

Prevalence and trends of Transfusion Transmissible Infections among blood donors in the State of Qatar, 2013-2017

Mohamed Aabdien (✉ Aabdien_Mohamed@outlook.com)

Hamad Medical Corporation <https://orcid.org/0000-0002-6518-0773>

Nagah Selim

Primary Health Care Corporation

Sayed Mohamed Himatt

Ministry of Public Health

Saloua Hmissi

Hamad Medical Corporation

Zeyd Merenkov

Hamad Medical Corporation

Noora AlKubaisi

Primary Health Care Corporation

Manar Elhassan

Qatar University

Abdelatif Abdelmola

Hamad Medical Corporation

Shadi Khelfa

Hamad Medical Corporation

Elmoubasher Farag

Ministry of Public Health

Hamad E. Al-Romaihi

Ministry of Public health

Mohamed Al-Thani

Ministry of Public Health

Moutaz Derbala

Hamad Medical Corporation

Saad Al Kaabi

Hamad Medical Corporation

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Abstract

Background: Millions of lives around the world are being saved annually through blood transfusion. However, blood transfusion is among the important vehicles for transmitting infections. The overall prevalence of Transfusion Transmissible Infections (TTIs) among blood donors differs around the world, reflecting the variation in the prevalence of these infections. The aim of this study is to assess the prevalence and trends of TTIs among blood donors in Qatar. Methods: This is a cross sectional study utilizing donation records of a five-year period from January 2013 to December 2017. Results for all screening and confirmatory tests for Hepatitis B Virus (HBV), Hepatitis C Virus (HCV), Human T-Lymphotropic Virus-I/II (HTLV-I/II), Syphilis and Malaria were included in the study. Results: Among the 190,509 donations received at the donation center during the study period, about 91% donations were received from males and 9% from females. The overall positivity rate for all tests were 1.95, 2.18, 1.62, 1.81 and 1.85 for the years 2013 through 2017. The overall positivity rates for HBV, Syphilis and Malaria were 0.30, 0.43 and 0.20, respectively. Throughout the years, the positivity rates decreased for HBV, Syphilis and Malaria and increased for HCV and HTLV. Conclusion: The overall positivity rate of all tests combined for the TTIs demonstrated a gradual increasing trend from 2013 to 2017. The rates for HCV and HTLV showed increasing trends too. To support developing effective prevention and control strategies, further investigations are needed to improve the estimations of the prevalence of these infections.

Introduction

Blood transfusion is a life-saving procedure that saves millions of lives every year around the world, it can be transfused as a whole blood for one patient or may be manufactured into blood derived products to be provided for more than one patient. However, its known that blood transfusion can be associated with risks of transmitting certain infections.(1,2)

These infections are known as Transfusion Transmissible Infections (TTIs), which defined as any infection that can be transmitted from person to person through parenteral administration of blood or any blood products. Thus, different outcomes may follow unsafe transfusion, as it can cause an acute clinical sickness, it can persist in the receiver as carrier or it can cause an asymptomatic infection.(3)

These infections include viral, bacterial, parasites and prions. The most prominent among these are, Human Immunodeficiency Virus (HIV), Hepatitis B Virus (HBV) and Hepatitis C Virus (HCV), due to their high prevalence rates. Other agents are Human T-cell Lymphotropic Virus (HTLV-I/II), Cytomegalovirus (CMV), Parvovirus B19, West Nile Virus (WNV) and Dengue Viruses, Trypanosomiasis, Malaria and Transmissible Spongiform Encephalopathy (TSE).(4)

The prevalence of TTIs among blood donations varies between high and low-income countries. It was reported that the prevalence of HIV, HBV, HCV and Syphilis in high-income countries are 0.003%, 0.03%, 0.02% and 0.05%, respectively. While in low income-countries, the prevalence of these infections is higher;

1.08%, 3.70%, 1.03% and 0.90%, respectively. These differences reflect the variation in the prevalence of these infections among the populations of these countries.(5) These variations are also observed between the World Health Organization (WHO) regions. As African and Pacific regions are the highest in HBV prevalence, and the Eastern Mediterranean region is the highest for HCV prevalence, according to the WHO.(6)

Many global efforts are provided to ensure the safety of the whole blood transfusion process. These efforts include providing recommendations and guidelines to establish a national blood screening and surveillance system for the entire transfusion chain, i.e. haemovigilance system. Moreover, efforts are also provided for the establishment of the Global Database on Blood Safety (GDBS) aiming to improve transfusion services globally.(7,8)

In Qatar, The Blood Donor Center at Hamad Medical Corporation is responsible for the provision of safe blood supply through the efforts provided to ensure that donated blood is free from infections. However, there is scarcity in local epidemiological studies assessing transfusion transmitted infections among blood donors. Hence, conducting this study to assess transfusion transmissible infections among blood donors can provide better understanding of the epidemiology of these infections, which can support strategies development to evaluate safe blood supply measures, in addition to the preventive and control measures that are needed to manage the burden of these infections in the community. In this study the aim is to assess the prevalence and the trends of the transfusion transmissible infections among blood donors during the period 2013–2017, in Blood Donor Center at Hamad Medical Corporation in the State of Qatar.

Methods

Study Setting

The Division of Transfusion Medicine includes Blood Bank Section & Donor Unit. The Transfusion Division is the only provider of blood and blood components in the State of Qatar. Its main function is to assure the availability of safe blood whenever needed. The center follows international recommendations for the provision of safe, efficacious blood products and transfusion. In September 2017, Hamad Medical Corporation's committee for blood transfusion announced a new program for monitoring blood transfusion process in the country. The Centralized Hemovigilance Program aims to improve the quality of the blood transfusion chain, with a main focus on safety. The program has been initially implemented at HMC and is being introduced across all healthcare facilities around the country, that collect, use or store blood and its products. All donated unit samples are initially screened prior transfusion for the following infectious diseases markers: Human Immune Deficiency Antigen/Antibody (HIV Ag/Ab Combo), Human T cell Lymphotropic Virus type I and II antibodies (HTLV–1/II Ab), Syphilis Treponema Pallidum Antibody screening (Syphilis TP Ab), Hepatitis B surface Antigen (HBsAg), Hepatitis B core Antibody (HBcAb), Hepatitis C Antibody (Anti HCV), Nucleic acid Testing (NAT) for HBV, HCV, HIV. In addition to Malaria Ab and Ag tests.

Data Collection

This is a cross sectional study, conducted using data of all blood donations received in the period between January 2013 and December 2017 at Blood Donor Center in Hamad Medical Corporation. All data included in the study were retrieved from the records anonymously with no identifications of the donors. An extraction sheet was used, and data were provided only as frequencies of positive results for each screening test, in addition to basic demographics including age, gender and nationality of all donors. Tests included in this study were: HBsAg, HBcAb, HBV NAT, HCV Ab, INNO-LIA HCV, HCV NAT, HTLV-I/II Ab, INNO-LIA HTLV-I, Syphilis Ab and INNO-LIA Syphilis, in addition to Malaria Ab and Ag tests. Data for HIV were not included due to its sensitivity, complexity, need of careful handling and unique address with specific and comprehensive approach.

Data Analysis

All blood donors' data were entered in a Microsoft excel sheet. Frequencies and percentages were used for the description of blood donors by gender, age groups and nationality. Furthermore, descriptive analysis was conducted to assess the positivity rate of the transfusion transmissible infections distribution by age groups, gender and nationality (Qataris and Non-Qataris). The positivity rates of these infections were also measured for each year to identify the trends throughout the five years period.

Results

A total of 190,509 donations were received at Blood Donor Centre in Hamad Medical Corporation in the period between January 2013 and December 2017. About 91% of the donations were received from males and 9% from females (Table–1). Moreover, donors of age group 31–40 years were the highest to donate blood with a percentage of 38.6% from the total donations during the study period (Table–1). Qataris donors were the second most nationality to donate blood in three years of the study duration (Figure–1).

The positivity rates for all the tests combined together were: 1.95, 2.18, 1.62, 1.81, 1.85 for the years 2013, 2014, 2015, 2016 and 2017, respectively. These rates include all screening and confirmatory tests performed for blood donation safety, i.e. HBsAg, HBcAb, HBV NAT, HCV Ab, INNO-LIA HCV, HCV NAT, HTLV-I/II Ab, INNO-LIA HTLV-I, Syphilis Ab and INNO-LIA Syphilis, in addition to Malaria Ab and Ag tests (Figure–2).

Moreover, the positivity rates of these tests combined together also showed a difference between male and female donors. These differences are observed during all years of the study period, as the rate ranged between 1.63 and 2.21 for male donors, and ranged between 1.28 and 2.71 for female donors (Figure–3).

Assessing the positivity rate among the donors considering different age groups showed that donors aged 31–40 years old represented the highest proportion of positivity for TTIs among positives in all age groups for each year. The proportions of the positivity were 0.79, 0.88, 0.61, 0.67 and 0.73 for the years 2013 through 2017, respectively (Figure–4). Moreover, When the positivity rates were assessed according to nationality throughout the years, it was found that these rates were higher in Non-Qataris compared to Qataris throughout all the study years (Figure–5).

Furthermore, positivity rate of the screening tests including HCV Ab, HTLV I/II Ab, Syphilis Ab, HBsAg and Malaria Ag were calculated to assess the trends from 2013 through 2017. The trends were found to be decreasing for HBV, Malaria and Syphilis. However, trends were increasing for HCV and HCV I/II from 0.58 to 0.70 and from 0.08 to 0.23, respectively (Table–2).

Discussion

Despite the fact that blood transfusion saves millions of lives every year, unsafe blood remains as a threat for the spread of infections. Moreover, it's also important to address the fact that safe blood is considered a universal right, and it should not cause any harm. Thus, it should be fully screened and ensured not be contaminated by any transmissible infection.(9)

Blood donation centers are among valuable sources of data, as the prevalence of transfusion transmissible infections among blood donors differs throughout the world, and it can reflect the burden variations among these populations. This is due the fact that blood donors are usually representing the healthy members of the community, so it can have its inferences on the general population. Currently, the number of registered donors at Blood Donor Center in Hamad Medical Corporation had increased noticeably as a result of the continuous promotion, motivation, guidance, and education efforts about the importance of blood donation, which led to overall rise in the general public awareness.

In this study, it was found that around 90% of blood donations were by male donors, which was consistent with several studies, in which blood donations were predominantly by male donors.(10,11) However, some studies showed that this difference in number of donations between gender is much less. (12,13) The change in the country's population composition could have its implications on these findings, as large proportion of the country's population are expatriate residents, and mostly been male working immigrants.

Similarly, the literature showed that women contribute less to blood donations than men due to a number of factors, and physiological factors are among the important ones, which include weight difference between men and women, the concurrent losses due to menstruation in women, in addition to lactation and pregnancy for child bearing women. Therefore, men can give blood every 12 weeks, but women can donate every 16 weeks or more, with a variation of 4–6 donations per year for men and 3–4 donations for women.(14) In addition to that, some studies discussed other factors such as social and cultural norms that are less empowering women, developing countries as an example. These include, lack of access to education, employment and independent income.(15)

The predominance of males' contribution to blood donations was also observed in regards transfusion transmissible infections positivity rates, as this study showed a consistent predominance throughout most of the years, in which rates were higher in male donors. These was similar to the findings from studies in the region.(16–19)

In general, younger population seems to contribute more to blood donation, as it was shown in several studies, as most of donors were less than 30 years in age.(10,20,21) However, in this study most of the blood donors found to be aged 31–40 years old. This was also shown in regards the positivity rate for transfusion transmissible infections, as the highest proportion of positivity rate among all positives was found among the same age group. However, the rates were found to be highest among younger population (20–29 years) age group, from other studies in countries from different regions.(20–22)

In literature, it has been discussed that young males are more to be involved in risky behaviors than females and older age groups. Moreover, results from a number of studies showed that some donors are involved in risky behaviour activities, yet, they contribute to blood donation. The reason is that they are using it as a way to check if they were infected with any of the infections that can be related to their risky behaviours.(23–25)

In this study, the positivity rate of the combined tests including serological and NAT tests were assessed throughout the years 2013 to 2017. By assessing these rates through five years period, we were able to identify the trend for these infections, as a gradually increased trend for the positivity rate of the combined tests was identified. Despite this increase in the trend throughout the years, yet, the rates were less than what was found in other countries from the region, e.g. Saudi Arabia, where the positivity rates ranged between 6.8 and 7.4 from 2011through 2014.(26)

Moreover, the trends for each infection of the TTs were also assessed in this study. The results showed a declining trend for HBsAg throughout the years, form 0.34 in 2013 to 0.29 in 2017. These rates are less than what have been found in studies from countries in the region including Saudi Arabia, Kuwait, Jordan and Egypt.(27) The decline in these rates can be attributed to the effective prevention and control strategies including vaccination programs.(28)

On the contrary, the rates for HCV Ab showed a slightly increasing trend from 0.58 in 2013 to 0.70 in 2017. These rates were less than the reported from Egypt and Saudi Arabia,(29) which can be attributed to the high prevalence of the disease among general population and the migration from these countries to other countries with lower prevalence.(30) This was consistent with the findings from this study, as the rates were higher among the Non-Qataris throughout the years. However, the rates were higher than what was reported from other countries in the same region (i.e. middle east region), like Iran and Turkey.(29)

Furthermore, screening for HTLV is also among the recommended screening for transfusion, this include two viruses: I and II that differs in their geographical distribution and clinical disease association. HTLV is endemic in some parts of the world, and in some regions, prevalence of the virus is very low or it may be totally absent, as the situation here in Qatar.

The cost effectiveness of the universal screening strategies for HTLV has been argued. This was especially for the screening implementation by high income countries with low prevalence of the infection.(31,32) Qatar is among these countries, however, it is a destination for working force from all around the world, including areas endemic with the virus. Therefore, HTLV is among the screening requirements for blood safety in the country. The positivity rate for HTLV I/II Ab in 2017 found to be 0.23, which represents an increasing trend from 0.08 in 2103. Further analysis for the findings showed that the positivity rates were more in Non-Qataris than Qataris for the viral antibodies screening, in addition to zero positivity among Qataris for the viral confirmatory test (i.e. INNO-LIA), which is consistent with the epidemiological distribution of the disease, considering Qatar as a low prevalence area for HTLV.(33)

The blood safety can be threatened by donors with risky behavior as they may potentially acquire syphilis, among other infections. In this study, the positivity rates for Syphilis Ab among donors throughout the years showed a fluctuating trend that reported to be 0.48 in 2013, and to be 0.45 in 2017, and these rates were higher in Non-Qatari throughout the years. Yet, these rates were less than what was found in studies in neighboring countries, such as Saudi Arabia.(10,34) Moreover, it's important to consider the fact that a specific assay is been used to screen for syphilis (i.e. Treponema pallidum Ab), which leads to identifying who ever has been infected with syphilis, whether it is a recent or past infection, and whether it was treated or not, which may result in overestimation of the disease burden.(31)

Another serious infectious agent that remains to risks blood safety is the transfusion associated malaria. In which the country is free from a local transmission of malaria and all reported cases are imported from abroad, through migrants and travelers from endemic countries. Findings from our study are consistent with the situation among the general population, as the rates of positivity for Malaria Ag were found to be higher among Non-Qataris throughout the years. Moreover, assessing these rates throughout the year revealed a fluctuating trend, ranged between 0.10 and 0.14 in most of the years, with exception of the years 2014 and 2015, as the rates were 0.24 and 0.42, respectively. In addition to that the overall positivity rate found to be 0.18, almost the same to what was found in Saudi Arabia.(35)

In summary, the overall positivity rate of transfusion transmissible infections among blood donors were assessed through combined serological in addition to NAT tests, and results revealed a gradually increasing trend throughout the years, for these infections when combined together. However, this study also revealed a decreased trend for HBV, Syphilis and Malaria and increasing trends were identified for HCV and HTLV, with further analysis revealed that the rates were higher among Non-Qataris throughout the years. Despite the important study findings, there are a number of limitations that are worth to be mentioned. Among which, is the fact that this is a retrospective study conducted by utilizing records in the blood donor center, therefore, the study was limited to the data in these records only, which include results of the screening tests in addition to basic demographics (i.e. age, gender, nationality). Moreover, these records were limited to short time period, i.e. five years, from 2013 to 2017. Another limitation of this study is not including data about HIV, due to the sensitivity and the complexity of these data. Finally, it was not possible to assess the outcome of donors with positive results for any of the infections, as the donation records is not connected with the medical records.

Conclusion

In spite of the previously discussed limitations, this study still provides important findings that contribute to better understanding of TTIs epidemiology. Up to our knowledge, this is the first study to assess the prevalence and trends of TTIs including: HBV, HCV, HTLV, Syphilis and Malaria among blood donors in Qatar. In addition to that, further investigations, are needed to assess the distribution and determinants of these infections in the community to support the development of effective prevention and control strategies and to protect the community from potential risks.

Declarations

Acknowledgement

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Ethical Approval

This study was reviewed and approved by the Medical Research Center at Hamad Medical Corporation, under the reference number: MRC-01-18-374. 'Exempt' under MOPH guidelines "Category 3: Research involving the collection or study of existing: Data, documents, records and the information is recorded by the investigator in such a manner that subjects cannot be identified, directly or through identifiers linked to the subjects".

Consent for publication

N/A

Availability of data and material

The data that support the findings of this study are available from Blood donation Center at Hamad Medical Corporation in Qatar, and were used under license for the current study, and so are not publicly available. Data are however available from the authors upon reasonable request and with permission of Blood Donation Center.

Competing interests

The authors declare that they have no competing interests.

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This study did not receive any financial support.

Authors' contributions

Authors participated in the study design, data analysis, results interpretation, in addition to manuscript reviewing and writing. All authors read and approved the final manuscript.

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Tables

Table-1: Demographic characteristics of blood donors in Blood Donor Center at Hamad Medical Corporation in the period 2013-2017.

Year	2013	2014	2015	2016	2017	Total
Total Donations	26153	38577	42528	40865	42386	190509
	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
Gender						
Male	24140 (92.3)	34961 (90.6)	38531 (90.6)	37028 (90.6)	38577 (91.0)	173237 (90.9)
Female	2013 (7.7)	3616 (9.4)	3997 (9.4)	3837 (9.4)	3809 (9.0)	17272 (9.1)
Age Group						
<=18	8 (0.03)	11 (0.03)	24 (0.06)	8 (0.02)	6 (0.01)	57 (0.03)
19-20	762 (2.9)	1265 (3.3)	1170 (2.8)	1349 (3.3)	909 (2.1)	5455 (2.9)
21-30	9035 (34.5)	13341 (34.6)	14598 (34.3)	13847 (33.9)	13131 (31.0)	63952 (33.6)
31-40	10044 (38.4)	14609 (37.9)	16112 (37.9)	15706 (38.4)	16974 (40.0)	73445 (38.6)
41-50	4831 (18.5)	6977 (18.1)	7920 (18.6)	7424 (18.2)	8381 (19.8)	35533 (18.7)
51-60	1337 (5.1)	2142 (5.6)	2429 (5.7)	2264 (5.5)	2644 (6.2)	10816 (5.7)
>60	136 (0.5)	232 (0.6)	275 (0.6)	267 (0.7)	341 (0.8)	1251 (0.7)

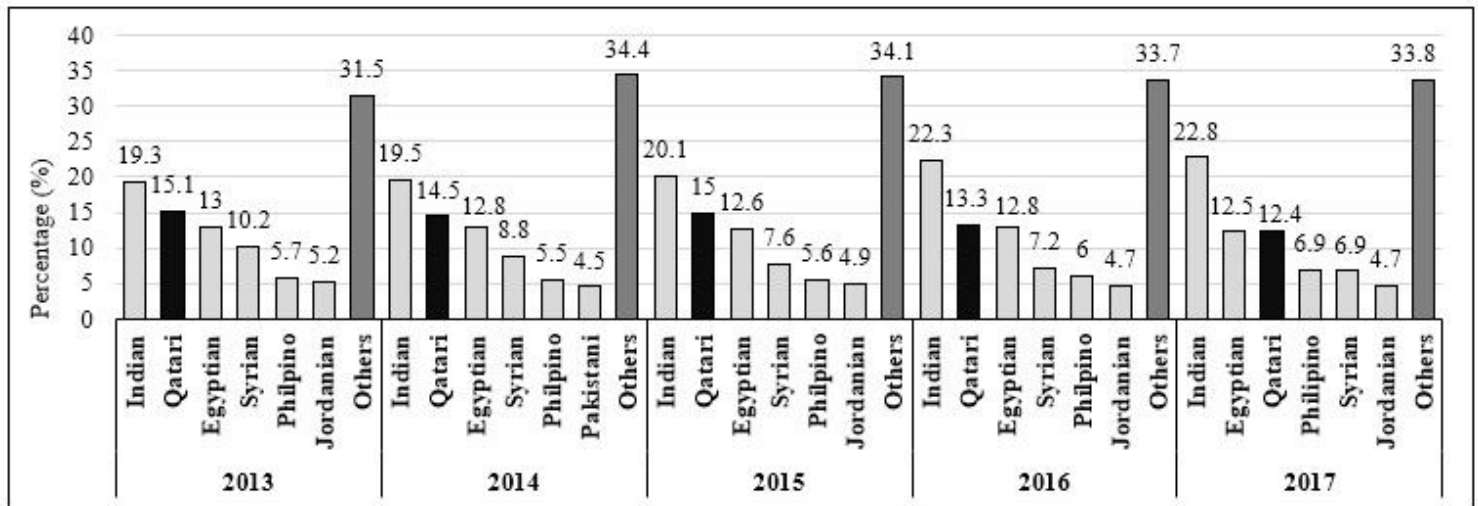
*Others: Including all nationalities together following the top six ranking nationalities for donation.

Table-2: Temporal trends of HCV, HBV, HTLV, Syphilis and Malaria positivity rate for screening tests: (HCV Ab, HBsAg, HTLV I/II Ab, Syphilis Ab and Malaria Ag) among blood donors in Blood Donors Center at

Hamad Medical Corporation in the period 2013-2017.

Year	2013	2014	2015	2016	2017	Overall
Total screened	24136	25432	27326	26983	27895	131772
HCV Ab	0.58	0.58	0.56	0.60	0.70	0.60
HTLV I/II Ab	0.08	0.16	0.20	0.22	0.23	0.18
Syphilis Ab	0.48	0.49	0.35	0.41	0.45	0.43
HBsAg	0.34	0.28	0.31	0.26	0.29	0.30
Malaria Ag	0.14	0.24	0.42	0.10	0.10	0.20

Figures



*Others: Including all nationalities together following the top six ranking nationalities for donation.

Figure 1

Percentage of blood donations by nationality in Blood Donors Center at Hamad Medical Corporation in the period 2013-2017.

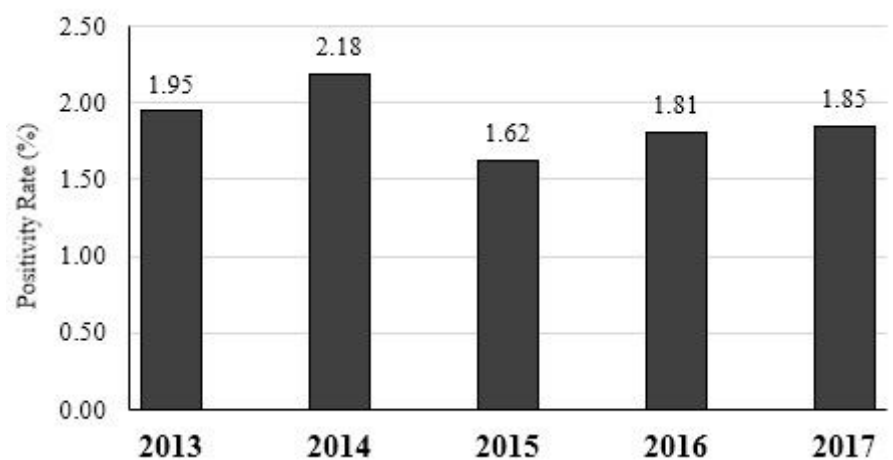


Figure 2

Temporal trend of total TTIs prevalence using combined serological and NAT screening (HBsAg, HBcAb, HBV NAT, HCV Ab, INNO-LIA HCV, HCV NAT, HTLV-I/II Ab, INNO-LIA HTLV-I, Syphilis Ab and INNO-LIA Syphilis, in addition to Malaria Ab and Ag tests) among blood donors in blood donors center at Hamad Medical Corporation in the period 2013-2017.

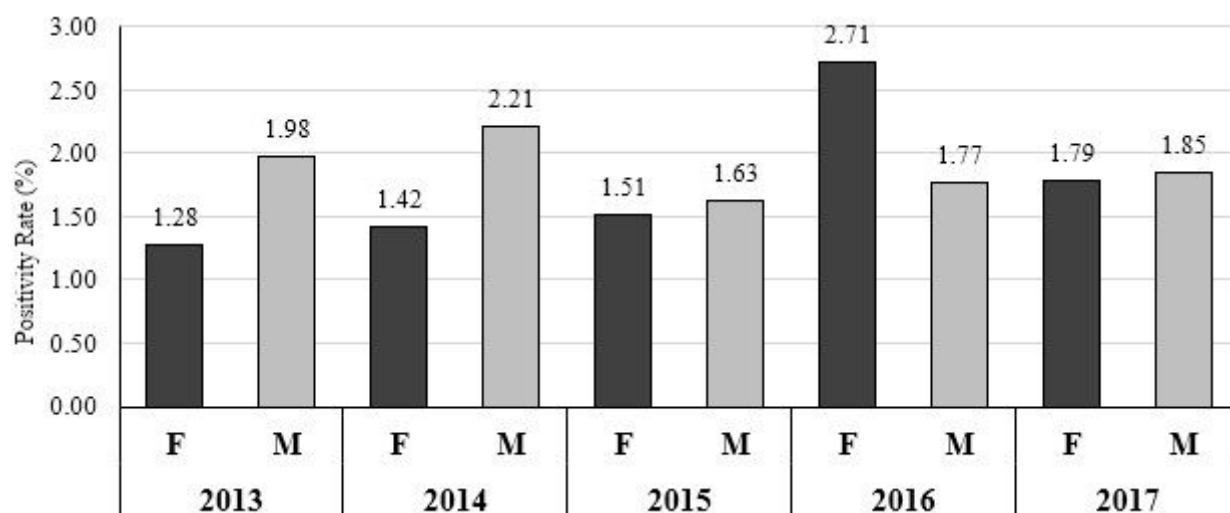


Figure 3

Gender distribution of positivity rate for combined serological and NAT screening (HBsAg, HBcAb, HBV NAT, HCV Ab, INNO-LIA HCV, HCV NAT, HTLV-I/II Ab, INNO-LIA HTLV-I, Syphilis Ab and INNO-LIA Syphilis, in addition to Malaria Ab and Ag tests) of blood donors in Blood Donors Center at Hamad Medical Corporation in the period 2013-2017.

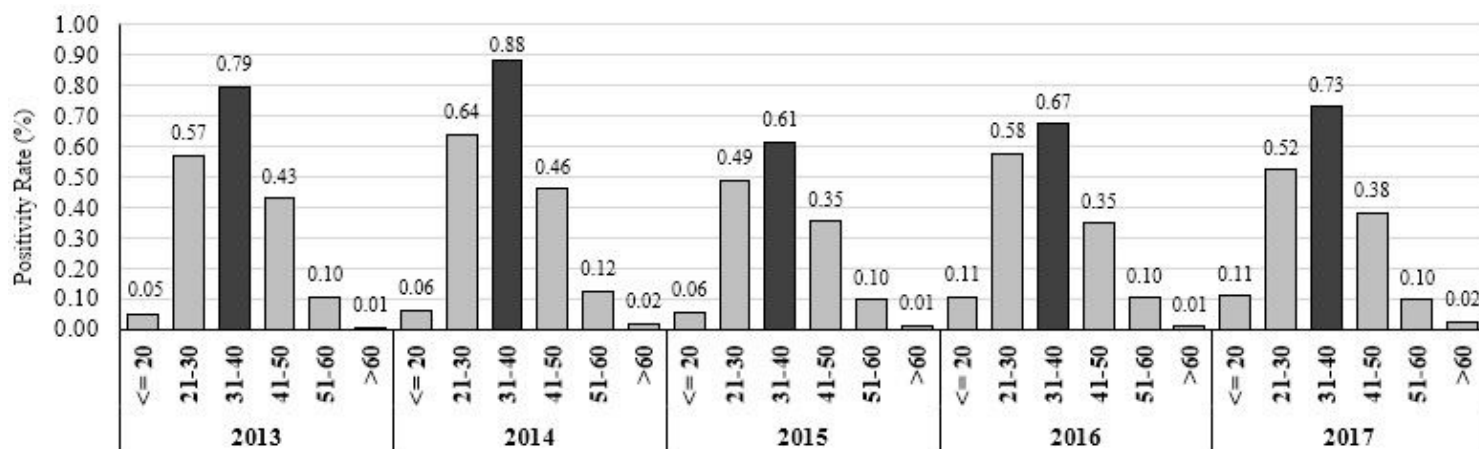


Figure 4

Age distribution of positivity rate for TTIs combined tests (HBsAg, HBcAb, HBV NAT, HCV Ab, INNO-LIA HCV, HCV NAT, HTLV-I/II Ab, INNO-LIA HTLV-I, Syphilis Ab and INNO-LIA Syphilis, in addition to Malaria Ab and Ag tests) of blood donors in Blood Donors Center at Hamad Medical Corporation in the period 2013-2017.

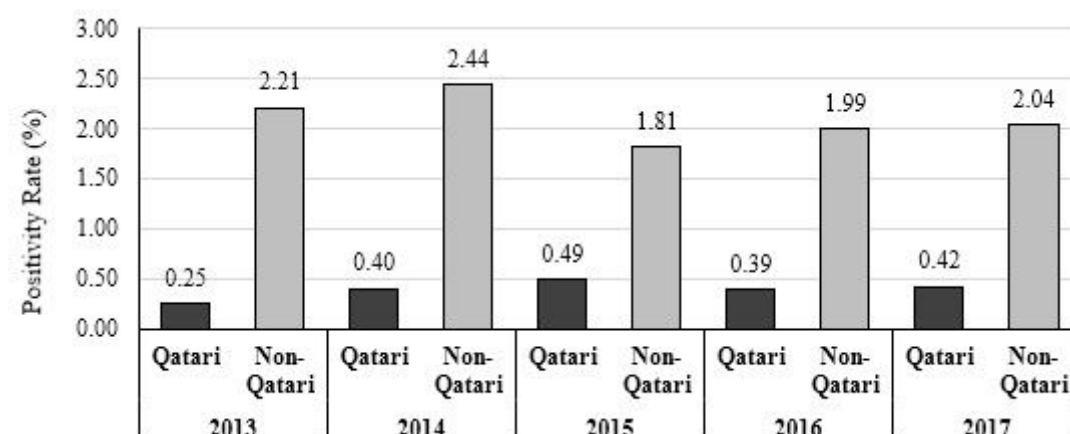


Figure 5

Positivity rate for TTIs tests combined: (HBsAg, HBcAb, HBV NAT, HCV Ab, INNO-LIA HCV, HCV NAT, HTLV-I/II Ab, INNO-LIA HTLV-I, Syphilis Ab and INNO-LIA Syphilis, Malaria Ab and Ag tests) of blood donors (Qatari Vs Non-Qatari) in Blood Donors Center at Hamad Medical Corporation in the period 2013-2017.