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Seroprevalence of Transfusion-Transmitted Infection in Different Type of Blood Donors

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A B S T R A C T

Background: Blood products play a very important role in treating numerous life-threatening conditions, but contain inherent possibility of acquiring blood transmitted diseases, including HIV, syphilis, HBV, and HCV. Over 1.5 million blood transfusions are performed in Pakistan every year by different categories of blood donors including, volunteer, replacement, and familial donors.

Objective: To access the prevalence of transfusion-transmitted infections (TTIs) among blood different type of blood donors.

Methodology: A cross-sectional research was carried out at the Al-Khidmat Foundation in Lahore, Pakistan, spanning from January 2021 to April 2022. During this period, blood donors underwent screening for HCV, HIV, HBV, malaria and syphilis.

Results: Total 2,236 of donors were included in current study, 85.6% of total were family donors, while 11.3% were voluntary donors, and replacement donors were about 3.1%. Total 1.6% of donors were female, with the remaining 98.4% blood donors were males. The predominant blood group among donors was B followed by blood group O, A and AB with 37.4%, 30.5%, 23.3%, and 8.8 percent respectively. Rh positive was 91.7%, while Rh negative was 8.3% among all the donors. The largest proportion of donors (69.3%) fell within the 18-30 age groups. A total of 3.3% of donors tested positive for transfusion-transmissible infections (TTIs), with HCV being the highest (1.3%) prevalent followed by syphilis (1.0%), Hepatitis B Virus (0.6%), and Human Immuno Virus (0.4%). No instances of malaria were recorded. Notably, the main occurrence of TTIs was observed among family donors.

Conclusion: Men donate blood more frequently as compared to females. The most frequently encountered type of donor is family donor, followed by volunteers and replacement donors. In terms of transfusion-transmitted infections (TTIs), family donors have a higher prevalence compared to voluntary and replacement donors. The most frequent blood groups type was blood group B followed by O, A, and AB, in that order.

Keywords: HBV, HCV, HIV, Syphilis, Malaria, ABO.

Introduction

Blood products play a crucial role in preventing and treating numerous life-threatening conditions, yet their utilization carries the inherent possibility of acquiring transfusion-transmitted diseases (TTIs), including HIV, syphilis, HBV, and HCV.[1] Any infection that can spread from person to person through blood transfusions is referred to as a TTI. In Pakistan, each year over 1.5 million blood transfusions are performed, this risk is particularly pronounced.[2] Unsafe transfusion practices contribute to alarming statistics, with the World Health Organization (WHO) reporting that 3.5% of the Pakistani population is infected with Hepatitis B Virus (HBV). Globally, the burden of Human Immunodeficiency Virus (HIV) affects 36.7

million individuals. However, it's important to note that the prevalence of these infections varies significantly between countries, highlighting the need for stringent safety measures and standardized protocols in blood transfusion practices worldwide.[3]

There are different types of blood donors including autologous, volunteer, replacement, and familial donors. In order to guarantee the adequate and safe quality of blood products, the World Health Organization (WHO) endorses that nations aim for self-sufficiency and support voluntary, anonymous, and unidentified blood donation. Research study showed that donors who get compensation are more likely to acquire transfusion-transmissible illnesses (TTIs).[4] In Pakistan, statistics reveal that 65% of blood donations originate from replacement donors, 25% from volunteer donors, and around 10% from professional donors. This highlights the importance of promoting voluntary donations to enhance the safety and availability of blood supplies.[5]

Ensuring the availability of safe blood and blood products stands as a paramount health priority globally. The potential risks associated with blood transfusions or blood product administrations, such as transfusion-transmitted infections (TTIs), underscore the importance for requirement of rigorous screening and constant improvements of safety protocols.[6] Among the notable TTIs, hepatitis B and hepatitis C viruses pose significant concerns. Hepatitis B spreads through mucosal or percutaneous exposure to infected blood or bodily fluids[7], while hepatitis C, a leading cause of liver transplantation worldwide, can transmit through various means including contaminated needles, sexual contact, and from mother to child.[8] Additionally, human immunodeficiency virus (HIV) remains a critical concern, affecting CD4 T-lymphocytes and compromising the immune system, leading to increased vulnerability to opportunistic infections.[9] The identification of the first HIV case among blood donors in Pakistan in 1988 serves as a poignant reminder of the ongoing importance of stringent blood safety measures to protect both donors and recipients alike.[10]

Further transfusion of blood and blood products has also been reported to transmit Treponema pallidum (TP) and malaria. Treponema pallidum (TP) is well-known for producing the sexually transmitted disease syphilis. It generally occurs on the oral and vaginal mucous membranes, although it can also cause cutaneous pustules.[11] On the other hand, malaria is a blood-borne disease that is spread by the bite of an Anopheles mosquito that is infected with the Plasmodium parasite.[12] While transfusion-transmitted illnesses are serious, it is critical to keep a close eye on how common they are in the community. This is necessary for the protection of blood safety as well as the assessment of the effectiveness of current blood safety procedures. This study aims to estimate the prevalence of transfusion transmitted diseases among different types of blood donors.

Methodology

Observational research was carried out at the Surriya Azeem Hospital in Lahore, Pakistan, at the Al-Khidmat Blood Bank. The research aimed to gather comprehensive demographic data concerning blood donors, encompassing variables such as age, gender, and donor classification (family, volunteer, replacement, or commercial). The study focused on a cohort of blood donors meeting specific health criteria: they were physically fit individuals aged 18 to 60 years, weighing more than 50 kg, and having a hemoglobin level more than 12.0 g/dl. Participants were not allowed to participate if their hemoglobin levels were below this cutoff for their age or gender or if they had a previous history of transfusion-transmitted illnesses (TTI).

All donors had been consent with prior to enrollment. Three milliliters of blood were drawn and placed in EDTA vials for both blood group identification and hemoglobin analysis using a fully automated Sysmex analyzer. Additional specimens were gathered in clotted vials to screen for TTI, which includes HIV, syphilis, malaria, HCV, and HBV. The Chemiluminescent immunoassay (CLIA) Cobas e411 analyzer was used to screen serum samples for HIV, HBV, and anti-HCV. The Immunochromatographic method (ICT) was used to screen for syphilis and malaria. Data analysis was then carried out using SPSS version 25.

Results

The study involved 2,236 participants, primarily male, representing 98.4% (2,201 people), with women making up 1.6% (35 people) as shown in Figure 1.

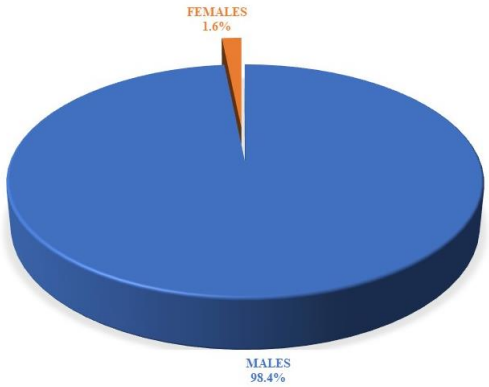

Figure 1: Gender-wise distribution of blood donors.

Table I: Age-wise distribution of Transfusion Transmitted Infections among blood donor.					
Transfusion Transmitted infection	**18-30 years No. (%)**	**31-40 years No. (%)**	**41-50 years No. (%)**	**51-60 years No. (%)**	***P-value***
Venereal Disease Research Laboratory (VDRL)	10 (0.6)	12(2.1)	0	0	0.018
Hepatitis B virus (HBV)	11(0.7)	2(0.3)	0	0	0.652
Hepatitis C virus (HCV)	21(1.4)	7(1.2)	0	0	0.675
Human Immunodeficiency virus (HIV)	6(0.4)	2(0.3)	1	0	0.839

Notably, a significant proportion of people between the ages of 18 and 30 had transfusion-transmissible illnesses (TTIs), which include syphilis, HIV, HCV, and malaria. Table I provides specifics on the distribution of TTIs among blood donors in each age range. At 85.6%, family donors made up the bulk; volunteers came in second at 11.3% and replacement donors at 3.1%. Notably, the study did not involve any paid blood donors, and *P* =0.841 did not show any statistically significant link between donor type and TTIs.

Only 72 (3.3%) of the 2,236 donors who underwent screening tested positive for TTIs; the details of transfusion transmitted infection according to blood donor type are enumerated in Table II. Moreover, no significant correlations were found (P-values of 0.846 and 0.290, respectively) between ABO blood types or the Rhesus factor and TTIs.

Table II: Positivity rate of Transfusion Transmitted Infection in blood donor. (N=2236)	
Transfusion Transmitted infection	**No. (%)**
Human Immunodeficiency virus (HIV)	9 (0.4)
Hepatitis B virus (HBV)	13 (0.6)
Syphilis	22 (1.0)
Hepatitis C virus (HCV)	28 (1.3)
Total	72 (0.3)

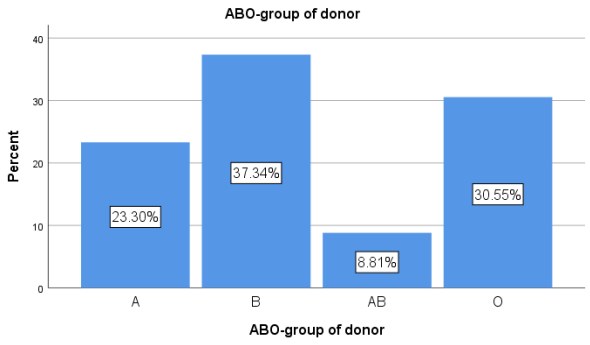

Figure 2. Frequency of ABO blood group donor.

Variation was observed in the distribution of blood donors. The highest prevalence 37.34% of blood group B was found among all the ABO donor whereas 8.8% frequency of blood group B was observed in figure 2.

Rh factor (Rh+) blood group was prevalent in 96.1% blood donor and other 8.3% was observed negative for Rh blood group in figure 3.

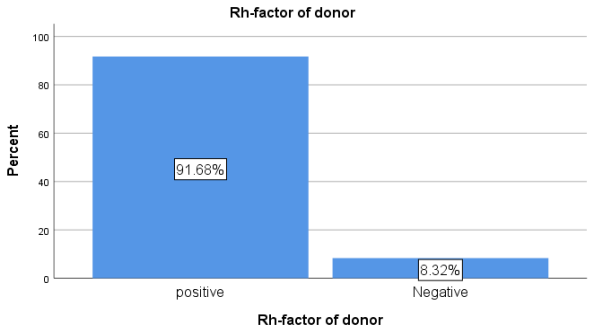

Figure 3. Frequency of Rh-factor of blood group donor.

Transfusion-related infections (TTIs) were shown to be more prevalent in family donors (59) than in volunteer donors. The prevalence of transfusion transmitted infections in different type of donors is presented in Figure 4.

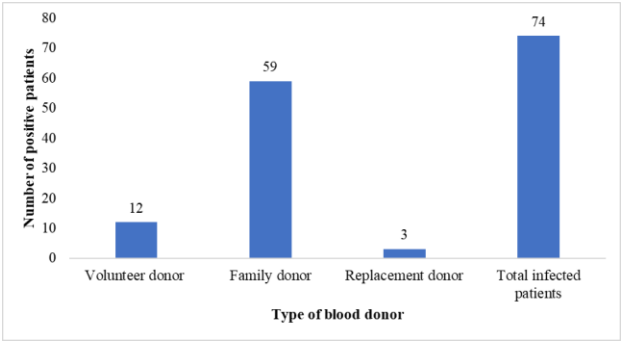

Figure 4. Transfusion Transfusion Infections in different types of blood donors.

Discussion

Although it has inherent hazards including the spread of major transfusion-transmitted diseases (TTIs) like HIV, Hepatitis B, and Hepatitis C, blood transfusion is an essential life-saving intervention in modern medical practice. There is a 1% risk of contracting syphilis, HIV, hepatitis B, or hepatitis C from each unit of transfused blood, which emphasizes the significance of stringent screening procedures.[13] Notably, a gender gap has been seen among blood donors, with men making up the majority in most recent research. For example, in India, a startling 98.4% of donors were men and only 1.6% were women, a tendency that was observed both in India and in nearby countries.[14] The male-to-female donor ratio remained lopsided in several areas, such as Kolkata and Nepal, where

men made up 85% and 84.8% of donors, respectively.[15,16] Similarly, in Tanzania, male donors had a much greater prevalence of TTIs (89.1%) than did female donors (10.9%).[17] On the other hand, Chinese research found that a greater percentage of donors were female, making up 44.5% of the total donor pool. These variances highlight how crucial it is to comprehend how demographic factors influence blood donation patterns and to put focused plans into place in order to guarantee a sufficient and safe supply of blood for all patients who want it.[18]

In the present investigation, it was observed that the largest proportion of blood donors stemmed from familial relationships, comprising 85.6% of the total, while voluntary donors constituted 11.3%, and replacement donors represented a smaller fraction at 3.1%. This distribution stands in stark contrast to the observations made[19] who found that voluntary donors made up a larger percentage of blood donors in Kenya, although the reasons for this incongruity were not elucidated.[20] Conversely, a separate study revealed that replacement donors made up 95% of the donor pool, aligning with existing evidence suggesting that replacement donors typically step forward to assist acquaintances, family members, or community members in need of transfusions.[5,21]

In our current investigation, it was observed that the majority of blood donors, accounting for 69.3%, were in the age bracket of 18 to 30 years, highlighting a pronounced concentration within this demographic. Conversely, the 51-60 age group constituted the smallest fraction, comprising only 0.2% of the donor pool.[22] This distribution aligns with earlier research findings, as evidenced by studies such as that conducted[23] It found that among donors aged 21 to 25, the incidence was 26.2%, while just 1.1% of donors were in the 51 to 55 age group.[23] This pattern is also supported by study conducted[24] which shows that a sizable percentage of blood donors—68.77%—were between the ages of 21 and 40.[15]

The findings of the study highlight notable seroprevalence rates for various transfusion-transmitted infections (TTIs) among blood donors. Specifically, the study identified a 1.3% seroprevalence for HCV, in line with previous research [25] reported a slightly lower prevalence of 1.09% among a large sample size of blood units.[26] Regional variations were evident, with Rawalpindi, Lahore, and Mardan exhibiting higher rates of HCV infection.[27,28] Additionally, the study noted a 1.0% seroprevalence of syphilis, consistent with similar studies, including one in Iran reporting a prevalence of 0.04%.[29,30] Hepatitis B emerged as the third most prevalent TTI, with a 0.6% seroprevalence, aligning with prior research highlighting its significance among blood donors. Notably, studies[31] underscored HBV's prominence, reporting higher prevalence rates. These findings emphasize the importance of robust screening protocols and regional surveillance to mitigate the risk of TTIs in blood transfusion practices.[32,33]

In the present investigation, the incidence of transfusion-transmissible infections (TTIs) was examined, revealing a notably low rate of HIV transmission, standing at 0.4%. This finding contrasts with the higher prevalence reported by Birhaneselassie M et al.[34], where HIV incidence reached 1.6%. Notably, studies conducted by Singh B et al.[35] highlighted regional disparities in HIV frequencies across India. Furthermore, a range of HIV prevalence rates among blood donors spanning from 0.08% to 0.51% was observed in various regions of the country, corroborating the notion of geographical heterogeneity. Importantly, the absence of malaria among the study participants underscores the efficacy of current screening measures in mitigating this particular TTI risk.[26,32,33]

The analysis of blood group distribution and Rhesus (D) factor among blood donors in this study reveals intriguing insights. In comparison to O and A, blood group B appears to be the most common (37.4%) whilst AB was the least common (8.8%) among donors, making up of donors. Furthermore, Rh factor positive blood groups made up 91.7% of the donor pool, while Rhesus (D) negative blood groups made up the remaining 8.3%. This represents a large numerical advantage over their negative counterparts. These results are consistent with research[36] that was carried out in Pakistan and found that blood type B was the most common. This stands in interesting contrast to a study previously conducted in Nepal, where blood group A was shown to have the highest prevalence, followed by O, AB, and B. However, B blood group was the most common in our study, followed sequentially by O, A, and AB. These differences highlight the intricate interactions between genetic and environmental variables that affect the distribution of blood groups in various communities.[18,37]

Conclusion

The research findings reveal a notable gender disparity in blood donation, with males exhibiting a higher likelihood of donating compared to females. Within the donor pool, two primary categories emerge: both volunteer and family donations. Notably, compared to replacement and volunteer donors, family donors have a higher incidence of transfusion-transmitted illnesses. Analysis of blood types indicates a predominance of B type, closely followed by O, A, and AB types. Regarding infections, HCV and syphilis exhibit the highest prevalence rates, trailed by HBV and HIV. To corroborate these findings comprehensively, further investigations encompassing larger sample sizes across diverse geographic regions are imperative.

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