

## The Association between the Prevalence of Transfusion Transmitted Infections and Characteristics of Infected Blood Donors in Kerman, Iran

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### Abstract

**Background:** Nowadays, one of the main challenges of the blood transfusion organization is the procurement, distribution, and monitoring of the appropriate use of blood and its products. Therefore, the aim of this study was to investigate the prevalence of Transfusion Transmitted Infections (TTIs) including human immunodeficiency virus (HIV+), hepatitis B virus (HBV+), and hepatitis C virus (HCV+), and also to determine the relationship between the prevalence of Transfusion Transmitted Infections and characteristics of Infected blood donors, which can be useful in the selection of blood donors.

**Methods:** This retrospective study was conducted on all blood donors in Kerman Province during five years (from March 2014 to February 2019). Individuals whose initial test and supplementary test results were positive, were considered as definitely positive. Chi-square test was used to investigate the relationship between measured factor and outcome. Data were analyzed by SPSS version 20. Statistically significant value was considered at  $P \leq 0.05$ .

**Results:** After confirmatory tests, it was revealed that 500 cases were infected with one of the three blood-borne viruses of HIV+, HBs+, and HCV+. Considering a 95% confidence interval, the prevalence of HIV+, HBs+, and HCV+ was, 0.0006%, 0.1%, and 0.04%, respectively. There was a significant relationship between the prevalence of infections and age, educational status ( $P=0.008$ ), and donation status ( $P=0.007$ ), but there was no significant relationship between the prevalence of infections and gender and marital status ( $P>0.05$ ).

**Conclusion:** The overall prevalence of TTIs among blood donors of Kerman province was 0.14%, indicating that the prevalence of TTIs is very low, it can be due to the appropriate screening of blood donors prior to the blood donation and performing advanced screening approved by the World Health Organization. According to the results, the healthiest blood donors are regular blood donors and those with a history of blood donation.

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## Introduction

The health status of donated blood is related to the blood donors' health status, so that today, one of the most vital and important challenges for the Blood Transfusion Organization (BTO) is the procurement, distribution, and monitoring of the appropriate use of blood and its products. To deal with these challenges, a broad and comprehensive plan should be provided to encourage healthy people to donate their blood. It is also necessary to perform strict tests to ensure the health of blood products under control of the relevant specialists, and exclude people with a history of high risk behaviors from the donation cycle (1, 2). Transfusion Transmitted Infections (TTIs) are the most common causes of death in the blood recipients since these people are at high risk of infection (3).

Blood and its products can be dangerous products, especially when they are contaminated with TTI agents such as human immunodeficiency virus (HIV), hepatitis B virus (HBV), hepatitis C virus (HCV), human T-cell lymphotropic virus (HTLV), malaria, and syphilis (4). For screening and selection of the eligible blood donors, a complete history of the volunteer blood donors is obtained in the BTO. For this purpose, the volunteer is examined and interviewed by a physician using an approved international protocol. After physician approval, the volunteer is directed to blood donation room. This stage is one of the most sensitive stages of the blood donation cycle, in which according to the instructions, the volunteers who are high risk individuals, for any reason, are temporarily excluded from the donation cycle (5). However, in spite of screening, these infections are partially transmitted through blood transfusion (6). Therefore, it is of great importance to consider the screening and selection methods for the selection of blood donors (7).

For this purpose, some tests are performed on donated blood samples to monitor the infection with three main TTI agents of HIV, hepatitis B surface antigen (HBs Ag), HCV, and

in many parts of the world, the blood samples are screened for human t-cell lymphotropic virus (HTLV), types I (HTLV-I) and type II (HTLV-II), and then, are distributed among treatment centers. At all these stages, the BTO monitors blood donation and its transfusion (8). Large amounts of the infected blood units belong to people who donated blood during the window period- it is a time between donor exposure to a virus and the appearance of antibodies in people who have been recently at risk. However, today, all TTIs can be diagnosed using advanced and existing tests, and the window period has been significantly reduced using new-generation diagnostic kits (9). Almost all laboratories of BTO use serologic tests to detect antibodies for detection of blood-borne infections (10). Nucleic Acid Tests (NATs) are among advanced tests that are used to diagnose HCV, HIV, and HBV infections, and can eliminate false-negative cases (11, 12). The transmitted infection may have long-term outcomes for blood recipients and affects their lives, it can also be transmitted to others for a while, even though the infection symptoms have not been appeared in the infected person. Therefore, the role of BTOs in detecting infected cases and preventing new cases is indisputable (13, 14). The aim of this study was to determine the relationship between the prevalence of TTIs and characteristics of blood donors among blood donors of Kerman, and also to evaluate the efficiency of screening methods.

## Materials and Methods

This retrospective study was conducted on all blood donors in Kerman province during five years (from March 2014 to February 2019), Of 355,148 blood donors. Demographic data (age, gender, educational status, and donation status) of volunteer blood donors who had a positive supplementary test, were collected from the BTO.

### Sampling

Serologic screening tests were performed using ELISA method in the BTO. HIV antibody was detected using Bio-Rad kit with 100% sensitivity and 99.95% specificity, HCV antibodies were detected using Bio-Rad kit with 100% sensitivity and 99.92% specificity, and HBs Ag was detected using Siemens kit with 100% sensitivity and 99.94% specificity. Then, positive samples were tested using regular approval tests (Western blot for HIV and HCV positive and Confirm HBs for HBs Ag positive). If the results of the complementary tests were positive, the initial positive samples were considered to be definitely positive.

### Statistical analysis

The relationship between the prevalence of TTIs and demographic characteristics of blood donors was determined using Chi-square test by SPSS version 23 (Inc., Chicago, IL). Statistical significant level was considered at  $P \leq 0.05$ .

### Results

The total number of volunteer blood donors from March 2014 to February 2019 was 355148 people, of whom 500 were infected with one of the blood-borne viruses of HBs+, HIV+, and HCV+. The overall prevalence of the infection was 0.14%. The prevalence of HIV+, HBs+, and HCV+ infections were 0.0006% (n=2), 0.1% (n=359), and 0.04% (n=139), respectively. Two of the volunteer blood donors who were men and first-time blood donors, were co-infected with two infections, one with HIV+/HCV+ and another with HBs Ag+/HCV+. The highest rate of infection was observed among men (92%), first-time blood donors (89.2%), married individuals (86.4%), individuals with lower education (50.2%), and age groups higher than 35 years (60.6%). And the lowest rate of infection was observed among women, individuals with a history of blood donation, single individuals, people with higher education, and age groups less than 20 years (Table 1).

**Table 1.** Demographic characteristics of the infected blood donors

Variable	Frequency (%)	
<b>Gender</b>	Male	460(92)
	Female	40(8)
<b>Age</b>	<20	3(6)
	20-25	35(7)
	25-30	62(12.4)
	30-35	97(19.4)
	35<	303(60.6)
<b>Marital status</b>	Single	68(13.6)
	Married	432(86.4)
<b>Educational status</b>	Lower education	251(50.2)
	High school diploma	159(31.8)
	Higher education	90(18)
<b>Donation status*</b>	1st time	446(89.2)
	1<	23(4.6)
	Regular	31(6.2)

\*Individuals who donated blood for the first time are called the first-time blood donors, and individuals with a history of blood donation and those who donated blood at least twice a year, are called regular donors.

It was revealed that 2 cases of HIV+ were men who donated blood for the first time. The highest rate of infection was related to HBs and the lowest one was related to HIV+. Finally, it was revealed that the rate of infections had a

significant relationship with age, donation status ( $P=0.007$ ), and educational status ( $P=0.008$ ), but it had no significant relationship with gender and marital status (Table 2).

**Table 2.** Demographic characteristics of the infected blood donors according to the infection status

Variable	Disease	Disease			P-value**
		HIV+	HBs+	HCV+	
Gender	Male	2(4)	326(70.9)	132(28.7)	0.28
	Female	0(0)	33(82.5)	7(17.5)	
Age group	>20	0(0)	3(100)	0(0)	0.01
	20-25	1(2.9)	28(80)	6(17.1)	
	25-30	0(0)	53(85.5)	9(14.5)	
	30-35	0(0)	74(76.3)	23(23.7)	
Marital status	35<	1(0.3)	201(66.3)	101(33.3)	0.316
	Single	1(1.5)	49(72.1)	18(26.5)	
	Married	1(2)	310(71.8)	121(28)	
Educational status	Lower education	2(0.8)	173(68.9)	76(30.3)	0.008
	High school diploma	0(0)	108(67.9)	51(32.1)	
	Higher education	0(0)	78(86.7)	12(13.3)	
Donation status	1st time	2(0.4)	331(74.2)	113(25.3)	0.007
	1<	0(0)	10(43.5)	13(56.5)	
	Regular	0(0)	18(58.1)	13(41.9)	

HIV: Human immunodeficiency virus; HCV: Hepatitis C virus; HBs Ag+: Hepatitis B antigen

\*\* $P \leq 0.05$  was significant, Chi-square test

## Discussion

According to the results of this study, the overall rate of TTIs in the blood donors of Kerman province from March 2014 to February 2019 was 0.14%. A similar study by Sorouri Zanjani et al. in Zanjan from 2005 to 2006, showed that the overall incidence of transmitted infections was 0.46% (15). Also, another study conducted by Ataro et al. in Ethiopia between December 2011 and May 2012, revealed that the overall prevalence of transmitted infections was 7.06%, indicating a lower incidence of infection among blood donors

of Kerman province (16). The prevalence of HIV+, HBs+, HCV+ infections among blood donors of Kerman province was 0.0006%, 0.1%, and 0.04%, respectively. In a similar study conducted by Bani Aghil et al. in Golestan between 2006 and 2008, the prevalence of HIV+, HBs+, and HCV+ infections was reported to be 0.0015%, 0.99%, and 125.0%, respectively (17). The discrepancies in the results could be due to the method, study population, and study period, as well as the referral of high-risk individuals to the Blood Transfusion Organization (BTO) for blood donation at different sites.

According to the results of the present study, 92% of the positive cases were men and 8% were women. This can be due to the effect of culture of societies, because Iranian women believe that due to blood loss associated with childbirth and menstruation, they are not eligible to donate blood, which is consistent with the results of the study by Alaidarous et al. (18). As the subjects with lower education had the highest rate of infection and there was a significant relationship between educational status and infection rate, therefore, it can be concluded that people with lower education have less knowledge of the transmission and transmission method of infection, which is consistent with the results of a study by Askari et al. (8). In this study, 89.2% of the blood donors were the first-time blood donors. The significant relationship between infections and donation status of donors can be due to this undeniable fact that regular blood donors and those with a history of donation are the healthiest people who can donate the blood needed in the community, which is consistent with the results of some studies conducted by Pillonel et al and Siraj et al. (19, 20). The main reason for the high rate of infection among first-time donors may be due to their refusal to mention their high-risk behaviors during screening and the fact that they referred to the organization for testing to ensure about their health status. In a similar study conducted by Arshad et al. in Pakistan, most of the blood donors were the first-time blood donors (21).

Transfusion Transmitted Infections (TTIs), especially chronic infections such as HIV, HCV, and HBs infections, which remain in the infected person for a long time and impose many adverse outcomes on the community, will increase the costs of healthcare sector of the country. Therefore, the effectiveness of screening tests is one of the main concerns of

the BTO. The use of modern screening methods will significantly reduce the transmission of infection through blood donation, so that the transmission of infection through the organization will be rarely occur (22).

One of the limitations of this study is that the demographic characteristics of patients infected with the infections were obtained from the information registration system of blood donors, and there was no access to other demographic characteristics of the blood donors.

### Conclusion

According to the results of the present study, the prevalence of TTIs is very low. However, it is necessary to encourage more regular donors to donate their blood in all seasons, because it has been proven that the healthiest people are regular donors, in addition, single and educated people should be also encouraged to do so. The plans of blood transfusion organization should be developed so that people who donate blood for testing, be screened, and while being advised about the risk of transfusion of infected blood and its subsequent outcomes, these high risk groups should be confidentially involved in the related tests. The use of NATs can also play an important role in screening the cases that are in the window phase, although these methods impose high costs on the organization in the country and need the support of other related organizations.

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conclusion, is subjective and reflects the authors' point of view, not the policies of the university.

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### References

- Zolfaghari Anaraki S A Atlas of Blood Transfusion [Internet]. 2011. Available from: [ghhospital.mui.ac.ir/sites/ghhospital.mui.ac.ir/files/7\\_1\\_0.pdf](http://ghhospital.mui.ac.ir/sites/ghhospital.mui.ac.ir/files/7_1_0.pdf).
- Salawu L, Bolarinwa R, Adegunloye A, Muraina H. HBsAg, anti-HCV, anti-HIV and VDRL in blood donors: Prevalence and trends in the last three and a half years in a tertiary health care facility in Ile-Ife, Nigeria. *International Journal of Medicine and Medical Sciences*. 2010;2(11):335-41.
- Kamran M, Mahmood RT, Khan MA, Mehmood A, Nisar L, Asad MJ. Prevalence of transfusion transmitted infections among blood donors; A prospective study. *AJPCT*. 2014;2(4):540-43.
- Bloch EM, Vermeulen M, Murphy E. Blood transfusion safety in Africa: a literature review of infectious disease and organizational challenges. *Transfusion medicine reviews*. 2012;26(2):164-80.
- Organization WH. Blood donor selection: guidelines on assessing donor suitability for blood donation: World Health Organization; 2012.
- Elbjeirami W, Arsheed N, Al-Jedani H, Elnagdi N, Eisha H, Abdulwahab A. Prevalence and trends of common transfusion transmitted infections using serological and nucleic acid markers in Saudi Blood Donors. *J Blood Disord Transfus*. 2015;6(3):1000280.
- Vermeulen M, Lelie N, Sykes W, Crookes R, Swanevelder J, Gaggia L, et al. Impact of individual-donation nucleic acid testing on risk of human immunodeficiency virus, hepatitis B virus, and hepatitis C virus transmission by blood transfusion in South Africa. *Transfusion*. 2009;49(6):1115-25.
- Seyed-Askari SM, Beigzadeh A. The prevalence of transfusion transmitted infections among blood donors in Kerman, Iran. *Journal of Kerman University of Medical Sciences*. 2015.
- Dwyre D, Fernando La, Holland P. Hepatitis B, hepatitis C and HIV transfusion-transmitted infections in the 21st century. *Vox sanguinis*. 2011;100(1):92-8.
- Choudhary RK, Singh P, Singh H, Singh H. Algorithm to use hepatitis core antibody and/or ID-

### Ethics Statement

This research was approved by the Ethics Committee of Kerman University of Medical Sciences (Ethical Code: IR.KMU.REC.1397.409).

### Conflict of Interests

The authors declare that they have no conflict of interests.

- NAT for HBV screening. *Zenith Int J Multidiscip Res.* 2013;3(5):192-200.
11. Busch MP, Glynn SA, Stramer SL, Strong DM, Caglioti S, Wright DJ, et al. A new strategy for estimating risks of transfusion-transmitted viral infections based on rates of detection of recently infected donors. *Transfusion.* 2005;45(2):254-64.
  12. Makroo RN, Hegde V, Chowdhry M, Bhatia A, Rosamma N. Seroprevalence of infectious markers & their trends in blood donors in a hospital based blood bank in north India. *The Indian journal of medical research.* 2015;142(3):317.
  13. Kitchen A, Barbara J. Transfusion-transmitted infections. *Practical transfusion medicine.* 2001:221-4.
  14. Tapko J, Sam O, Diarra-Nama A. Status of blood safety in the WHO African Region: report of the 2004 survey. Brazzaville: WHO Regional Office for Africa. 2007:1-25.
  15. Sorouri Zanjani R, Mazloomzadeh S, Koocheki A, Noori M. Prevalence of Hepatitis B, C and HIV Infection in Blood Donors in Zanjan, 2005-2006. *Preventive Care In Nursing & Midwifery Journal.* 2013;3(1):56-63.
  16. Ataro Z, Urgessa F, Wasihun T. Prevalence and Trends of Major Transfusion Transmissible Infections among Blood Donors in Dire Dawa Blood bank, Eastern Ethiopia: Retrospective Study. *Ethiopian journal of health sciences.* 2018;28(6):701-10.
  17. Bani Aghil SS, Abbasi S, Arab M, Seyedein MS. The Prevalence of HCV, HBV, HIV in Blood Donors of Golestan Province, (2006-2008). *Medical Laboratory Journal.* 2009;3(2):0-.
  18. Alaidarous M, Choudhary RK, Waly MI, Mir S, Bin Dukhyil A, Banawas SS, et al. The prevalence of transfusion-transmitted infections and nucleic acid testing among blood donors in Majmaah, Saudi Arabia. *Journal of infection and public health.* 2018;11(5):702-6.
  19. Pillonel J, Le Marrec N, Girault A, David D, Laperche S. [Epidemiological surveillance of blood donors and residual risk of blood-borne infections in France, 2001 to 2003]. *Transfusion clinique et biologique : journal de la Societe francaise de transfusion sanguine.* 2005;12(3):239-46.
  20. Siraj N, Achila OO, Issac J, Menghisteb E, Hailemariam M, Hagos S, et al. Seroprevalence of transfusion-transmissible infections among blood donors at National Blood Transfusion Service, Eritrea: a seven-year retrospective study. *BMC Infectious Diseases.* 2018;18(1):264.
  21. Arshad A, Borhany M, Anwar N, Naseer I, Ansari R, Boota S, et al. Prevalence of transfusion transmissible infections in blood donors of Pakistan. *BMC hematology.* 2016;16:27-.
  22. Busch M, Young M, Samson S, Mosley J, Ward J, Perkins H, et al. Risk of human immunodeficiency virus (HIV) transmission by blood transfusions before the implementation of HIV-1 antibody screening. *Transfusion.* 1991;31(1):4-11.