

Sidra Ghazanfer<sup>1</sup>  
Hasan Osman<sup>2</sup>

<sup>1</sup>Assistant Professor Pathology,  
Khawaja Muhammad Safdar  
Medical College, Sialkot

<sup>2</sup>Director, Col Sultan's Lab, Sialkot

# Frequency of TTIs in Apparently Healthy Blood Donors in Sialkot District, A Small District of Punjab-Pakistan with Big Reservoir of TTIs

## Abstract

**Objective:** To determine the frequency of hepatitis C virus (HCV), hepatitis B virus (HBV), human immunodeficiency virus (HIV), syphilis, and malarial parasite (MP) in district blood banks of Sialkot; and to compare it with national and international data.

**Methodology:** This Descriptive study was conducted between January 2013 to September 2019 at Allama Iqbal Memorial Teaching Hospital (AIMTH), Sialkot, Government Sardar Begum Hospital (GSBH), Sialkot and District Headquarter (DHQ) Hospital, Daska. All donors were between 18-60 years of age, weighed above 50 kgs and their Hemoglobin was above 12g/dl. Donors with physical disabilities and/or having co- morbid conditions were excluded from the study.

**Results:** In a span of 7 years a total of 84,305 blood donations were acquired collectively in all the three hospitals. In AIMTH, 54,630 donations were made, among which HCV positive cases were 1.70% (n=926), HBV positive cases were 1.25% (n=682), HIV positive were 0.01% (n=6), syphilis positive were 0.75% (n=408) and MP positive cases were only 0.01% (n=4). In GSBH, a total of 14,402 donations were made. Among them HCV positive were 1.25% (n=180), HBV positive were 0.80% (n=115), HIV positive were 0.02% (n=3), syphilis positive cases were equal to 0.35% (n=50), while MP positive 0.01% (n=1). In DHQ Hospital-Daska, total number of donations was 15,273, among which HCV positive were 1.16% (n=177), HBV positive were 0.88% (n=134), HIV positive cases were reported to be 0.01% (n=1), syphilis positive 0.59% (n=90) and MP positive were 0.03% (n=5). Collectively, among the total 84,305 donations made in all three hospitals, HCV positive were 1.52% (n=1283), HBV positive were 1.10% (n=931), HIV positive were 0.01% (n=10), syphilis was found positive in 0.65% (n=548) and MP positive were 0.01% (n=10).

**Conclusion:** The incidence of TTIs transmission can be decreased by improving donor screening techniques. Better techniques will also filter-out more potentially hazardous donors by which improvement in transfusion service quality can be achieved.

**Keywords:** HIV, HCV, HBV, Transfusion transmitted diseases, infections, Syphilis.

## Address for Correspondence

Dr. Sidra Ghazanfer  
Assistant Professor Pathology,  
Khawaja Muhammad Safdar  
Medical College, Sialkot  
dr.sidrahasan@hotmail.com

## Introduction

Blood transfusion is a life-saving procedure.<sup>1,2</sup> Approximately 112.5 million blood units are collected each year globally according to World Health Organization (WHO).<sup>2</sup> On the other hand, 3 million bags are being donated each year in Pakistan.<sup>3</sup> However, blood transfusion is associated with mortality and morbidity due to infections that can be transmitted

through transfusions. With each bag transfused, there is a 1% chance of transmission of transfusion transmitted infections (TTIs).<sup>3,4</sup> The TTIs remain in stored blood for a longer period and remain stable at temperature of 4°C or lower. They have long incubation periods associated with asymptomatic phase or mild symptoms before clinical appearance of the disease, so they can be easily missed during 'window period'.<sup>5</sup>

According to a study done by Pakistan Medical Research Council in 2007-08, 7.6% Pakistani population suffered from hepatitis B and C, where around 4.8% were infected from hepatitis C only.<sup>6</sup> While as far as HIV is concerned, collective data of 30 years shows a prevalence of 0.41% in Pakistani population.<sup>7</sup> In blood

Authorship Contribution: <sup>1</sup>Conceived and planned the idea of the study, final approval of the version to be published, drafting the work or revising it critically for important intellectual content, Acquisition, <sup>2</sup>analysis, or interpretation of data for the work

Funding Source: none

Received: Aug 31, 2020

Conflict of Interest: none

Accepted: Dec 21, 2021

banking sector of Pakistan, hepatitis B virus (HBV), hepatitis C virus (HCV), human immunodeficiency virus (HIV), malarial parasite (MP), and syphilis (caused by *treponema pallidum* spirochete) are usually screened because these are the most frequently found TTIs in this part of the world.<sup>3</sup> At the same time, these TTIs are also important because they cause a great deal of threat to the life of the recipients.<sup>8</sup>

Sialkot is a small district situated in North-East of Punjab Province. Jammu and Kashmir in its North, Gujranwala in the West and Narowal in South.<sup>9</sup> Although Sialkot is a small region, yet no authentic data of TTIs prevalence is available. A study was conducted in Gujranwala, a big city in near vicinity of Sialkot, where college students were screened. It showed prevalence of HBV as 1.76% and HCV as 4.08% among them.<sup>10</sup> These stats show a worrisome number of cases among the college students in Gujranwala, and it is quite possible that the number of active cases among the general population maybe much bigger. Sialkot may be showing almost the similar stats. And since the data of TTIs in this part of the country is scarce, current study was designed to get a more appropriate and deeper look at the situation of TTIs in Sialkot district.

## Methodology

This study was conducted at three blood banks in Sialkot district including Allama Iqbal Memorial Teaching Hospital (AIMTH), Government Sardar Begum Teaching Hospital (GSBTH) and District Headquarters (DHQ) Hospital-Daska. Total data collected include a duration of 6 years and 9 months, starting from January 2013 till September 2019. The blood was collected mostly from direct donations, few replacements and occasional voluntary donations. Blood donation commenced with basic demographic data collection of the donor, starting from name, age, gender, CNIC number, address, contact number, occupation, state of health, last date of donation and center of donation. Major history questions included history of Malaria, TB, typhoid, heart disease, epilepsy, hypertension, syncopal attacks, jaundice, previous transfusion, recent surgery, tooth extraction, tattooing, acupuncture, ear or nose piercing, recent hospitalization, recent travel, addiction, time & type of food last taken, imprisonment, diabetes, bleeding disorder, asthma, recent immunization and allergies. Pre donation counselling of the donor included explanation of

donation procedure, screening and outcome of screening results of TTIs. Vitals were recorded. Thorough inspection of drug abuse and skin punctures helped us to rule out professional donors. All donors were between 18-60 years of age, weighed above 50 kgs and their Hemoglobin was above 12g/dl. Donors with physical disabilities and/or having co- morbid conditions were excluded from the study. Written consent from the donors were taken (sample attached) and blood was then collected under aseptic measures as per SOPs of blood bank.

All donors were tested for hepatitis C virus (HCV), hepatitis B virus (HBV), human immunodeficiency virus (HIV), syphilis, and malarial parasite (MP). Immunochromatography technique was used since availability of ELISA lacked at our blood banks. All positive tests were deferred and referred to specialized centers for confirmation. The statistics and data were analyzed using SPSS v.20. Ethical approval was obtained from Institutional Review Board (IRB) of Khawaja Muhammad Safdar Medical College/Allama Iqbal Memorial Teaching Hospital.

## Results

According to the data obtained the infections most frequently found among apparently healthy blood donors were HCV, followed by HBV, Syphilis then HIV and MP (Table I). Quarterly comparisons at all these blood banks reflected similar in Table II-IV.

## Discussion

Blood transfusion has now become an integral part of modern-day medical practice. Safe blood procurement and prevalence of TTIs in our population can only be addressed if the screening process is strict and accurate.<sup>11</sup> Pakistan is a developing country that has been struggling in the healthcare field for quite a long time. There are many shortcomings in almost all the fields, and blood banking is no different. Blood transfusion services are not much developed in Pakistan. Lack of quality equipment and infrastructure play a key role in keeping its low standards and poorly-developed strict donor selection and donor deferral criteria.<sup>8</sup>

Our study showed that HCV and HBV positive cases were 1.52% and 1.10%, while HIV, syphilis and

**Table I: Comparison of yearly trend of TTIs in different blood banks of Sialkot.**

	YEAR	Donations	HCV	HBV	HIV	Syphilis	MP
AIMTH	2013	5,534	95 (1.72%)	48 (0.87%)	0 (0.00%)	4 (0.07%)	0 (0.00%)
	2014	5,777	100 (1.73%)	81 (1.40%)	0 (0.00%)	27 (0.47%)	0 (0.00%)
	2015	6,231	152 (2.44%)	98 (1.57%)	0 (0.00%)	38 (0.61%)	1 (0.02%)
	2016	8,100	147 (1.81%)	123 (1.52%)	3 (0.04%)	58 (0.72%)	0 (0.00%)
	2017	9,716	164 (1.69%)	128 (1.32%)	0 (0.00%)	107 (1.10%)	1 (0.01%)
	2018	10,758	137 (1.27%)	124 (1.15%)	0 (0.00%)	96 (0.89%)	0 (0.00%)
	2019	8,514	131 (1.54%)	80 (0.94%)	3 (0.04%)	78 (0.92%)	2 (0.02%)
	<b>TOTAL</b>	<b>54,630</b>	<b>926 (1.70%)</b>	<b>682 (1.25%)</b>	<b>6 (0.01%)</b>	<b>408 (0.75%)</b>	<b>4 (0.01%)</b>
GSBH	2013	1,003	16 (1.60%)	12 (1.20%)	0 (0.00%)	0 (0.00%)	0 (0.00%)
	2014	1,091	17 (1.56%)	4 (0.37%)	0 (0.00%)	0 (0.00%)	0 (0.00%)
	2015	1,137	16 (1.41%)	11 (0.97%)	0 (0.00%)	0 (0.00%)	0 (0.00%)
	2016	2,305	34 (1.48%)	25 (1.08%)	2 (0.09%)	0 (0.00%)	0 (0.00%)
	2017	3,004	32 (1.07%)	20 (0.67%)	0 (0.00%)	8 (0.27%)	0 (0.00%)
	2018	3,166	43 (1.36%)	22 (0.69%)	0 (0.00%)	24 (0.76%)	1 (0.03%)
	2019	2,696	22 (0.82%)	20 (0.74%)	1 (0.04%)	18 (0.67%)	0 (0.00%)
	<b>TOTAL</b>	<b>14,402</b>	<b>180 (1.25%)</b>	<b>115 (0.80%)</b>	<b>3 (0.02%)</b>	<b>50 (0.35%)</b>	<b>1 (0.01%)</b>
DHQ DASKA	2013	920	19 (2.07%)	11 (1.20%)	0 (0.00%)	0 (0.00%)	0 (0.00%)
	2014	1,430	20 (1.40%)	13 (0.91%)	0 (0.00%)	0 (0.00%)	0 (0.00%)
	2015	1,494	9 (0.60%)	8 (0.54%)	0 (0.00%)	0 (0.00%)	0 (0.00%)
	2016	2,305	14 (0.61%)	4 (0.17%)	0 (0.00%)	4 (0.17%)	0 (0.00%)
	2017	3,004	15 (0.50%)	8 (0.27%)	0 (0.00%)	16 (0.53%)	1 (0.03%)
	2018	3,166	52 (1.64%)	49 (1.55%)	0 (0.00%)	37 (1.17%)	4 (0.13%)
	2019	2,954	48 (1.62%)	41 (1.39%)	1 (0.03%)	33 (1.12%)	0 (0.00%)
	<b>TOTAL</b>	<b>15,273</b>	<b>177 (1.16%)</b>	<b>134 (0.88%)</b>	<b>1 (0.01%)</b>	<b>90 (0.59%)</b>	<b>5 (0.03%)</b>

**Table II: Quarterly Comparison of TTIs at AIMTH Blood Bank**

		AntiHCV	HBV	HIV	Syphilis	M.P	Total
2013	Q1	26(2.16%)	12(1.00%)	0	2(0.17%)	0	1206
	Q2	28(1.84%)	13(0.85%)	0	1(0.07%)	0	1525
	Q3	22(1.57%)	14(1.00%)	0	0	0	1398
	Q4	19(1.35%)	9(0.64%)	0	1(0.07%)	0	1405
2014	Q1	21(1.78%)	12(1.02%)	0	6(0.51%)	0	1180
	Q2	24(1.64%)	15(1.02%)	0	2(0.14%)	0	1467
	Q3	26(1.65%)	29(1.84%)	0	2(0.13%)	0	1579
	Q4	29(1.87%)	25(1.61%)	0	17(1.10%)	0	1551
2015	Q1	38(2.83%)	16(1.19%)	0	13(0.97%)	1(0.07%)	1343
	Q2	31(2.02%)	29(1.89%)	0	6(0.39%)	0	1534
	Q3	44(2.66%)	29(1.75%)	0	12(0.72%)	0	1656
	Q4	39(2.30%)	24(1.41%)	0	7(0.41%)	0	1698
2016	Q1	29(1.80%)	30(1.86%)	0	8(0.50%)	0	1610
	Q2	34(1.72%)	29(1.47%)	1(0.05%)	11(0.56%)	0	1973
	Q3	30(1.38%)	37(1.71%)	0	22(1.02%)	0	2167
	Q4	54(2.30%)	27(1.15%)	2(0.09%)	17(0.72%)	0	2350
2017	Q1	44(1.83%)	32(1.33%)	0	28(1.16%)	0	2404
	Q2	47(2.02%)	28(1.20%)	0	27(1.16%)	0	2324
	Q3	36(1.41%)	37(1.45%)	0	19(0.74%)	1(0.04%)	2553
	Q4	37(1.52%)	31(1.27%)	0	33(1.36%)	0	2435
2018	Q1	39(1.39%)	27(0.96%)	0	21(0.75%)	0	2809
	Q2	40(1.35%)	42(1.42%)	0	29(0.98%)	0	2965
	Q3	33(1.51%)	31(1.42%)	0	26(1.19%)	0	2184
	Q4	25(0.89%)	24(0.86%)	0	20(0.71%)	0	2800
2019	Q1	40(1.52%)	23(0.88%)	2(0.08%)	28(1.07%)	2(0.08%)	2627
	Q2	42(1.48%)	25(0.88%)	0	19(0.67%)	0	2836
	Q3	49(1.61%)	32(1.05%)	1(0.03%)	31(1.02%)	0	3051

MP positive were 0.01%, 0.65% and 0.01% respectively. Our results are fairly comparable to a study conducted in Karachi in 2016, that found the

frequencies of aforementioned TTIs equal to 1.80%, 1.70%, 0.04%, 2.1% and 0.07% respectively.<sup>11</sup>

**Table III: Quarterly Comparison of TTIs at GSBH Blood Bank**

		AntiHCV	HBV	HIV	Syphilis	M.P	Total
2013	Q1	4(1.49%)	7(2.60%)	0	0	0	269
	Q2	6(2.38%)	1(0.40%)	0	0	0	252
	Q3	3(1.20%)	3(1.20%)	0	0	0	249
	Q4	3(1.29%)	1(0.43%)	0	0	0	233
2014	Q1	5(2.08%)	0	0	0	0	240
	Q2	4(1.3%)	2(0.65%)	0	0	0	308
	Q3	4(1.32%)	1(0.33%)	0	0	0	303
	Q4	4(1.67%)	2(0.83%)	0	0	0	240
2015	Q1	4(1.33%)	3(1.00%)	0	0	0	301
	Q2	4(1.48%)	2(0.74%)	0	0	0	271
	Q3	5(1.71%)	4(1.37%)	0	0	0	292
	Q4	3(1.10%)	2(0.73%)	0	0	0	273
2016	Q1	9(2.17%)	6(1.45%)	0	0	0	414
	Q2	7(1.23%)	6(1.05%)	0	0	0	569
	Q3	10(1.47%)	6(0.88%)	0	0	0	679
	Q4	8(1.24%)	7(1.09%)	2(0.31%)	0	0	643
2017	Q1	8(1.23%)	2(0.31%)	0	1(0.15%)	0	650
	Q2	4(0.57%)	3(0.43%)	0	3(0.43%)	0	697
	Q3	14(1.15%)	9(0.97%)	0	3(0.32%)	0	929
	Q4	6(0.82%)	6(0.82%)	0	1(0.14%)	0	728
2018	Q1	10(1.19%)	6(0.72%)	0	4(0.48%)	1(0.12%)	838
	Q2	13(1.58%)	6(0.73%)	0	7(0.85%)	0	821
	Q3	12(1.62%)	5(0.67%)	0	4(0.54%)	0	742
	Q4	8(1.05%)	5(0.65%)	0	9(1.18%)	0	765
2019	Q1	8(0.96%)	5(0.60%)	0	11(1.32%)	0	831
	Q2	7(0.75%)	6(0.64%)	0	3(0.32%)	0	933
	Q3	7(0.75%)	9(0.97%)	1(0.11%)	4(0.43%)	0	932

**Table IV: Quarterly Comparison of TTIs at DHQ Hospital-Daska, Blood Bank**

		AntiHCV	HBV	HIV	Syphilis	M.P	Total
2013	Q1	4(2.27%)	1(0.57%)	0	0	0	176
	Q2	2(0.95%)	1(0.48%)	0	0	0	210
	Q3	6(2.04%)	2(0.68%)	0	0	0	294
	Q4	7(2.92%)	7(2.92%)	0	0	0	240
2014	Q1	0	2(0.74%)	0	0	0	269
	Q2	9(2.77%)	2(0.62%)	0	0	0	325
	Q3	5(1.16%)	4(0.93%)	0	0	0	432
	Q4	6(1.49%)	5(1.24%)	0	0	0	404
2015	Q1	0	3(0.83%)	0	0	0	363
	Q2	2(0.56%)	3(0.84%)	0	0	0	358
	Q3	5(1.33%)	0	0	0	0	376
	Q4	2(0.50%)	2(0.50%)	0	0	0	397
2016	Q1	5(1.21%)	1(0.24%)	0	0	0	414
	Q2	3(0.53%)	0	0	0	0	569
	Q3	1(0.15%)	2(0.29%)	0	4(0.59%)	0	679
	Q4	5(0.78%)	1(0.16%)	0	0	0	643
2017	Q1	2(0.31%)	3(0.46%)	0	5(0.77%)	0	650
	Q2	5(0.72%)	1(0.14%)	0	2(0.29%)	0	697
	Q3	2(0.22%)	3(0.32%)	0	3(0.32%)	1(0.11%)	929
	Q4	6(0.82%)	1(0.14%)	0	6(0.82%)	0	728
2018	Q1	13(1.55%)	9(1.07%)	0	6(0.72%)	0	838
	Q2	9(1.10%)	12(1.46%)	0	11(1.34%)	2(0.24%)	821
	Q3	15(2.02%)	12(1.62%)	0	9(1.21%)	2(0.27%)	742
	Q4	15(1.96%)	16(2.09%)	0	11(1.44%)	0	765
2019	Q1	16(1.93%)	9(1.08%)	0	7(0.84%)	0	831
	Q2	20(2.14%)	16(1.71%)	0	15(1.61%)	0	933
	Q3	12(1.01%)	16(1.34%)	1(0.08%)	11(0.92%)	0	1190

Somewhat similar results were seen in another study published in 2019 and conducted in Islamabad by Siddiqui et al. The frequencies they found were 1.77%, 1.29%, 0.23%, 0.35% and 0.11% respectively (12).

Saeed et al., published a study in 2017 which depicted the frequencies of the said TTIs as 2.62%,

1.10%, 0.02%, 1.55% and 0.10% respectively (3). Memon et al., conducted a similar study in Hyderabad which was published in 2017. According to them, the frequencies were 3.52%, 1.40%, 0.06%, 3.01% and 0.10% respectively (13). Another study conducted by Ghafoor et al., in Rahim Yar Khan and published in 2015 revealed the frequencies as 4.1%, 1.47%, 0.13%

and 0.46% respectively, while they did not perform the MP.<sup>14</sup>

In comparison of our study with neighboring countries, a study conducted in Nepal showed frequencies as 0.64%, 0.47%, 0.12% and 0.48% respectively, while they did not perform MP.<sup>15</sup> According to a study conducted by Patil et al., in India and published in 2019, seroprevalence of the given TTIs were 0.44%, 1.05%, 0.25%, 0.05% and 0.01% respectively.<sup>16</sup> Another study conducted by Arora et al., in India in 2017 showed quite different results from our study. They tested HCV, HBV, HIV and syphilis only and found the seroprevalence equal to 0.42%, 0.82%, 3.24% and 0.82% respectively.<sup>17</sup> Saghir et al., published their study in 2012. Their study was conducted in Yemen. According to their stats, the prevalence of HCV, HBV, HIV and syphilis were 0.79%, 2.35%, 0.14% and 0.34% respectively.<sup>18</sup>

Another study revealed almost somewhat results. It was conducted in Eastern Ethiopia by Teklemariam et al., and was published in 2018. They found the prevalence of the same TTIs equal to 0.8%, 4.4%, 0.6% and 1.1% respectively.<sup>19</sup> Another study which was conducted in Northwest Ethiopia by Biadgo et al., and was published in 2017. They tested only HCV, HBV and HIV. They found the prevalence of the said TTIs as 0.8%, 3.6% and 2.24% respectively.<sup>20</sup> Another study conducted in Port Sudan and published in 2019 revealed that prevalence of HCV, HBV, HIV and syphilis were 0.4%, 11.7%, 1.4% and 6.6% respectively.<sup>21</sup>

## Conclusion

Although acute and chronic liver diseases are among the most widespread diseases in Pakistan, yet other diseases such as HIV, syphilis and malarial parasite (MP) are also taking up the pace gradually. This can become a very serious health concern in the long run. If the healthcare officials do not take necessary measures in time, things may become uncontrollable in the future.

This study showed that TTIs specially HCV, HBV and syphilis are prevalent in this area and therefore improved screening techniques should be implemented for stringent donor screening. Every donor should be screened either by using ELISA, by

using CLIA or by using NAT for better results and safe blood procurement. Areas which are under-resourced, such as Sialkot, are hidden reservoirs of TTIs and therefore the above-mentioned screening techniques should be implemented to help avoid their spread.

## References

1. Dogra M, Dogra A, Sidhu M, Kotwal U. Seroprevalence of coinfections among blood donors in tertiary health care centre of Jammu region. *Indian J Med Microbiol*. 2015 Jan 1;33(1):181.
2. Bibi S, Siddiqui T, Jafry S, Ahmed W. Infection control practices in blood banks of Pakistan. *East Mediterr Health J*. 2019 May 1;25(5):331–40.
3. Saeed M, Hussain S, Rasheed F, Ahmad M, Arif M, Rahmani MTH. Silent killers: Transfusion Transmissible Infections-TTI, among asymptomatic population of Pakistan. *J Pak Med Assoc*. 2017;67(3):6.
4. Choudhury N. Transfusion transmitted infections: How many more? *Asian J Transfus Sci*. 2010 Jul;4(2):71–2.
5. Hassan MJ, Khan S, Jairajpuri ZS, Rana S. Seroprevalence of Transfusion Transmitted Infections by Using 4th Generation Enzyme- Linked Immunosorbent Assay kit: A 3 Year Study in a Tertiary Health Care Centre of Delhi. *Ann Pathol Lab Med*. 2016;03(04):7.
6. Ashraf S, Ahmad A. Viral hepatitis in Pakistan: challenges and priorities. *Asian Pac J Trop Biomed*. 2015 Mar 1;5(3):190–1.
7. Ali M, Nadeem M, Numan M, Khalil AT, Maqbool K, Yousaf MZ, et al. Thirty years of HIV in Pakistan: a systematic review of prevalence and current scenario. *Future Virol*. 2017 Oct 1;12(10):609–23.
8. Sultan S, Murad S, Irfan SM, Biag MA. Trends of Venereal Infections among Healthy Blood Donors at Karachi. *Arch Iran Med*. 2016;19(3):192–6.
9. Ullah R, Malik RN, Qadir A. Assessment of groundwater contamination in an industrial city, Sialkot, Pakistan. *Afr J Environ Sci Technol [Internet]*. 2009 [cited 2020 Apr 17];3(12). Available from: <https://www.ajol.info/index.php/ajest/article/view/56273>
10. Ilyas M, Iftikhar M, Rasheed U. Prevalence of hepatitis B and hepatitis C in populations of college students in Gujranwala. *Biol Pak*. 2011;57(1 & 2):89–96.
11. 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 Hematol*. 2016;16:27.
12. Siddiqui FM, Ahmed N, Oluwatayo O, Jabeen S, Qadir SM, Khan SA, et al. Prevalence of Transfusion-Transmissible Infections among Voluntary Blood Donors in Tertiary Health-Care Facility in Islamabad, Pakistan. 2019;9(6):4.
13. Memon FA, Ujjan ID, Memon AI, Shaikh AR, Rao AR, Naz A. Seroprevalence of transfusion transmitted infections among different blood group donors at Blood Bank LUMHS, Hyderabad. *Pak J Med Sci*. 2017;33(2):443–6.