

SERO-EPIDEMIOLOGY OF TRANSFUSION TRANSMISSIBLE INFECTIONS (TTIs) AMONGST VOLUNTARY BLOOD DONORS IN ERINGETI, DEMOCRATIC REPUBLIC OF THE CONGO (D.R.C).

Authors' contributions

This work was carried out in collaboration between all authors. Authors MKI and JKK designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors GKB, VKT, MMV, TKK, SV and FKS managed the analyses of the study and the literature searches. All authors read and approved the final manuscript.

ABSTRACT

Background: The seroepidemiology of transfusion transmissible infections (TTIs) is generally lowly reported in many rural settings of Africa particularly in the Democratic Republic of Congo (DRC).

Objective: The objective of this study is to assess the sero-epidemiology of TTIs amongst voluntary blood donors at the Health Center of Reference, Eringeti-D.R.C.

Methodology: This was a cross-sectional retrospective study of blood bank records carried out between 1st January and 31st December on 139 voluntary blood donors at the haematology laboratory of the Health Center of Reference, Eringeti-D.R.C.

Results: One hundred and thirty nine out of 961 blood donors were found to have TTIs (prevalence 14.5%) majority of whom were males (61.1%) and aged between 17 years and above. Most of the patients with TTIs were from the village of Eringeti, single and farmers without any level of education. Syphilis, Hepatitis B virus, HIV and the Hepatitis C virus were more represented with 38.1%, 30.2%, 20.1% and 11.5 % respectively followed by HIV-confection with syphilis, hepatitis B and syphilis -Hepatitis B and C in the same proportion of 0.7%.each respectively. The former donors were no longer affected by the TTIs with 55.4%.

Conclusion: Blood safety with respect to TTIs is a still key health problem and enormous efforts are required to effectively organize blood safety interventions in the rural eastern part of D.R.C.

Recommendation: The establishment of a safe supply of blood and the provision of stable funding for blood safety activities at the Health Center of Reference, Eringeti-D.R.C could improve the quality of blood product distributed to the population in this rural setting.

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Keywords: Sero-epidemiology, voluntary blood donors, transfusion transmitted infections, blood safety, Eringeti, D.R.C.

INTRODUCTION

Blood transfusion as one of the most sensitive activities in the health care system may be life-saving and play contribute in the care and wellbeing of patients but it also carries risks of transmitting blood borne pathogens [1][2]. Interventions in Blood safety therefore concerns all stages of the transfusion chain, from the collection of blood products to the monitoring of post-transfusion recipients including the epidemiological monitoring of donors [3, 4, 5].

In the early 90's, it was estimated that, up to 10% of HIV could have been due to contaminated blood transfusions but as at today, blood contaminated with HIV is reported to be responsible for only 5% of HIV infections in Africa [6].

Globally, there are significant variations in the extent to which testing is performed as well as the strategies adopted for this screening, the overall quality and effectiveness of such blood screening process. In some countries, recipients of blood and blood products are exposed to unacceptable risk of transfusion transmissible pathogens because quality screening tests are not satisfactorily in place. [7]. [8].

The 2007 World Database of the World Health Organization (WHO) on Blood Safety (GDBS) reported that, of the 155 countries reportedly practicing HIV testing on 100% of blood donations, only 71 realize a guaranteed quality screening [9]. According to WHO, 5 to 10% of HIV infections worldwide are transmitted by transfusion of blood or blood products. An even greater number of labile blood product recipients are contaminated with hepatitis B and C, Treponema syphilis and other infectious agents [10].

More than 3 million units of blood donations are collected each year in France and these are subjected to quality screening of all known active infections transmitted through blood; viral hepatitis, syphilis, HIV, Human T cell lymphotropic Virus (HTLV), Chagas disease and malaria [11].

In Africa, research works are often limited to local initiatives which hardly represent generalized conclusions for the region. [12, 13] At the National Blood Transfusion Center in Bamako, all blood units are tested for HIV, hepatitis B, hepatitis C and syphilis since 2004 and the prevalence for these TTIs in 2007 were 2.6%, 13.9%, 3.3% and 0.3% respectively. [14] In D.R.C, the

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transfusion system is a colonial legacy. The political and socio-economic crisis that the country has been experiencing for some decades has led to a profound disruption of its socio-economic development, particularly its sanitary apparatus [15]. The transfusion system is also affected as it is still at the implementation phase. In the period between 2001 to 2012, there were 112,882 volunteer blood donors mobilized, more than 80% of safe blood products and over 80% of needs covered. Furthermore, 89 688 HIV infections were averted. During the same period, 8461 people have been trained in blood transfusion. With blood safety practice, there has been a regression of viral markers. Thus, HIV prevalence declined from 4.7% to 2.1% between 2001 and 2012; while hepatitis B declined from 7.1% to 3.5% and hepatitis C declined from 11.8% to 2.3% between 2004 and 2012 [16].

A study at the Blood Transfusion Center in Kisangani in 2007 showed that, about 3390 blood donors, 159 (4.7%) had the risk of transmitting HIV, 182 (5.4%) hepatitis B and 126 (3.7 %) syphilis [17].

Relatedly, a recent study among blood donors in Kalemie showed that, of 13,500 donors surveyed from January to December 2013, 293 (2.2%), 198 (1.5%) and 140 (1%) risk respectively transmitting HIV virus, hepatitis virus B and C [18].

From the above, blood transfusion remains a risk therapy and a major public health problem in our communities where we do not yet benefit from all the technological advances associated with blood safety.

Given the paucity of data on blood safety monitoring in the rural eastern part of D.R.C, this study aims to assess the sero-epidemiology of transfusion transmissible infections in voluntary blood donors at the Health center of Reference, Eringeti-D.R.C.

MATERIAL AND METHODS

Study Middle

Our study was conducted in the laboratory service of the Health Center of Reference Eringeti located in the village of Eringeti located in the North Kivu province of Beni territory in the north-Eastern part of DCR. It is a village 60 km north-east of Beni, town in the Oicha health area, along the border with the province of Ituri.

The laboratory service of Health Center of Reference Eringeti consists of a single room, with hematology and parasitology department. It has two electric microscopes, a centrifuge and a freezer.

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Methods

This was a cross-sectional retrospective study, covering a period from 1st January to 31th December 2017. This study involved 139 voluntary blood donors. The sample was comprehensive. The information for each voluntary blood donors was collected on the laboratory register with the following elements: gender, age, address, marital status, occupation level of study and type of donation. Testing was done using different markers. The technique was to identify antibodies against the pathogen sought using the rapid diagnostic test (RDT) strips. These were composed of two parts: the first to confirm the validity of the test and the second for the specific properties, the test. Thus, in case of positive test, a red thong should appear in the first and second zone. If negative, the red strap should only appear in the first zone. Data entry and analysis was performed using the EPI INFO software version 3.5.4. The standards of ethics were respected in carrying out this work. Confidentiality was guaranteed for voluntary blood donors participating in the study.

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RESULTS

1. Prevalence of Transfusion Transmissible Infections (TTIs) among voluntary blood donors in the laboratory service of Health Center of Reference Eringeti-D.R.C.

During our study period, 961 voluntary blood donors were found in the laboratory service of Health Center of Reference Eringeti among which 139 had transfusion transmissible infections, the prevalence was 14.1%.

2. Socio-demographic Characteristics of voluntary blood donors infected with transfusion transmissible infections

The table below replied voluntary blood donors based on their socio-demographic characteristics.

Table I. Distribution of voluntary blood donors according to their socio-demographic characteristics

Characteristics	Number	Percentage
Sex		
Female	54	38.9
Male	85	61.1
Age in years		
Less than 20 years	75	54

21-30	27	19.5
31-40	24	17.2
41-50	13	9.3
Occupation		
Farmer	83	59.7
Student	34	24.5
Military	18	13
Teachers	4	2.8
Level of Education		
No level of Education	65	46.7
Primary	44	31.6
Secondary	30	17.7
University	0	0
Marital status		
Married	27	19.4
Single	95	68.4
Divorced	17	12.2
Address		
Eringeti	103	74.1
Outside Eringeti	36	25.9
Total	139	100

3. Distribution of voluntary blood donors according on infections found in their blood.

The table below replied voluntary blood donors based on transmissible infections through transfusion.

Table II. Transfusion Transmissible Infections found.

Transfusion Transmissible Infections found	Number	Percentage
Syphilis	50	36
Hepatitis B	42	30.2
HIV	28	20.2
Hepatitis C	16	11.5
Coinfection HIV-Syphilis	1	0.7
Coinfection Syphilis, Hepatitis B and C	1	0.7
Coinfection hepatitis C- syphilis	1	0.7
Total	139	100

4. Distribution of voluntary blood donors according to the categories of donors

The table below replied voluntary blood donors according to their category.

Table III. Category of voluntary blood donors

Categories of voluntary blood donors	Effective	Percentage
Former	77	55.4
New	62	44.6
Total	139	100

DISCUSSIONS

This study has found the prevalence of Transfusion Transmissible Infections (TTIs) amongst voluntary blood donors at the laboratory service of Health Center of Reference Eringeti to be 14.1%.

In Butembo-D.R.C, about 2 984 blood bags collected in 2016 to the Blood Transfusion Center, 59 (1.9%) were infected. This value is higher than that found in a study done in Kisangani on voluntary blood donors in 2007 [19]. However, it is less than that found in a study done in Kinshasa on three infectious markers: HIV, HBV and HCV 2013 [20].

Studies in Africa have shown that, the provision of blood donations to low-risk individuals remains insufficient in the wake of the relatively high prevalence of transfusion transmissible infectious amongst voluntary blood donors throughout the continent. [21] In a stud by Josiane Pillonel between 1992 and 2002, about 31 million collected voluntary blood donors, 23876 voluntary blood donors were transfusion transmissible infectious with the frequency of 0.08% [22]. The observed decrease in the number of voluntary blood donors compared to our study is most likely multifactorial. The revision of transfusion indications, the evolution of surgical techniques in particular the development of endoscopic interventions and the development of autologous transfusion are factors explaining the decrease in the need for blood products [23].

In this research, males represent 95.7% of voluntary blood donors and majority of them were of lower age (20 years in 54% of cases), average age of 22 years and with extremes of years of donors as 17 and 50 years. The majority of them were single, without any level of education, farmers by occupation and living in the village of Eringeti respectively as reported in tables.....respectively 68.1%, 46.7%, 59, 7% and 74, 1% of cases.

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These results are explained by the fact that, this population is actively sexual, practicing unsafe and unprotected sex. The population of Eringeti is largely rural and ignorant of the practice of responsible sexuality. With the sale of agricultural products of their culture with the people from neighboring regions, this may be the main cause of sexual promiscuity and increasing TTIs in this population.

Fifty nine bags of blood was infected by TTIs in Butembo, 43 of these were collected respectively from bachelor (in 76.8%); married (in 17.9%); and divorced (in 5.4%) [19].

Works on this theme were done in 2008 in seven countries [24] and in 2011 in 15 countries in Africa [25]. These studies suggest that, in many Transfusion Centers in sub-Saharan Africa, the voluntary blood donors with TTIs are usually young, with an average age of 26 years (17-60 years) and males.

In America, Murphy EL and his colleagues reported that a higher prevalence of TTIs were found amongst men than women and in the average age of 30-39 years [26].

It is clear from this work that syphilis, Hepatitis B virus, HIV and Hepatitis C virus were over represented with respectively 36%, 30.2%, 20, 2% and 11.5% followed by co-infections HIV-syphilis, hepatitis B,C and syphilis and hepatitis C-syphilis in the same proportion is 0.7%.

Tagny and colleagues, in their study in francophone African countries, reported that, the average sero prevalence of TTIs were 1.84% for HIV antibody, 7.21% for hepatitis B virus (HBV) the antibodies, 1.99% for hepatitis C virus (HCV) the antibodies and 1.60% for antibodies to *Treponema pallidum* [25].

In France, the incidence rates of HBV, HIV and HCV decreased significantly between 1992 and 2000 except for hepatitis C virus for which the incidence continues to decline over the last period so that the Human Immunodeficiency Virus incidence was equal to or lower than that of hepatitis C virus until 1997-1999, it is now higher than that of hepatitis C virus [22]. This decrease in the number of donors and in parallel the number of donations in the last decade, the evolution of geo-demographic characteristics of the donor, the low prevalence and incidence of hepatitis B virus, hepatitis C virus and Human Immunodeficiency Virus compared to those observed in the population in general and decrease between 1992 and 2002 are all indicators of the selection of donors and its improvement during the study period.

In DRC, a study done from 2001 to 2012 found that of 112,882 voluntary blood donors mobilized, 89,688 HIV infections have been avoided by the systematic qualification of blood

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products. During the same period, 8461 people have been trained in blood transfusion and there was a decline in viral markers. Thus, HIV prevalence rose from 4.7% to 2.1% between 2001 and 2012 while hepatitis B experienced a decline of 7.1% to 3.5% during the same period. For hepatitis C, the rate increased from 11.8% to 2.3% between 2004 and 2012 [16].

Other studies have reported that the prevalence among new voluntary blood donors is consistent with those found in other populations. Moreover, comparisons of prevalence and impact with countries with similar criteria to those of France (England, Canada, and USA) show that the differences between the rates of the population of voluntary blood donors of these four countries are also found at the general population in these countries. Finally, if the improvement of donor selection over time has undoubtedly played a key role in decreasing the prevalence and impact, this change resulted probably also the preventive measures taken in the general population to avoid including new infections [22]. With the constant improvement of donor selection firstly, and secondly, to progress in the development of more sensitive screening tools and in the development of innovative screening measures blood components today present a very low viral risk [22].

The voluntary donation by subjects from low-risk group is associated with a lower prevalence of transfusion transmissible agents, and even more so that they are regular donors (they constitute 24% of all donors).

CONCLUSION

Transfusion transmissible infections are a major public health problem in the village of Eringeti that deserves immediate resolution.

The establishment of a blood bank, with full complement of recommended equipment and personnel is essential to safe transfusion at the Health Center of Reference Eringeti in order to improve and reduce the risk of transfusion.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. World Health Organization, Screening for transfusion-transmissible infections in donated blood: Recommendations, 2010, p6.
2. ABDELALI I, Blood transfusion in Morocco, thesis, 2012, issue 51, p162.

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3. WHO. Blood safety checklist for national blood programs. Geneva 1999. Comment [U26]: Reference is not complete.
4. Takpo JB, Samo, Diarra Namaa. Report on the status of blood safety in the WHO African Region for 2004. WHO, African, Brazzaville, Republic of Congo. Comment [U27]: Reference is not complete
5. Bates I, Manyasi A, Medina Lara A. Reducing replacement Donors in Sub-Saharan Africa: challenges and affordability. *Transfus Med* 2007; 17: 434-42.
6. World Health Organization. Blood donation and transfusion safety: global perspective. Checklist number, June 2005. Comment [U28]: Incomplete reference.
7. The World Health Assembly. Resolution WHA58.13: Blood safety: proposal to establish World Blood Donor Day In: Fifty-eighth World Health Assembly. Geneva, 16-25 May 2005. Geneva, World Health Organization, 2005. Comment [U29]: Incomplete reference.
8. Lefrere Jean Jacques, P. Rouger new practice of blood transfusion. Published by Elsevier: 2006; 158 p. Comment [U30]: Incomplete reference
9. WHO Global Database on Blood Safety, 2004-2005 postponement. Geneva, World Health Organization, 2008. Comment [U31]: Incomplete reference.
10. World Health Organization: Checklist for national blood programs. http://www.who.int/bloodsafety/quality/en/Quality_Aide-Memoire_French.pdf last updated: October 2004, Accessed 03/02/2018.
11. Vu S, Le Strat Y, Barin F, Pillonel J Cazein F, BousquetnV, et al. Population-based HIV-1 incidence in France, 2003-08: A modeling analysis. *Lancet Infect Dis.* 2010; 10 (10): 682-7.
12. Tagny CT, Mbanya D, Tapko JB, Lefrere JJ. Blood safety in Sub-Saharan Africa: a multifactorial problem. *Transfusion.* 2008; 48: 1256-1261. [PubMed: 18713111]
13. Tayou Tagny C, Owusu-Ofori S, D Mbanya, Deney V. The Blood donor in Sub-Saharan Africa: a review. *Trans Med.* 2010; 20: 1-10.
14. National Blood Transfusion Policy, Ministry of Health, Republic of Mali. Bamako, September 2008. Comment [U32]: Review reference.
15. J. KABINDA MAOTELA, ET AL. Blood transfusion in the Democratic Republic of Congo: efforts made and challenges, *Tropical Medicine and HEALTH* 2015; 25: 342-349.

16. Kabinda MJ, residual risk of transfusion Issues of HIV and hepatitis B and C in the Democratic Republic of Congo, a public health problem, docorat thesis, Free University of Brussels, 23-06-2015. Comment [U33]: Review reference.
17. BATINA A., S. Kabemba, MALENGELA R. Infectious markers Among blood donors in Democratic Republic of Congo (DRC): The case of Kisangani in Rev Med Brux - 2007, pp. 28: 145-149. Comment [U34]: Review reference.
18. Kabemba BUSAKA H.et al, seroprevalence of infection with human immunodeficiency and hepatitis B and C among blood donors in blood safety service Kalemie in Medicine of Black Africa, in January 2017; Flight. 64 (1). Comment [U35]: Review reference
19. OSSINGA BASSANDJA J. et al, seroprevalence of syphilis in voluntary blood donors in Kisangani, DRC, KisMed December 2014; Vol 5 (2) pp. 82-85. Comment [U36]: Incomplete reference
20. KABAMBA Nzaji M. KABYLA ILUNGA B. A study of the prevalence of infectious markers in blood donors in rural areas. The case of Kamina Hospital in Public Health, March-April 2013; flight. 25 (2), pp. 213-217. Comment [U37]: Incomplete reference.
21. Tagny T et al, the transfusion research group in Francophone Africa: review of the first five years, Transfus Clin Biol. 2014 March; 21 (1): 37-42. Comment [U38]: Check the use of authors and et al to correspond with this journals prescriptions.
22. Josiane P., Syria L. et al, epidemiological surveillance of blood donors France, 1992 - 2002, p100. Comment [U39]: Incomplete reference.
23. Pillonel J, David D, Pinget R Laperche S. Prevalence of HBV, HCV, HIV and HTLV in autologous blood donors in France entre 1993 and 2000. Transfus Clin Biol 2002, 9: 289-296.
24. Tagny CT, Diarra A, Yahaya R, et al. Characteristics of blood donors and Donated blood in sub-Saharan Francophone Africa. Transfusion. 2009; 49: 1592-9. [PubMed: 19389036]
25. Tagny CT, Kouao MD, Touré H, et al. Transfusion safety in Francophone African countries: an analysis of strategies for the medical selection of blood donors. Transfusion. 2012; 52: 134-43. [PubMed: 22014098]
26. Murphy EL, JP Figueroa, WN Gibbs, A Brathwaite, Holding-Cobham M, Waters D, Cranston B, B Hanchard, WA Blattner. Sexual transmission of human T-lymphotropic virus type I (HTLV-I). Ann Intern Med 1989 111: 555-560.