV compared to Musanze district

Conclusion: The prevalence late of HCV among Blood donors was 2.5% the prevalence rate increased with increase in age (31-50). Blood donors from southern and Eastern province had a high prevalence rate of HCV, and donors whose blood groups were O-,A+ and B- were more likely associated with HCV compared to those with A- . Blood donors who lived in Burera, GakenkeNyamasheke, Kamonyi, and Ngororero districts were founded significantly associated with HCV infection compared to those who lived in Musanze District

Key Words: HCV, prevalence, risk factors, geographical distribution, socio-demogaphic

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LIST OF ACRONYMS AND ABBREVIATIONS

AIDS **:** Acquired Immune Deficiency Syndrome

Anti-HCV **:** Anti-HCV antibody

CMIA :chemiluminescent microparticle immuno Assay

EIA **:** Enzyme immune assays

GIS **:** Geographic Information System

HCC **:** Hepatocellular carcinoma

HCV **:** Hepatitis C virus

HCVAb **:** Hepatitis C Antibody

HIV **:** Human Immunodeficiency Virus

IBM **:** International Business Machines

NCBT **:** National center for Blood transfusion

NY **:** New York

PLHIV **:** People Living with Human Immunodeficiency Virus

SPSS **:** Statistical Package for the Social Sciences

TTIs **:** Transfusion-transmitted infections

USA **:** United States of America

WHO **:** World Health Organization

CHAPTER ONE:INTRODUCTION

1. Background of the Study

One of the primary health concerns in developing countries is Hepatitis C. The disease has infected about 3% of the population in the world [(9)]. The disease has chronically infected about 71 million, which is 1% of the global population. The rate of infection in Sub-Saharan regions is a bit higher. The disease was found to have infected about 2.7% in a meta-analysis of 1151337 people in Sub-Saharan states. The prevalence of the disease has been documented in Rwanda, with a section of the scholarly evidence showing the prevalence among HIV positive people and pregnant women. The predominance of anti-HCV, which is an indication for HCV exposure was found to be between 4.3-4.7% among the individuals who are HIV positive (PLHIV), and the rate among the expectant mothers was 2.6% [(19; 24)]. However, no research has been documented to assess the risk in Rwanda.

The disease is linked with high death rate due to its association with severe liver sicknesses. They incorporate liver cirrhosis, malfunction of the liver, and furthermore hepatocellular carcinoma (HCC)[(25)]. The mode of transmissions of HCV is through direct blood contact, transfusions, and even blood products, unprotected sex, and also arterial injections. Blood transfusion is a notable hazard factor for spreading HCV. Be that as it may, it represents a non-alternative method of reducing morbidity and saving thousands of lives annually [(9; 26; 1)]. There is a recorded increasing transmission of HCV from donors to recipients in the developing countries. One of the causes is the failure of subjecting donors to routine serological tests [(26)]. The World Health Organization recommended regular serological tests for the transfusion-transmissible infections (TTIs), with HCV included, in a bid to curb the increasing transmissions of the disease[(9)]. The results from the donor tests could be used as a benchmark for a secure donation of blood. Also, the blood was used to examine the rate of HCV infection among blood donors, which assisted in understanding the epidemiology of the condition in the community [(9)].

There have been some complications in preventing and controlling the spread and infection of HCV, describing the risk factors associated with the condition, and also have a precise evaluation of the co-factors which are related to accelerating the infection progress [(8)]. Countries that have adopted a routine serological blood screening have experienced reduced

HCV and other transfusion-related illnesses [2]. The pace of contamination among blood givers in North European and South European countries is very minimal. However, there is a higher HCV infection rate in developing countries due to some reasons. For instance, low-quality screening of blood during the transfusions, medical practices that do not fit medical standards, and also intravenous drug use, which includes sharing of needles. For instance, there has been a higher HCV infection rate in Southeast Asian states, which includes India, Malaysia, Pakistan, Philippines, Egypt, and also Equatorial Africa[22].

One of the causes of increasing viral infection rates is blood transfusions, where by an asymptomatic person can transmit the infection. There are some benefits accrued from screening and assessing the blood donors. They include decreasing the risks of transmitting the disease through infected blood products and also having the infection prevalence rates in a given community. The evaluation and monitoring of the rates of infection among the blood donors help in establishing the quality and effectiveness of screening blood donors, conducting public education, screening tests, and also the probable dangers of transmitting HCV infections through blood transfusion [4]. Evaluating the associated socio-demographic factors and the dissemination of HCV disease helps in making arrangements for the preventive measures and the resources which will be needed. Some of the complications of establishing the prevalence of the disease globally include the asymptomatic and the inherent idea of the condition before the clinical introduction [27]. Sampling the general population is the ideal condition of carrying out seroprevalence research. However, the process has no assured feasibility. There is a low infection rate of the disease among the general population. Therefore, the determination is always cumbersome since carrying out a study on the general population implies that large sample sizes would be needed. For such a factor, blood benefactors may not really mirror the all-inclusive community. Henceforth, a progressively huge level of the examinations are directed in this group since the outcomes from a bigger populace could be priceless information to help comprehend the study of disease transmission of the condition in our societies [10].

The treatment of HCV is costly, more so due to the absences of a vaccine against the infection. Therefore, having primary prevention of HCV is of great significance. Any process that aims at enhancing primary prevention of HCV should have accurate data, which includes

the trends and its geographic distribution. Some studies have been conducted on the infection rates, trends, and the geographical distribution of HCV infections in the past among the blood donors. This examination targets looking at the infection rates and the geographical distribution of the disease HCV among Rwandese blood donors. Blood donor data from the Rwanda Biomedical Center (RBC) in the NCBT division will be used in the study. The data from this center will be used to ensure comprehensive and reliable infection rates as well as the geographical appropriation of HCV contamination rates among blood donors in Rwanda. The data is hypothesized to help in essential prevention of the infection and furthermore managing in further research.

1.2 Problem Statement

There is a worldwide distribution of disease HCV, with all populations, ages, genders, and different geographical locations being and bloodat risk of contracting the condition. There is no clear definition of the social and monetary effects of HCV in many countries. Some of the factors which impact the health systems in the regions where hepatitis C the study of disease transmission has been considered to incorporate chronic HCV, HCC, and furthermore end-stage liver cirrhosis [16]. There are still new infections which are recorded due to some reasons. For instance, increasing utilization of unscreened or inadmissibly screened blood transfusions, lack of adequately sterilizing the medical equipment, and increased use of intravenous drug use in areas that were previously affected.

The Hepatitis C infection (HCV) in Rwanda is an essential causative factor of liver ailment. The prevalence estimation lies between 4.3-4.7 % among the HIV positive patients, and 2.6 % among the expectant mothers in Rwanda [19]. The elderly, aged 55 years and above, have the highest HCV prevalence in Rwanda [23]. It is challenging to identify new HCV infection prevalence. There are rare reports and diagnosis of newly infected HCV victims, especially among people with asymptomatic acute infection [15]. Due to this, the diagnosis of HCV occurs years after the infection. Also, new diagnoses are not a representation of new HCV infections. The elderly, who have been diagnosed with HCV, may have been infected over a decade ago, and have been living with the disease for decades. Therefore, having an understanding of the epidemiologic and demographic characteristics of the condition can help in primary prevention policies through having a clear plan on the populations to target

first during the prevention initiatives. The study analyzed HCV blood donor data from five regional transfusion centers of the whole country for the year 2018. It helped in understanding the socio-demographic factors and the predominance of the malady.

Understanding the pervasiveness of the ailment can support the medical department and different government organizations deal with the expanding burden of the disease. Also, it can help formulate strategies to assist in potential anti HCV therapies. Similarly, it will help guide more efficient screening campaigns and also implement activities aimed at preventing the spread of the disease, which will help reduce the exposure of the primary transmission channels. To NCBT, this study will be more effective as recommended and need to know areas that are less affected by hepatitis for a better orientation of blood donation and blood collection. To NCBT this study will be more effective as recommended and need to know areas that are less affected by the hepatitis for a better orientation of blood donation and blood collection.

1.3 Study Objectives

1.3.1 General Objective

The current study aimed to assess the socio demographic factors associated with hepatitis c and geographical distribution among blood donors in Rwanda.

1.3.2 Specific Objectives

a) To assess the prevalence of hepatitis c among blood donors in Rwanda
b) To identify socio demographical risk factors associated with Hepatitis c infection
c) To assess the geographical distribution of Hepatitis C among blood donors in Rwanda

1.4 Significance of the Study

Proper documentation of HCV prevalence is essential in aiding medical communities' government agencies in managing the burden posed by increased infections as well as institute strategies in line with the several potent anti - HCV therapies. Understanding the HCV prevalence and geographical distribution will be essential to managing increasingly proficient screening efforts and actualizing protection exercises to lessen populace exposure to significant courses of transmission. To NCBT this investigation will be more effective as

recommended and need to know areas that are less affected by the hepatitis for a better orientation of blood donation and blood collection.

CHAPTER TWO:

LITERATURE REVIEW.

2.1 Occurrence and Distribution of Transfusion Transmissible Infection

There is no veritable substitution of blood, which makes blood transfusion a therapeutic procedure. However, blood transfusion of contaminated blood is a significant cause of transmitting infectious diseases and can have adverse effects instead of saving lives. A practical, high-quality medical care is based on the safe transfusion of blood. Such a system requires organized medical equipment, well-educated medical practitioners, reliable equipment, and also proper reagents as well as ample and steady electricity supply [18].There are high economic and medical costs associated with unsafe blood transfusions. Some far-reaching consequences include long-term morbidity and mortality and delayed viraemia. The results affect the recipients, families, and also the community at large. A point to note is that low viral titer associate with TTI. Therefore, molecular mean blood screening was taken as a reliable virus detection method [14; 6]. There is less data on safe blood transfusion in many developing nations. Likewise, the primary blood banks do not offer reliable services, which are recommended by WHO.

One of the primary contributor of transmission of the infectious diseases is poorly organized blood transfusions [3; 13]. Some of the dangers which associate with blood transfusions link with few blood donors, selective screening of blood samples, and also the willingness of a person to pay for the screening costs. Therefore, ensuring a safe supply of blood requires stringent screening of blood donors. An assessment of the estimated risks of TTIs allows evaluating the data on TTI commonness among the blood donors. The process helps in establishing long term strategies meant to enhance medical care and curb the spread of infectious diseases in the local population.

There are several types of viruses, bacteria, and parasites that can be transmitted through blood transfusions. One of the most serious diseases transmitted through blood transfusion is HCV [3]. There is as yet a high rate of HCV infection in some regions despite the progress made in its diagnosis and treatment. All parts are at risk of having HCV due to globalization, which has increased the chances of spreading the disease. Compulsory screening tests are performed before any blood transfusion in Egypt in a bid to prevent TTIs.

There is a vertical transmission of HCV from mother to child and a horizontal transmission through body secretions and blood products. There are other risk factors, which include intravenous drug abuse, unsafe dental procedures, body piercing such as tattooing, and also having unprotected sexual intercourse [8]. A health issue of concern among the industrialized and developing countries is viral hepatitis C. An estimate of about 200 million individuals are living with the condition on the planet. HCV is an essential liver ailment causative factor, for example, liver cirrhosis and hepatocellular carcinoma [6].

2. 2 Prevalence and Geographical Distribution of Hepatitis C

HCV has a worldwide distribution, with every population gender, age, and region being at risk of its infection. There are no definitions of the socio-economic burdens of the disease in many countries. The national health systems are impacted by the consequences of the disease, for example chronic HCV, liver cirrhosis, and furthermore HCC[16]. Continued use of unsafe blood screen transfusions and blood products, lack of proper sterilization of medical equipment, and increased use of intravenous medications in places previously unaffected have made new infections to occur.

There should be an improvement in the quality and coverage of the HCV infection rate by using accurate diagnostic tests and also have a representative population sample. There should be stratification of the prevalence in ages, gender, and ethnicity, which will help in evaluating incidence trends and chronic disease burden. There is limited evidence of HCV prevalence, with the first publication done in 1997. Data from many countries is limited, with some published studies having limited scope and a partial representation of the population. Also, few studies represent the entire population. There is scarce data on new HCV infections since most acute HCV infection, about 60-70% are asymptomatic. There are some risk groups such as hemophiliacs and hemodialysis, which unscreened blood transfusions, which inmate for long-duration correctional facilities. Also, individuals with occupational exposure have high chances of HCV infections.

Most of the approximations rely on published prevalence data since there is less reliable number due to asymptomatic acute infection. The estimation lies between 130-170 million infections, which represents 2-3% of the total populace. There has been an enhanced safety

of blood supply in the United States. It is demonstrated by a declining transfusion infection rate and residual risk for these infections. The American Red Cross system has enabled a reliable remaining risk infection estimations due to a lot of steady and trustworthy information on blood donations and diseases. It has marked a reduction of HCV prevalence among blood donations.

Scholarly evidence has revealed an uneven distribution of HCV in various regions in Argentina. Among the significant HCV determinants among donors was age [9]. There was a low anti-HCV donor prevalence in the country. Also, the study noted a decreasing anti-HCV trend. Also, the samples for testing positive for screening assays were different from samples testing negative for NAT assays. It highlighted some issues with blood donors who tested repeatedly but confirmed positive upon having further tests. Change in risk pathogens and longer transmission-risks exposure, especially among the elderly, attributes to the uneven age distribution for healthy and NAT positive donors.

Chinese studies found a gradual reducing prevalence in the infection rates transfusion-transmitted HCV in the current years[10]. However, the present residual risk of the country was higher than that found in developing. In Iran, the pervasiveness of TTIs among blood donors recommends that the majority of the wellbeing estimates utilized in later had been active as the prevalence rates for HCV have significantly decreased [21; 4]. In Pakistan, a major TTI transmitting risk factor is a blood transfusion. It indicates the need for compulsory screening of the contagious indicators in blood contributions [6].

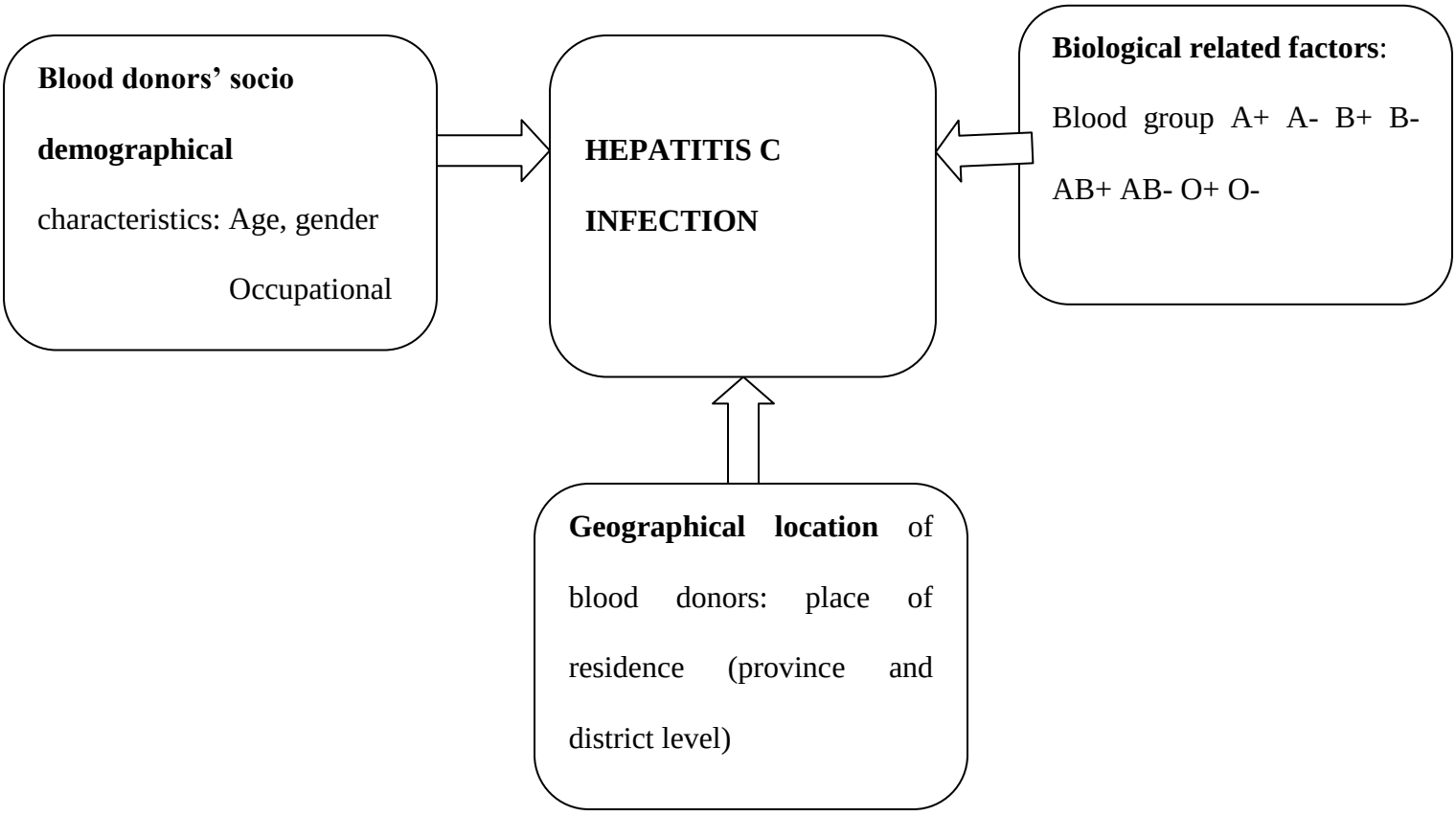
2.3 Conceptual Framework

The conceptual framework Fig 1 shows the linkages expected between hepatitis C infection among Blood donors and socio-demographic characteristics related factors, location of blood donors and blood group characteristic.

The variables used in this framework were based on the literature review.

The conceptual framework guiding the study is as illustrated in

Figure 2.1: Conceptual framework



CHAPTER THREE:
RESEARCH METHODOLOGY

3.1 Research Design

A cross sectional retrospective survey on the secondary data of NCBT for one year (2018) study was completed in blood donors' information of Five provincial transfusion focuses covering the entire nation.

3.2 Research Setting

The study was conducted in Rwanda (National Center for Blood Transfusion) and it covered all the voluntary blood donors aged 18-60 as the acceptable range of donating blood. The data were from the five Provinces for 2018. A questionnaire used for collecting information and getting the consent from during donation time will be found in the annex of this document

3.3 Target population

The target population of this study were all recorded and tested blood Blood Donors who donated blood in all provinces of Rwanda within the year of 2018 from January to december.

3.3.1 Source of data

NCBT has five Regional Centers for Blood transfusion (RCBTs). These Regional centers are integrated with hospitals in health system infrastructure located in all four provinces of the country plus the City of Kigali. Countrywide NCBT has 5 fixed blood collection sites and 589 mobile blood collection sites .a volunteer blood donors meet the technical team of NCBT at any site and they give blood after filling a blood donor’s questionnaire. Organization of that activity is a partnership between of NCBT, local leaders and existing blood donors

A total of 44,520 blood donors have donated from January to December 2018.some of them have donated more than one times, the total blood units collected by the year were 66.550 all the data were merged to the concern donor.NCBT have a central electronically data base combing all five RCBT data. Only NCBT staff can access. the obtained data Information was sorted and only that which pertained the study was entered into the researcher’s data set for analysis. No hardcopies of the data were obtained. Softcopies were kept safe from

unauthorized access, accidental loss, or destruction as encrypted files in computers, and all analyses carried out were appropriate.

accumulation, the reason for which information was gathered, and the substance of the information

3.4 Sample size:

Total of **44,520** blood donors who donated blood during research period were considered by study. It was a general population of Blood donors from January to December 2018

3**.4.1 Inclusion Criteria**

All donors who were eligible and donated blood

Age 18-60

Weight >50

Not having any deferral for blood donation as indicated on blood donor questionnaire

Accept to sign the consent before donating blood

3.4.2 Exclusion Criteria

All blood donors who were not eligible during the study period

Study variables

- ✓ Dependent variable:

Prevalence and geographical distribution of hepatitis c among blood donors

Were assessed in different categories of Blood donors

- ✓ Independent variables

Socio demographical characteristics

Age: categorized into three categories (18-30, 31-40 41-50 and <50 age).

Sex: two categories Male and Female

Occupation: farmes,students,military and police,other(business,none,and other business)

Biological characteristics:

Blood group: A+ -,B+- O+- AB+-

Location: blood donors were analyzed according to their location address by district. All 30 districts

3.5 Data management and data analysis

Records of viral screening results from January to December2018 of blood donors referring to 5 regional RBC transfusion centers were reviewed. Serologic screening using the ARCHITEC anti HCV-chemiluminescent immuno assay technology for anti-HCV in human serum and plasma were performed in all samples collected during the research period. Result Donor's demographic characteristics of age, gender, occupation,Blood goup and place of residency were entered in to the information sheets. The results for all donors' tests for HCV were extracted from the electronic database in the main NCBT. The data was analyzed according to 30 districts then to the five provinces; Kigali, Eastern, Western, Southern, and Northern. Age, Blood group Gender and occupation of donors were used to compare epidemiological features. Data was entered in Microsoft Excel sheets and exported to the Statistical Packages for Social Sciences (SPSS) software (IBM SPSS Statistics 23, NY USA) for analysis. The geo-location data of the patients were analyzed by GIS package version 2.18.

The association between HCV and other categorical variables was measured using the Pearson Chi-square test. Bivariate and multivariable models were used in assessing potential HCV infection determinants. The logistic channels were used in the process, with the outcome variable being HCV prevalence. Socio-demographic factors that associate with HCV prevalence were tested using multivariate analysis. Other variables used in bivariate analysis were to be included in the multivariate regression model on the condition that their

inclusion was theoretically logical. A p-value which produced a final model in determining an independent link among variables and HCV infection was used to remove insignificant variables through the backward stepwise technique.

3.6 Ethical considerations

Secondary data obtained from NCBT donor data base and was kept privately and confidentially and only used for academic purposes. All material related to the study was secured The consent form which authorized the researcher to use blood donated; in research interest was signed by the donor on questionnaire before donating blood. All donations were hidden by the code not by donor name. In addition, the study was performed in accordance with provisions of good Clinical Practice guidelines.

CHAPTER FOUR:
RESULTS AND DISCUSSION

4.1 Results

4.1.1Socio-Demographic Characteristics of Blood Donors

Socio-demographic characteristics of the study population are presented in Table 1. Most of the samples were from male donors 68.6% representing more than half of the total samples. The mean age of the participants was 29.9 years. More than half of the population was 18 – 30 years (59.2%), 25.1% were 31 – 40 years, 12.6% were 41 – 50 years, and 2.9% were 51 and above years. 51.2% of the blood donors, which was more than half of the acquired samples were farmers, 28.9% were students, 10.7 were military/police, Most of the blood donors screened were from Southern Province (25.9%) followed by Western Province (22.1%), and Kigali Province (9.8%) had the lowest number of blood donors among the samples. The high number of blood donors were founded in Musanze(5%) ,Burera(4.7%),Ruhango(4.4),Gasabo(4.4%) and Gakenke(4.2%) districts the lowest number of blood donors they were founded in Kayonza district(1.1%)

Table4. 1: Socio-demographic characteristics of blood donors

Variables	Frequency	Percentage
Gender (n=44520)		
Female	13978	31.4
Male	30542	68.6
Age category (n=44520)		
18 - 30 Years	26453	59.4
31 - 40 Years	11158	25.1
41 - 50 Years	5617	12.6
51 Years and Above	1292	2.9
Occupation (n=44520)		
Student	12849	28.9
Millitary and Police	4760	10.7
Farmers	22776	51.2
Others	4135	9.3
ABO RHD R (n=44520)		
A NEG	552	1.2
A POS	10757	24.2
AB NEG	89	.2
AB POS	1871	4.2
B NEG	423	1.0
B POS	8315	18.7
O NEG	1221	2.7
O POS	21290	47.8
Province		
Kigali	4355	9.8
Southern	11530	25.9
Western	9827	22.1
Northern	9214	20.7
Eastern	9594	21.5

District (n=44520)		
MUSANZE	**2248**	**5.0**
BURERA	**2098**	**4.7**
NYAMASHEKE	1979	4.4
RUHANGO	1957	4.4
GASABO	1941	4.4
GAKENKE	1879	4.2
HUYE	1840	4.1
BUGESERA	1780	4.0
GICUMBI	1765	4.0
RUSIZI	1749	3.9
MUHANGA	**1694**	**3.8**
NYABIHU	**1645**	**3.7**
RWAMAGANA	1594	3.6
KIREHE	1563	3.5
NYAMAGABE	1502	3.4
GISAGARA	1481	3.3
RUTSIRO	1461	3.3
NYAGATARE	1444	3.2
GATSIBO	1437	3.2
KARONGI	1360	3.1
NYARUGENGE	1324	3.0
NGOMA	1303	2.9
KAMONYI	1270	2.9
RULINDO	1224	2.7
KICUKIRO	1090	2.4
RUBAVU	1000	2.2
NYANZA	930	2.1
NYARUGURU	856	1.9
NGORORERO	633	1.4
KAYONZA	473	1.1

4.1. 2 Prevalence of hepatitis C

A total of 44,520 samples from blood donors were available for analysis. Among the samples, 97.5% were non-reactive, and 2.5% were reactive on HCV test as presented

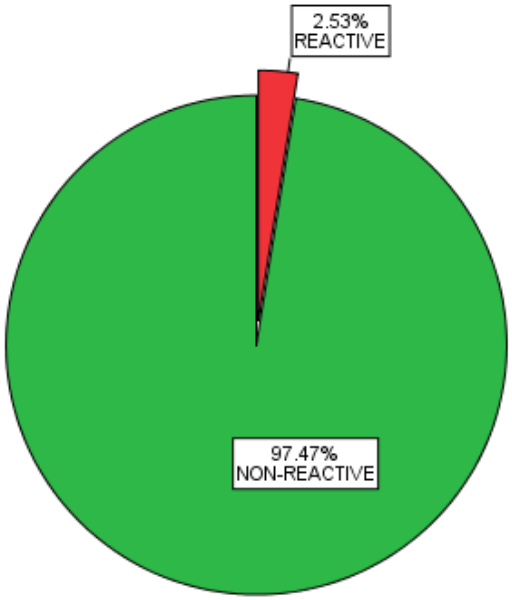


Figure4. 2: HCV Samples

4.1.3 Relationship between HCV status and socio demographic characteristics

Table 3 shows socio-demographic characteristics and risk exposures of participants. There were high HCV infection rates among male donors 785 (2.6%), donors within the age group of 18 – 30, 728 (2.8%), and among military 140 (2.9%). Southern province, 410(3.6%) recorded the highest number of HCV positive incidence cases.

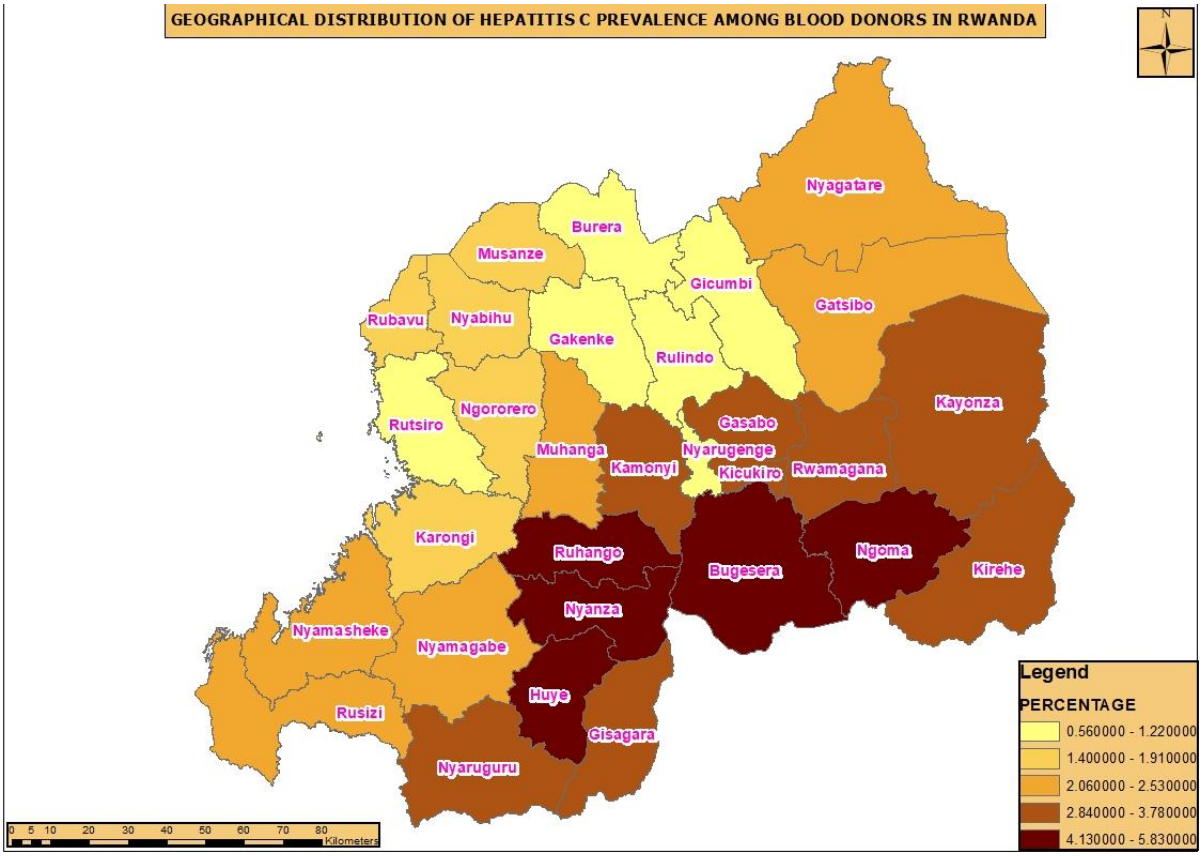
Table4. 2: HCV Prevalence by different characteristics

Characteristics	Number of Participants (%)	HCV prevalence by Characteristics(%)	HCV Ab negative by Characteristics(%)
Gender			
Male	30,542 (68.6%)	785(**2.6%**)	29,757(97.4%)
Female	13,978 (31.4%)	340(**2.4**%)	13,638(97.6%)
Age			
18 - 30 Years	26,453 (59.2%)	728(**2.8%)**	25,725(92.7%)
31 - 40 Years	11,158 (25.1%)	245(**2.2%)**	10,193(97.8%)
41 - 50 Years	5,617 (12.6%)	126(**2.2%)**	5,491(97.8%)
51 Years and Above	1,292 (2.9%)	26(**2.0%)**	1,266(98/0%
Occupation			
Student	12,849 (28.9%)	321**(2.5%)**	12,528(97.5%)
Military/Police	4,760 (10.7%)	140**(2.9%)**	4,620(97.1%)
Farmers	22,776 (51.2%)	590**(2.6%)**	22,186(97.4%)
Other Occupations	4,135 (9.3%)	73(**1.8%)**	4,061(98.2%)
Province of Screening			
Kigali Province	4,355 (9.8%)	101(**2.3%)**	4,254(97.7%)
Southern	11,530 (25.9%)	410(**3.6%)**	11,120(96.4%)
Western	9,827 (22.1%)	182**(1.9%)**	9,645(98.1%)
Northern	9,214 (20.7%)	91(**1.0%)**	9,123(99.0%)
Eastern	9,594 (21.5%)	341**(2.5%)**	9,253(96.4%)
ABO RHD R			
A NEG	552 (1.2%)	9(1,63)	543
A POS	10757 (24.2%)	259(2.4)	10498
AB NEG	89 (0.2%)	4(4,4)	85
AB POS	1871 (4.2%)	67(3,5)	1804
B NEG	423 (1.0%)	9(2,12)	414
B POS	8315 (18.7%)	212(2,54)	8103
O NEG	1221 (2.7%)	23(1,88)	1198
O POS	21290 (47.8%)	541(2.54)	20749

4.1.3 Geographical Distribution of Hepatitis C among Blood Donors in Rwanda

Figure 3 illustrated the distribution and prevalence according to districts. The top five districts in the country with high prevalence rates among blood donors included Ngoma 5.8%, Nyanza 5.2%, Bugesera 4.8%, Ruhango 4.2%, and Kayonza 4.7%. Burera was the one with lowest prevalence 0.75%.

Figure4.3:Geographical Distribution and Prevalence of Hepatitis C by District, Rwanda



4.1.4 Bivariate analysis of HCV infection among Blood donors

Statistics from the bivariate analysis did not find any correlations between gender and Hepatitis C infection since the p-value (0.397) was not statistically significant, hence, the . Significant correlations (p= <0.003) were found between age, and occupation (p=

<0.005)and Hepatitis C infection, there were a correlation between districts location of donors and HCV with a P value of *(p*=0.0001)

Table4. 3: Bivariate analysis of HCV infection among Blood donors

Variables	**HCV CONF**		**P-Value**
	REACTIVE	NON-REACTIVE	
Gender (n=44520)			
Female	340	13638	0.397
Male	785	29757	
Age category (n=44520)			
18 - 30 Years	728	25725	0.003
31 - 40 Years	245	10913	
41 - 50 Years	126	5491	
51 Years and Above	26	1266	
Occupation (n=44520)			
Student	321	12528	0.005
Millitary and Police	140	4620	
Farmers	590	22186	
Others	74	4061	
ABO RHD R (n=44520)			
A NEG	9	543	<0.0001
A POS	259	10498	
AB NEG	4	85	
AB POS	67	1804	
B NEG	9	414	
B POS	212	8103	
O NEG	23	1198	
O POS	541	20749	

Provinces			
Kigali	101	4254	<0.0001
Southern	410	11120	
Western	182	9645	
Northern	91	9123	
Eastern	341	9253	
Districts			
MUSANZE	33	2215	<0.0001
BURERA	15	2083	
NYAMASHEKE	48	1931	
RUHANGO	83	1874	
GASABO	58	1883	
GAKENKE	18	1861	
HUYE	76	1764	
BUGESERA	86	1694	
GICUMBI	10	1755	
RUSIZI	41	1708	
MUHANGA	43	1651	
NYABIHU	30	1615	
RWAMAGANA	47	1547	
KIREHE	46	1517	
NYAMAGABE	31	1471	
GISAGARA	56	1425	
RUTSIRO	11	1450	
NYAGATARE	32	1412	
GATSIBO	32	1405	
KARONGI	26	1334	
NYARUGENGE	12	1312	
NGOMA	76	1227	
KAMONYI	46	1224	
RULINDO	15	1209	
KICUKIRO	31	1059	
RUBAVU	14	986	
NYANZA	48	882	
NYARUGURU	27	829	
NGORORERO	12	621	
KAYONZA	22	451	

4.1.5 Socio demographical factors and HVC infection association

In the multivariate analysis as shown in Table 3 blood donors between31-40 years [aOR = 1.264, 95%CI:(1.086-1.471)and 41-50 years [aOR = 1.250, 95%CI: (1.028-1.520)were 1.2 more likely to have high HCV compared to those in the age category of 18 – 30. Multivariate analysis results for occupation revealed that none of the occupations were significant associated with HCV. Unless blood group ABpos ABneg all other blood groups were founded associated with HCVinfection compare to the blood group Aneg, recorded that among blood donors of group O- [aOR = 30.811, 95%CI:(1.851-512.801)] followed by B- [aOR = 25.814, 95%CI:(1.479-450.706)].

Relative to Kigali Province, but for those who lived in Burera OR:7 CI:(4.2-12.7),Nyamasheke OR:5,3 CI(3.2-9.9),Gakenke OR:8.8 CI(4.5-17,1), Kamonyi OR 5.4 CI(2.948-9.963),Nyanza OR 4.10 CI(2.356-7.138)

Were more likely to have hepatitis c infection compared to those who live in Musanze district

Table4. 4: Multivariate analysis of factors associated with HCV infection

Variables	B	Full model				Reduced Model			
		P-value	Odd ratio	95%CI		P-value	Odd ratio	95%CI	
Age category									
18 - 30 Years	REF								
31 - 40 Years	.288	.000	1.333	1.136	1.564	**.002**	**1.264**	1.086	1.471
41 - 50 Years	.276	.007	1.318	1.077	1.613	**.025**	**1.250**	1.028	1.520
51 Years and Above	.341	.097	1.406	.940	2.105	.164	1.327	.891	1.978
Occupation									
Student	REF								
Millitary and Police	-.050	.671	.952	.757	1.197				
Farmers	-.216	.013	.806	.679	.956				
Others	.058	.688	1.060	.798	1.409				
ABO RHD R									
A NEG	REF								
A POS	3.098	.029	22.143	1.367	358.599	**.027**	**23.083**	1.426	373.689
AB NEG	2.401	.112	11.036	.572	213.005	.104	11.650	.604	224.747
AB POS	2.642	.064	14.041	.860	229.147	.060	14.554	.892	237.445
B NEG	3.209	.028	24.752	1.417	432.329	**.026**	**25.814**	1.479	450.706
B POS	3.029	.033	20.678	1.276	335.045	**.031**	**21.517**	1.328	348.518
O NEG	3.381	.018	29.406	1.766	489.665	**.017**	**30.811**	1.851	512.801
O POS	3.057	.031	21.257	1.315	343.739	**.029**	**22.160**	1.371	358.183
Provinces									
Kigali	REF								
Southern	-1.390	.000	.249	.132	.470				
Western	.404	.344	1.497	.649	3.457				
Northern	-.073	.855	.929	.424	2.037				
Eastern	-1.523	.000	.218	.116	.410				

Districts									
MUSANZE	REF								
BURERA	.525	.153	1.691	.822	3.476	**.000**	**7.324**	4.211	12.740
NYAMASHEKE	.243	.489	1.276	.640	2.542	**.000**	**5.374**	3.216	8.979
RUHANGO	-1.112	.001	.329	.173	.626	.004	1.644	1.170	2.312
GASABO	.822	.000	2.275	1.504	3.439	.000	2.231	1.476	3.373
GAKENKE	.787	.055	2.196	.983	4.906	**.000**	**8.876**	4.593	17.153
HUYE	.146	.413	1.158	.816	1.643	.093	1.345	.951	1.902
BUGESERA	.028	.864	1.028	.747	1.415	.192	1.237	.899	1.701
GICUMBI	.210	.276	1.234	.846	1.799	.102	1.358	.941	1.959
RUSIZI	-.958	.008	.384	.188	.781	.000	2.837	1.812	4.442
MUHANGA	.088	.722	1.092	.672	1.775	.655	1.116	.689	1.809
NYABIHU	-1.013	.004	.363	.182	.725	.011	1.727	1.136	2.626
RWAMAGANA	.545	.004	1.725	1.194	2.493	.006	1.671	1.159	2.409
KIREHE	.587	.003	1.799	1.227	2.636	.000	2.009	1.382	2.920
NYAMAGABE	-.208	.508	.812	.439	1.503	.000	3.521	2.342	5.295
GISAGARA	-.190	.245	.827	.600	1.140	.224	.821	.597	1.129
RUTSIRO	-.931	.027	.394	.173	.899	.001	2.832	1.533	5.229
NYAGATARE	-.931	.009	.394	.196	.791	.000	2.864	1.876	4.374
GATSIBO	.797	.000	2.220	1.467	3.359	.000	2.302	1.523	3.481
KARONGI	.737	.001	2.090	1.374	3.177	.000	2.568	1.688	3.906
NYARUGENGE	-1.218	.000	.296	.153	.574	.000	2.247	1.559	3.237
NGOMA	-.224	.229	.799	.555	1.151	.972	.994	.689	1.433
KAMONYI						**.000**	**5.420**	2.948	9.963
RULINDO	.324	.152	1.382	.888	2.151	.025	1.659	1.065	2.585
KICUKIRO	-.666	.101	.514	.232	1.139	.000	3.850	2.171	6.827
RUBAVU						.202	1.226	.897	1.677
NYANZA						**.000**	**4.101**	**2.356**	**7.138**
NYARUGURU	-1.154	.001	.315	.161	.616	.000	2.205	1.507	3.227
NGORORERO						**.000**	**7.099**	**3.769**	**13.372**
KAYONZA	.566	.002	1.762	1.222	2.541	.004	1.718	1.194	2.473

4.2 Discussion of Findings

The current study estimated a 2.4% HCV reactive prevalence rate from an analysis of blood donors HCV results for the year 2018.this is a high prevalence because it was measured in low risk population, where other risk factors has been eliminated.The study's prevalence rate was slightly higher than analysis conducted in Rwanda where the prevalence was 1.6% among the donors of first time [19]. The reason for the difference is that the previous had considered the samples with CMIA tested and high concentration of IgG value at least 5 sign to cut off. Previous estimates by scholarly evidence from Rwanda among special populations have produced estimates ranging from 4.6% to 2.6% [19; 24].Empirical evidence rates the prevalence of HCV among the general population to the ranges of 0.1% and 17.5%, and an average rate of 5.3%, which is the highest according to WHO records [12]. Within the East and Central African region, the Burundi's prevalence rate is 11.3%, Uganda (6.6%), Sudan (2.8%), Kenya (0.9%), Tanzania (3,2%), and Rwanda (4.1%). A critical analysis of the figures indicates that among the countries within the East African Community, Rwanda is rated third in terms of high HCV prevalence rates in general population.

The current study has reported a high prevalence rates of HCV infection among male donors 785 (2.6%).this can be explained by gender distribution of donors where 68% of donors are male

within the age group of 18 – 30, 728 (2.8%), and among military 140 (2.9%). Southern province, 410(3.6%) recorded the highest number of HCV reactive cases. study has found that the Northern province have lower Seroprevalence for HCV compared to other provinces. This may be due to high migration across the border and a big number of refugees camp.

The District HCV prevalence rankings from the study are somehow low compared to those carried out by similar analysis ranked Bugesera (10.7%) with the highest prevalence rate researchers [19; 24], while for our study, the prevalence rate for Bugesera was (4.8%), with the highest HCV infection rates being recorded in Ngoma District (5.8%). The findings of the study were similar to a 2017 Rwanda National HIV and Viral Hepatitis campaign conducted by the Ministry of Health that reported HCV prevalence rates of 5% and above among districts in Rwanda. Four of the districts with the highest HCV infection prevalence rates

(Nyaza, Ruhango, Bugesera, and Ngoma) were similarly identified by the ministry's report, and hence similarities in geographical distribution trends. The global epidemiological data have shown that the distribution of HCV genotypes varies by geographic region [(11)]. In Rwanda, Hepatitis C virus infections have been well documented among different populations as well as the general population[(19; 24; 17)]. The findings of the current study is similar to those by Makuza [(17)]and Umutesi [(24)]who identified Southern Province as having the highest HCV infection prevalence rates.

In multivariate analysis three variables were statistically significant in the association with Hepatitis C. age blood group and location of donors

For gender, sex, and occupation were not enough statistically to confirm an association with HCV infection among blood donors. the donors who were in age category of 31-40 and 41-50 [OR = 1.250, 95%CI: (1.028-1.520) were 25% more likely to be associated with a high HCV infection compared to those in the age category of 18 – 30.this could happen due to the age generation targeting in blood donation session. this is in line with Rwandan empirical evidence on the prevalence of HCV among pregnant women living with HIV associated old age with high HCV infections, with the trend increasing with the age group [(19; 24)]. Compared to the findings said that HCV prevalence rate increased with increase in age, a trend which was in line with those conducted in Rwanda. [(19; 24)].

Compared to blood group A- all other blood groups were found to be associated with high HCV reactive, recorded among blood doors of group O- [OR = 30.811, 95%CI:(1.851-512.801)] followed by B- [OR = 25.814, 95%CI:(1.479-450.706)]. Low HCV prevalence rates were recorded among blood donors of group AB+ [aOR = 14.554, 95%CI:(.892-237.445)] and AB- [aOR = 11.650, 95%CI:(.604-224.747)]. ABO blood group has been associated with the risk for numerous diseases.The current study observed that HCV infections were higher among blood donors in group O- and lowest among blood donors in group AB. this can be related to red cell immune adherence function among different blood type but it need further analysis study . The findings of the study were similar to previous studies conducted in Baghdad and India that reported high seroprevalence of HCV were found to be higher in donors of blood group O and lowest in blood group AB donors[(20; 7)].

Burera ,Gakenke ,Nyamasheke, Kamonyi and Nyanza districts were likely associated with HCV infection more than 5 times compared to those who live in Musanze District.

4.2 Limitations and Challenges

Secondary data analysis involves research that is not collected directly from the participants. The study faced limitation associated with the official statistics reflecting biases to what could be established, more so, given that the blood samples were from voluntary blood donors, and thus, it was hard for the resarcher to determine the motive for donation, which could could be other raison.

Like many immunoassay architect system is prone to produce non specific reactions, so the result can be overestimated

The data covered samples of the populations that NCBT wanted to examine, hence the sufficiency of details was a challenge. Given that the researcher was required to sort out the data and organize in into excel computer set, the process is prone to typing errors. Another limitation was associated with the inability of the researcher to vet the data set, due to their inability to know exactly how the data was collected,

CHAPTER FIVE:
CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusion

Compared to previous estimates in general population, the study recorded a lower prevalence of HCV among blood donors(2.4%)

The current study have shown that Blood donors between 31-40 years and 41-50 years were associated with high HCV infection compared to those in the age category of 18 – 30. five districts in country where founded to have a high prevalence rate of HCV: Ngoma 5.8%, Nyanza 5.2%, Bugesera 4.8%, Ruhango 4.2%, and Kayonza 4.7% .study have have not found any significant association of Occupation and Sex with hepatitis c.five district Burera,Nyamasheke,Nyanza,Kamonyi and Gakenke were highly associated (more than 5%) with HCV infection compared to Musanze district

5.2Recommendations

The study recommended the following:

5.2.1 Ministry of Health

- There should be national screening of HCV, decentralized at village level(umudugudu) regardless of age, region or occupation to understand better this infection for adequate intervention
- Elaborating HCV management protocol at health center and district hospital level
- Surveillance for HCV among youth in both village and urban settings; as youthful age is an intermediary for late contamination with HCV, understanding the socioeconomics and hazard variables of youngsters with HCV can target HCV new infections
- The Ministry of Health together with the Ministry of Youth, Sports, and Culture should embark on serious sensitization programs among the youth engaging in injectable drug abuse as a strategy to limit cases of HCV infection through shared needles/syringes.
- Collaboration with boarders countries where can be a source of contamination

5.2.2 RBC

- With the high prevalence being accounted for among old blood donors, all the more screening for HCV can concentrate on this age group.
- Further investigations aimed at determining the epidemiology of disease transmission. of HCV among the all-inclusive community,
  will be of an incentive in deciding the security of blood/blood components.
  Further investigation on HCV-HIV co infection can lead to understand and better management of the problem
- Knowledge in various hazard practices of vulnerable population and methods of transmission of the infection will illuminate general wellbeing aversion methodologies.

5.2.3 NCBT

- A systematically follow up of donors who have reacted and referred, to know if they really consulted the health facilities
- Perform test repeatedly reactive specimens with sensitive supplemental test for exclude the false reactivity
- To reinforce a blood donor selection method for minimizing the risk factors among blood donors
- To minimize the session of blood collection in most affected area and increase the collection site in less affected area.

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