

Prevalence and Causes of Blood Deferral in Tertiary Care Teaching Hospital Islamabad

Mohsin Ali Hassni¹, Rubina Mir², Zafar H Tanveer³, Fatima Zahra⁴, Khalil Hasni⁵, Hassan Iftikhar⁶, Syeda Muntaha Zahra Zaidi⁷, Zia-ul-Rahman⁸, Arif Hussain⁹

¹Research Scholar, Center for Advance Studies in Vaccinology and Biotechnology, University of Balochistan, Pakistan.

²Secretary, Medical Faculty Board, Balochistan, Pakistan.

³Principal & Professor of Physiology, Quetta Institute of Medical Sciences/CMH, Quetta, Pakistan.

⁴Consultant, Sheikh Mohamed Bin Zayed Al Nahyan, Institute of Cardiology, Quetta, Pakistan.

⁵Associate Professor of Biotechnology, Lasbela University of Agriculture, Water and Marine Sciences, Uthal District Lasbela, Balochistan, Pakistan.

⁶District Medical Officer, Sehat Sahulat Program,

⁷Medical Laboratory Technologist, Bahria International Hospital, Rawalpindi, Pakistan.

⁸Medical Laboratory Technologist, Islamabad Diagnostic Center, Pakistan.

⁹Medical Laboratory Technologist at Shoukaut Khanum Hospital Lahore, Pakistan.

Corresponding Author*: Mr. Mohsin Ali Hassni (Mohsin.mlt18@imdcollge.edu.pk)

ABSTRACT

Background: A blood transfusion is a vital and potentially life-saving operation in modern therapeutic and surgical procedures; yet, it requires a sufficient supply of safe blood from a healthy donor. In addition to laboratory testing of blood bags for infectious illnesses, appropriate, safe, and healthy donor selection is required. On the other hand, the loss of valuable blood components that are accessible for transfusion results from fit donors deferring. Understanding the reasons for both temporary and permanent deferrals can help us prevent this, put our knowledge into practice. The current study aimed to assess the incidence and reasons behind blood donor deferrals at Islamabad teaching hospital that provides tertiary care.

Methods: This cross-sectional study was conducted at Dr. Akbar Niazi Teaching Hospital's blood bank. All Blood donors reporting to donate blood at a blood bank between the periods of 1st September 2020 to 24th December 2021 were included in the study. The data was obtained by interviewing the donors using specially designed Performa. The collected data of deferred blood donors was analyzed using SPSS version 21.

Results: Out of a total of 2054 blood donors, 523 (25.5%) were deferred due to different reasons and ineligible to donate blood. Out of 523 deferred donors, 455(87%) were males and 68(13%) were females. The average age of the blood donors was 26(4.2%) and most blood donors were between 20 to 40 years age. The common causes for deferral were low hemoglobin (41.3%), recent COVID-19 vaccination (12.6%) and increased TLC (7.1%). Hepatitis B virus 39(7.5%), Hepatitis C virus (4.4%), HIV 5(1.0%) and Syphilis 18 (3.4%).

Conclusion: The most frequent reasons for delay were elevated TLC count, recent COVID-19 immunization, and low hemoglobin levels. The cornerstone of a safe blood supply is the donor education on self-exclusion and strict selection criteria.

Keywords: Deferral, Transfusion, Hemoglobin, Blood, Vaccination, Donor, Hepatitis.

HOW TO CITE: Hassni MA, Mir R, Tanveer ZH, Zahra F, Hasni K, Iftikhar H, Zaidi SMZ, Rahman Z, Hussain A. Prevalence and Causes of Blood Deferral in Tertiary Care Teaching Hospital Islamabad. National Journal of Life and Health Sciences. 2024 Feb; 3(1), 14-19.

DOI: <https://doi.org/10.62746/njlhs.v3n1.19>

Date of Submission: 25/12/2023

Date of Revision: 27/02/2024

Date of Acceptance: 21/03/2024

INTRODUCTION

Blood transfusion is an extremely crucial component of daily hospital practices which is required in a variety of diseases and procedures that would be impossible without blood components like different surgical procedures, chemotherapy, Hemodialysis and for patients suffering from thalassemia (blood is required throughout the life).¹ Blood is life giving liquid and human beings are the only source by which blood can be obtained for others suffering from multiple diseases. A medical service provider must maintain a smooth and screened supply of blood. The use of unscreened blood and its products has negative effects on human beings and also a burden on the financial system of both developing and developed world.² Blood and transfusion of its unscreened

components (Platelets, PF24, Cryoprecipitate) leads to severe long term consequences of morbidity and mortality. Patients infected by transfusion of unscreened blood not only put the patient's life at risk but also lead to secondary wave of infections and contribute to endemic of that diseases. Providing safe blood and its components is not actually a huge difficulty for both developing and developed countries, which needs awareness on global level. Screened blood supply is inexpensive for all nations, even those with a small number of funds. If unscreened blood is transfused to patients and patients are infected by any viral diseases, it will cost patient life and have long term effects on economy of country. Patients with anemia, thalassemia needs blood frequently and are unable to survive without blood, there are a lot of

reasons for the local collection of blood which indirectly compromises standards of transfusion and screening. Centralized blood centers are more safe than local blood bank.^{3,4}

Blood donation is a vital life-saving procedure that fulfills several crucial roles in the global health care system. Globally, over 85 million units of pack cell volume are transfused annually.⁵ According to further statistics, since 2000, the number of patients hospitalized in hospitals for various causes has increased by 85.8%, necessitating the need for blood donors to fulfill the requirement Indirectly. There are essentially three categories of blood donors: paid/professional, family/replacement, and voluntary non-remunerated donors (VNRD).⁶ A voluntary blood donor for a patient in need is referred to as a VNRD. A great deal of effort has been put into promoting voluntary, recurrent donations; the optimum approach is seen to be selecting volunteer donors from lower-risk categories.⁷ Family or replacement donors are likewise voluntary and unpaid in the event of a blood shortage; however, hospital staff will arrange for their donation, which is intended to replace the blood needed by a friend or relative who is hospitalized.⁸ Depending on the specifics and the level of the blood scarcity, the transfusion could only go ahead if a replacement blood unit is obtained. In other cases, the family saves money on the transfusion by using accessible bloodstock to give the patient a transfusion.⁹ Paid or professional donors, typically from low-income backgrounds, donate blood on behalf of families unable to refill the unit in exchange for a substantial sum. They donate far too frequently at the price of their own health and have a high prevalence of viral infections.¹⁰

The term "blood donor deferral" describes a blood donor's ineligibility or disqualification according to the safety standards for blood transfusions established by the World Health Organization.¹¹ The loss of essential resources for both the donor and the blood bank employees is connected to the donor deferral. Deferral has an impact on the availability of blood components because it results in fewer voluntary donations and the absence of a blood bag collection.¹² Regular monitoring is necessary to ensure that the donor selection procedure is meeting its objectives of ensuring the safety of both donors and recipients as well as providing a sufficient and secure supply of blood.¹³ The World Health Organization (WHO) reports that 118.2 million blood units are drawn globally, with 60% of those units occurring in poor nations.¹⁰ Approximately 13 million blood donors are postponed due to the presence of transfusion-transmitted infection (TTIs).¹⁴ The World Health Organization suggests soliciting voluntary blood donations from those in low-risk categories. Due to a high incidence of hepatitis B and C, restricted access to Nucleic Acid Testing (NAT), and sociodemographic variables, the risk of transfusion-transmitted infections (TTIs) is gradually

increasing in Pakistan. A vital tool for ensuring transfusion safety is pre-donation donor selection, which leads to a specific deferral pattern for a considerable proportion of donors.¹⁵

Deferral refers to the temporary suspension or permanent disqualification from blood or its component donation due to a suspected or confirmed infectious disease. Blood and biochemical problems, as well as any other medical conditions that can jeopardize the safety of the blood or affect the donors' individual health. If a donor is placed under temporary deferral, they are only temporarily barred from providing blood while the cause is established; if they are placed under permanent deferral, they are never again permitted to donate blood to anybody.^{8, 16} Low hemoglobin levels compared to normal are a major factor in the temporary suspension of blood and component donation. Some less frequent causes are underweight, older than 50 or younger than 18, immunization history, allergies, diabetes, and tuberculosis, abnormality in blood counts, coagulation disorders, and early donation before completion of 3 months. The primary cause of the permanent deferrals are kidney failure, epilepsy and reactivity to any of the transfusion-transmitted infections (TTIs), which include the HIV, syphilis, and the hepatitis C and hepatitis B viruses (HCV and HBV). Blood transfusion-related illnesses are more likely in Pakistan due to the high incidence of hepatitis B and C.^{17, 18}

The safety of blood transfusions is seriously threatened by the widespread viral diseases hepatitis B (HBV) and hepatitis C (HCV) in Pakistani general populations.¹⁹ It is quite challenging to evaluate safe blood products in rural parts of Pakistan because of a lack of infrastructure and the sophisticated techniques used in district hospitals. According to estimates, up to 40% of transfused blood in Pakistan is not generally checked for communicable diseases. Specifically, approximately 50% of blood transfusions do not undergo screening for HIV, hepatitis B, or hepatitis C. Considering the high prevalence of hepatitis C (HCV) infections among individuals who receive regular blood transfusions, these statistics are extremely concerning. Patients with hemophilia and thalassemia may have as much as 20% and 56% of cases of hepatitis C, respectively.^{8, 16} Hepatitis B and hepatitis C (HCV and HBV) are more common in patients with these illnesses because numerous transfusions are sometimes necessary as part of treatment. According to one study, the primary risk factor for hepatitis C virus (HCV) in patients was a history of blood transfusions within the previous six months, with a 48% infection rate. It is important to keep in mind that reusing syringes could expose even larger number of people to infection or use of the recipients' original blood that was contaminated. In Pakistan, blood banks are frequently regarded as an underutilized part of the healthcare infrastructure. Pakistan's blood transfusion industry is incredibly dispersed, poorly organized, and

largely unregulated. Hospital-based blood banks as well as public, private, or nongovernmental organizations (NGOs) make up Pakistan's blood banking system.¹⁶ For the last several years, it has been evident that dengue has become a recurrent pandemic event in Pakistan. Blood transfusion recipients may be prohibited from donating for a maximum of six months if they have a dengue virus infection.¹⁶ Furthermore, the safety of blood transfusions is impacted by both the lack of human resources and poor infrastructure. This study intends to evaluate and investigate the frequency of blood donor deferral patterns and the reasons behind them at a blood bank located in a tertiary care teaching hospital.

MATERIALS AND METHODS

This cross-sectional study was carried out in the blood bank of Dr. Akber Naizi Teaching Hospital, a tertiary care hospital. It was conducted from September 2020 to December 2021 to determine the frequency and causes of blood donor deferral. All the donors reported for blood donation in Dr. Akber Naizi Teaching Hospital's Blood bank from 1, September 2020 to 24, December 2021 were included in the study. Donors who did not give consent for blood donation were excluded from this study.

All Ethical Considerations were followed during this study. Confidentiality of data was maintained. Ethical Clearances were approved by Islamabad Medical and Dental College Institutional Review Board (IRB letter No. 49/IMDC/IRB-2021) for the study.

The data for this study was obtained by interviewing the donor who presented to the blood bank for blood donation using a Questionnaire Performa divided into different sections such as socio-demographic data, reasons for donation, vital signs, Reasons for deferral and TTIs. The collected data of deferred blood donors was analyzed using SPSS Version 21.

Laboratory Investigation includes both Pre-Donation hematological tests (ABO blood grouping, Complete blood picture) and Serological Screening by Chromatography Method of (HBV, HCV, HIV, Malaria and Syphilis) Post-Donation test includes HBV, HCV and HIV I,II Screenings by chemiluminescence Method . Hematological tests Includes ABO Blood grouping performed by direct slide Method. ABO Blood grouping was performed on standard operating protocols. Allow the reagents and samples to reach room temperature (18–25°C). Then, using the included dropper, add 25µl of the precipitated cells next to each drop of reagent (40 µl ± 10 µl) onto the corresponding division on the slide. Using a clean stirring stick, combine the reagent and the cells over a 20–40 mm diameter area on a glass slide. For thirty seconds, incubate the slide at room temperature (18–25°C) without stirring. For three minutes, hold the slide and gently rock it, looking for any signs of agglutination under a microscope. Complete Blood Picture was performed on state-of-the-art Mindray BC-5000 5 parts

Hematological Analyzer and sample were mixed properly on roller before running on analyzer and all other ISO- 9001 standard protocols were followed. Hepatitis B surface antigen (HBsAg), Hepatitis C surface antigen (HCV), HIV-1 and HIV-2 surface antigen tests were performed by both chemiluminescence and Chromatography Method. chemiluminescence was performed on the Mindray analyzer is a fully automated 5-part analyzer controls were run with every batch. Instrument was calibrated by the Biomedical Team and Temperatures and maintenance were followed as per standard Operating Protocols. Abbott rapid kits detection test was performed as pre-donation baseline screening having Accuracy of up to 99.8% by chromatography Methods. For Syphilis Treponema Pallidum (TP) Antigen, and Malaria Antigen Rapid Tests were only performed by ICT kit method.

The causes of deferral donors were analyzed on the statistical SPSS (Statistical Package for the Social Sciences) version 21. A p-value less than 0.05 was taken as a significant level and p-value greater than 0.05 was considered statistically insignificant. The results were presented in numbers and percentages, mean and standard deviation. Descriptive statistics was applied to qualitative variables such as frequency and percentages. The results were presented in the form of pie and bar charts.

RESULTS

A total of 2054 blood donors presented at Dr. Akber Naizi Teaching Hospital's blood bank from September 01-2020 to December 25-2021 for donating blood in which 523 blood donors were deferred due to different reasons and ineligible to donate blood. Out of 523 deferred donors, 455 (87%) were males and 68 (13%) were females (Table 1). The average age of the blood donors was 26 and most blood donors were between 20 to 40 year's ages. The age of both male and female deferred donors shown is shown in (Figure 1). Different causes of blood donor deferred also studied (Table 2).

Table 1: Total number of donors and distribution of Blood donors deferred according to genders.

Total Donor	Eligible	Deferred
Percentage of Donors	74.6%	25.4%
Gender-wise Deferred	Male	Female
Percentage	87%	13%

The primary cause of permanent deferral is hepatitis B 39(7.5%), hepatitis C 23(4.4%), HIV 5(5.0%), Syphilis 18 (3.4%) and malaria 7(1.3%) were other cases detected during blood Post-Donation screening which lead to blood donor deferred shown in (Table 3).

DISCUSSION

A crucial step in the transfusion process is choosing a blood donor, which typically involves going through several checkpoints to guarantee both the recipients' and donors' safety. There are typically four steps in this process. Sharing information about common

infections that can spread during transfusion and other risks for donors is the first step in the process.

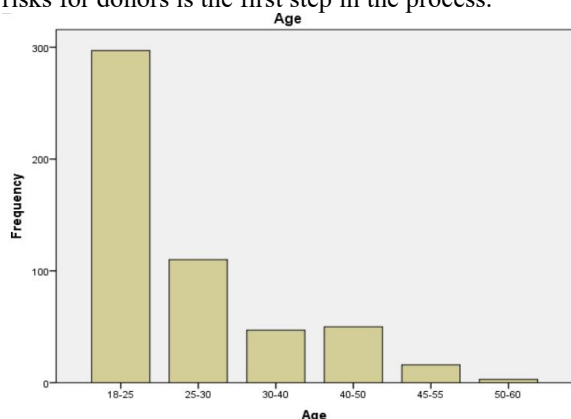


Figure 1: Age distribution of deferred donors. A donor health questionnaire must then be completed,

and a permitted health professional (HP) will interview the donor after that. Ultimately, physical examination and laboratory test results are used to assess the donor's health, determining whether to accept or reject them. The deferral may be indefinite or temporary, contingent on the underlying medical condition. Our research sought to determine the frequency of deferral donors.²⁰

Table 3: Distribution of blood donor deferral on presence of transfusion-transmitted infections

Tests	Yes n (%)	No n (%)
HBsAg	39(7.5)	484(92)
Anti-HCV	23(4.4)	500(95)
HIV I & II Antibodies	5(1.0)	518(99)
Syphilis TP Antibodies	18(3.4)	505(96)
ICT MP	7(1.3)	516(98)

Table 2: Distribution of blood donor deferral on the basis of causes with number and percentage

Questions	Yes n (%)	No n (%)
Previous blood donations	3 (0.6)	520 (99.4)
History of viral hepatitis (A, B, and C)	-	524 (100)
History of HIV infection	-	524 (100)
Previous blood transfusion	-	524 (100)
History of jaundice	3 (0.6)	520 (99.4)
Hypertension or heart disease history	-	524 (100)
History of recent vaccination	66 (12.6)	454 (87.4)
History of unexplained prolonged fever	-	524 (100)
History of unexplained weight loss	1 (0.2)	522 (99.8)
History of recent travel abroad	-	524 (100)
Present medication history	10 (1.9)	513 (98.1)
Any history of Invasive procedure	2 (0.4)	521 (99.6)
History of persistent Cough/T.B?	3 (0.6)	520 (99.4)
History of malaria since last six months	10 (1.9)	513 (98.1)
History of bleeding disorders	-	524 (100)
History of treatment from Hakeem, Homeopath or a paramedic?	8 (1.5)	515 (98.5)
History of kidney and liver diseases	11(2.1)	512(97.9)
History of blood disorder or other illness	-	524 (100)
History of psychiatric disorders	10 (1.9)	513 (98.1)

A study carried out in the United State of America to find out the association of donor deferral between gender demographics and low hemoglobin in donor's deferrals included 82% males and 18% females.²¹ Our study also demonstrates (87%) males were deferred and the mean age was 26 years. Deferral frequency was 139 (5.533%), with 129 (5.1538%) males and 10 (0.3995%) women; in contrast, 523 donors out of 2054 were deferred in our study, with 455 (87%) males and 68 (13%) females. The majority of blood donors were in the 20–40 age range. Male donors made up the majority of participants in our study (87%), which may have an impact on the findings of the research because certain deferral causes are more common in

either gender.²² For example, in two studies from India, the deferral rates were lower when more males participated in the trial because low hemoglobin levels led to more females being postponed than males. The current study's duration was lengthy in comparison to some of the previous national studies. The study reviewed both pre-donation and post-donation deferral patterns concurrently by presenting the combined data from the medical history questionnaire and the findings of the TTI.²³ For instance, in two Indian investigations, the deferral rates decreased when more male participants were included because low hemoglobin levels resulted in a higher deferral rate for females than for men.

Low hemoglobin levels were shown to be the most

common reason for deferrals (50.3%). This is on par with previous research. According to a study conducted in 19 licensed blood banks in Pakistan using a structured questionnaire, anemia was found to be the primary cause of deferral in 41% of cases. This outcome is similar to our findings (41.3%) regarding deferral owing to low hemoglobin levels. The most frequent reason for temporary deferrals, according to Valerian et al., was anemia; although the incidences were comparatively lower (21.1%).²² A unique research assessing the deferral pattern was conducted in south Pakistan using the peripheral count. It also showed that anemia is the primary cause of blood donors' temporary deferrals. The 13.5g/dL limit is used to postpone blood donation; this deferral is applicable irrespective of the donor's demographic profile and keeps them from being able to give blood.²⁴

Eight instances of low weight (0.3196%), five cases of acute infection and medicine usage (5 0.1998%), four cases of blood donation in the last eight weeks (0.1598%), and three cases of hypotension (0.1198%) are comparable to the results of a research that was conducted. Blood donation within the last three months is 3 (0.6%), low weight history is 1 (0.2%), and medication history is 10 (1.9%), according to our study.²⁵ Another research found that the grounds for postponement were poor hemoglobin (23.1%), high blood pressure (8.0%), and low body weight (12.4%). Additional reasons identified by our research include syphilis, persistent infections, and a few rare disorders including thrombocytosis, polycythemia, malaria, and TB. Valerian et al. discovered, in contrast to our study, that syphilis was the second most common cause of permanent deferral, behind anemia.²⁵ The rates were comparatively higher (9.3% versus 3.4%), in line with our findings. Due to insufficient screening, subpar blood transfusion facilities, rising transfusion-transmittable infection rates, and a shortage of safe and effective blood; Pakistan is experiencing a rise in demand for blood donations.²⁶ In our study, the WBC counts of 37 blood donors (7.1%) were high, while the platelet counts of 5 donors (10%) were low in 2 donors (0.4%). Four (0.8%) had pancytopenia, one (0.2%) had eosinophils, and five (1.0%) had polycythemia. Increased TLC was the primary reason for the deferral, as many donors had TLC counts above 50. Another common reason for deferral was high blood pressure, which is brought on by the first-time donors' nervousness and anxiety.²⁷ On the other hand, low blood pressure was common among our donor population and is primarily caused by fear of the donation. Age limitations and fasting were two more deferral causes. Donors under the age of eighteen and those over sixty are prohibited from making donations. Regular donors, on the other hand, are exempt and are permitted to donate until they are 65 years old.²⁸

The number and kind of TTIs tested, the number of donors, the kind of donor (voluntary vs. replacement),

the screening techniques used, and the quantity and kind of donors all had an impact on the TTI rate. The standard of screening for common TTIs was not met.²² Merely 38% and 46% of the overall contribution were tested for malaria and syphilis, respectively [38]. The following is revealed by a study: Syphilis is 1.1% (0.11-3.01%), malaria is 0.11% (0.05-1.20%), HBV is 2.04% (0.81% to 4.22%), HCV is 2.44% (1.29% to 10%), and HIV is 0.038% (0% to 0.18%). Our research indicates that the prevalence of hepatitis B 39 (7.5%), hepatitis C 23 (4.4%), and HIV 5 (5.0%) is present. Syphilis 18 (3.4%) and malaria 7 (1.3%). Hepatitis C infection was the main cause of permanent donor deferral, with hepatitis B infection ranking top among infections but second among causes.^{29, 30} Hepatitis B and C are exceedingly frequent illnesses, as is the hepatitis B virus infection (7.5%) in Pakistan.³¹

Donor deferral is linked to the loss of essential resources for both the donor and the blood bank staff. Without having to locate new donors, it could be able to improve the blood supply and halt some of these deferrals.³² Employees ought to attempt to avoid leaving a bad impression that would discourage donors from returning. Refusing to accept a potential donor can have negative psychological effects and often leaves the person feeling bad about the blood bank and themselves.

CONCLUSION

The most common causes for deferral were Hepatitis B Virus 39 (7.5), Hepatitis C virus (4.4), HIV 5(1.0) and Syphilis 18(3.4). The influence of blood donors' awareness of the deferral criterion is demonstrated by the analysis of the donor deferral pattern. By educating people about the selection criteria and giving information, the deferral rate can be decreased. Therefore, examining rejection patterns will benefit long-term donor pool health as well as the safety of donors and recipients. The cornerstone of a safe blood supply is donor education on self-exclusion and strict selection criteria.

REFERENCES

1. Dzik WH. Emily Cooley Lecture 2002: transfusion safety in the hospital. *Transfusion*. 2003;43(9):1190-9.
2. Lackritz EM, Campbell CC, Ruebush TK, Hightower AW, Wakube W, Were J. Effect of blood transfusion on survival among children in a Kenyan hospital. *The Lancet*. 1992;340(8818):524-8.
3. Bates I, Chapotera G, McKew S, Van Den Broek N. Maternal mortality in sub-Saharan Africa: the contribution of ineffective blood transfusion services. *BJOG: An International Journal of Obstetrics & Gynaecology*. 2008;115(11):1331-9.
4. Murphy M, Stanworth S, Yazer M. Transfusion practice and safety: current status and possibilities for improvement. *Vox sanguinis*. 2011;100(1):46-59.
5. Klein HG, Spahn DR, Carson JL. Red blood cell transfusion in clinical practice. *The Lancet*. 2007;370(9585):415-26.

6. Ugwu N, Oti W, Ugwu C, Uneke C. Voluntary non-remunerated blood donation: Awareness, perception, and attitude among potential blood donors in Abakaliki, Nigeria. *Nigerian journal of clinical practice*. 2019;22(11):1509-15.
7. Shrivastava M, Shah N, Navaid S, Agarwal K, Sharma G. Blood donor selection and deferral pattern as an important tool for blood safety in a tertiary care hospital. *Asian journal of transfusion science*. 2016;10(2):122.
8. Zaheer HA, Waheed U. Blood safety system reforms in Pakistan. *Blood Transfusion*. 2014;12(4):452.
9. Erhabor O, Adias T, Mainasara A. Provision of safe blood transfusion services in a low income setting in West Africa. Case study of Nigeria. *Adv Med Biol*. 2013;59:1-58.
10. Organization WH. Blood safety and availability fact sheet. In: 2020]. editor. 2020.
11. Noor e Saba MN, Shaukat A, Majeed N, Wazeer A, Waheed U. Blood donation deferral pattern among prospective blood donors in northwest region of Pakistan. *Ann Pak Inst Med Sci April-June*. 2020;16(2):63.
12. Organization WH. Summary report on the experts' consultative meeting to develop the regional strategy on blood safety and self-sufficiency (2014–2018), Amman, Jordan 18–20 June 2014. World Health Organization. Regional Office for the Eastern Mediterranean, 2015.
13. Saba N, Nasir JA, Waheed U, Aslam S, Mohammad I, Wazeer A, et al. Seroprevalence of transfusion-transmitted infections among voluntary and replacement blood donors at the Peshawar Regional Blood Centre, Khyber Pakhtunkhwa, Pakistan. *Journal of Laboratory Physicians*. 2021;13(02):162-8.
14. Saqlain N, Ahmed N, Ahmed A, Hareem S. Blood Donation:: Knowledge, Attitude And Beliefs Of The Female Attendants. *The Professional Medical Journal*. 2017;24(12):1806-11.
15. Muazzam A, Javed S. Predictors of caregiver's burden: interplay of physical and emotional health and perceived hope in children with thalassemia and hemophilia. *Pakistan Journal of Social and Clinical Psychology*. 2013;11(2):36.
16. Waheed U, Zaheer HA. Possible transmission of human immunodeficiency virus through blood transfusion in Pakistan. *Global Journal of Transfusion Medicine*. 2019;4(1):117-8.
17. Khan AA, Khan A, Bokhari A. The HIV epidemic in Pakistan. *J Pak Med Assoc*. 2010;60(4):300-7.
18. Bosan A, Qureshi H, Bile KM, Ahmad I, Hafiz R. A review of hepatitis viral infections in Pakistan. *JPMA-Journal of the Pakistan Medical Association*. 2010;60(12):1045.
19. Beg A, Kharal TH. Frequency of risk factors for hepatitis B (HBV) and Hepatitis C Virus (HCV). *Ann Pak Inst Med Sci*. 2010;6(3):161-3.
20. Iqbal H, Din ATU, Din ATU, Chaudhary FMD, Younas M, Jamil A. Frequency and causes of deferral among blood donors presenting to combined military hospital Multan. *Cureus*. 2020;12(1).
21. Gillet P, Neijens E. An original approach to evaluating the quality of blood donor selection: checking donor questionnaires and analyzing donor deferral rate. *Frontiers in Medicine*. 2018;5:74.
22. Valerian DM, Mauka WI, Kajeguka DC, Mgabo M, Juma A, Baliyima L, et al. Prevalence and causes of blood donor deferrals among clients presenting for blood donation in northern Tanzania. *PloS one*. 2018;13(10):e0206487.
23. Waheed U, Zaheer HA. Evaluation of deferral pattern among the blood donors in Islamabad, Pakistan. *Global Journal of Transfusion Medicine*. 2016;1(2):81-4.
24. Sultan S, Irfan SM, Baig MA, Usman SM, Shirazi UA. Insight into donor deferral pattern based on peripheral blood counts: An experience from South Pakistan. *Asian Journal of Transfusion Science*. 2017;11(2):151.
25. Mast AE. Low hemoglobin deferral in blood donors. *Transfusion medicine reviews*. 2014;28(1):18-22.
26. Sultan S, Baig MA, Irfan SM, Ahmed SI, Hasan SF. Adverse reactions in allogeneic blood donors: A tertiary care experience from a developing country. *Oman medical journal*. 2016;31(2):124.
27. Attaullah S, Khan S, Khan J. Trend of transfusion transmitted infections frequency in blood donors: provide a road map for its prevention and control. *Journal of translational medicine*. 2012;10(1):1-5.
28. Sultan F, Mehmood T, Mahmood MT. Infectious pathogens in volunteer and replacement blood donors in Pakistan: a ten-year experience. *International Journal of Infectious Diseases*. 2007;11(5):407-12.
29. Meinia SK, Sawhney V. Analysis of donor deferral rate and its various causes in voluntary and replacement blood donors in Jammu, India. *Int J Heal Sci Res*. 2016;6:49-56.
30. Custer B, Chinn A, Hirschler NV, Busch MP, Murphy EL. The consequences of temporary deferral on future whole blood donation. *Transfusion*. 2007;47(8):1514-23.
31. Sultan S, Jaffri SA, Irfan SM, Usman SM, Nadeem S, Waheed U, et al. An Insight into Donor Blood Unit's Wastage in a Hospital-Based Blood Bank from Pakistan. *Int J Med Res Health Sci*. 2021;10(5):91-5.
32. Sijjeel F, Khalid A, Khan MY, Khurshid R, Habiba UE, Majid H, et al. Prevalence of ABO and Rh Blood Groups and Their Association with Transfusion-Transmissible Infections (TTIs) among Blood Donors in Islamabad, Pakistan. *Pakistan Biosci Rev*. 2021;3:13-26.