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Seropositivity of TTIs among blood donors in Hail, Saudi Arabia, from 2014 to 2015

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ABSTRACT

Objective: To detect the seropositivity of transfusion transmitted infections among healthy blood donors in Hail Region, Saudi Arabia.**Methods:** In the study, about 361 blood donors from different nationalities and ages were tested. Serum samples were collected and tested by ELISA for detection of HIV, HTLV-I/II, hepatitis B virus, syphilis and hepatitis C virus (HCV).**Results:** Out of 361 donors, 26 were found to be positive for HCV in a percentage of 7.2% while 17 (4.7%) of them were infected with HIV. There were eight donors infected with HTLV-I/II, and three donors infected with syphilis. Hepatitis B surface antigen was detected in 10% of donors while hepatitis B surface antibody and hepatitis B core antibody were positive in thirty-one blood donors.**Conclusions:** The obtained data revealed that the seropositivity of hepatitis B virus, HCV, syphilis, HTLV-I/II, and HIV in Hail Region during the period under study were 8.6%, 7.2%, 4.7%, 2.2% and 0.8%, respectively. It is recommended to continue screening blood donors with highly specific and sensitive tests, to counsel donors who are positive to transfusion transmitted infections.

1. Introduction

Blood transfusion saves millions of people worldwide. However, it is associated with a large number of complications and some are life-threatening. Hence, transfusion transmitted infections (TTIs) screening are essential for monitoring safety of blood and evaluating efficacy of screening procedures[1,2]. Of the 108 million blood donations collected globally, approximately

half of these are collected in the high-income countries, equal to 18% of the world's population[3]. Eighteen million units of blood are not screened for TTIs; every unit of blood has a 1% chance of TTIs[4]. Strict selection of donors and proper testing for TTIs will ensure safe blood transfusion[5]. Transfusion of unscreened blood is the major source of TTIs, several infectious diseases and microbial agents are transmissible by blood transfusion[6]. HIV infection has been markedly reduced after mass vaccination programs. HIV-1 is the most seroprevalent type throughout the world. HIV-2 primarily was found in West Africa[7]. According to World Health Organization and the Joint United Nations Programme on HIV and AIDS, 35.3 million people were already affected with HIV at the end of 2012, 2.3 million people became newly infected, and 1.6 million people died of AIDS-related causes. Prevalence of chronic hepatitis B virus (HBV) infection worldwide was 260 million cases with a percentage of 6.6%;

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The study protocol was performed according to the Helsinki declaration and approved by the ethical committee of maternity hospital. Informed written consent was obtained from all blood donors who participated in this study.

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most of them lived in Asia-Pacific region. Hepatitis C virus (HCV) infection remains public health concern worldwide, HCV infecting 3% of world' population. World Health Organization estimated that 170 million persons worldwide were infected with HCV[8]. HIV prevalence was highly insignificant among blood donors of age group from 31 to 40 years. HBV, syphilis and HCV prevalence was highly significant among blood donors in age groups of 41 to 50 years, 21 to 30 years and 51 to 60 years in comparison with other groups. HTLV-II has not been associated with any disease, except granular lymphocyte leukemia and tropical spastic paraparesis-like diseases while HTLV-I infection is endemic in Southern Japan, Africa and South America[9]. Syphilis is sexually transmitted and caused by spirochete *Treponema pallidum*. Syphilis is a complex disease that can mimic many common infections and HIV infection alters the natural history and management of syphilis infection. Syphilis was detected in metropolitan areas of Western Europe and United States. Rheumatic heart disease negative donated blood show high percentage of seropositivity of TTIs. Large scale studies are needed to evaluate the association of blood group and rheumatic heart disease types with TTIs and to categorize rheumatic heart negative blood donors as a high risk group. Few current epidemiologic reports on the prevalence rate of HTLV, syphilis, HBV, HIV and HCV infections in blood donors in Kingdom of Saudi Arabia have been published. Aim of the present study was, to determine current seropositivity of HBV, syphilis, HCV, HTLV-I/II and HIV among blood donors at Maternity Hospital, Hail, Kingdom of Saudi Arabia and to compare them among different age groups, nationalities and geographic distribution.

2. Materials and methods

2.1. Study area

Seropositivity of TTIs in the province of Hail was studied. Hail is one of the 20 Saudi provinces. It is located in Northwestern Kingdom of Saudi Arabia. Hail is located in a higher altitude with an annual precipitation of 100.6 mm. According to the Ministry of the Interior (2013), Hail has a population of 527.000 persons.

2.2. Study design and data collection

The target population of this retrospective study consisted of all subjects who donated blood at Maternity Hospital, Hail, Kingdom of Saudi Arabia from 2014 to 2015. Blood donors were unpaid volunteers and cases were families of patients who were having medical treatment. All blood donors were thoroughly screened based on the history and physical examination. Pre-blood donation counseling was carried out and included explanation of blood donation procedure, TTIs test and post-blood

donation care. Then blood donors were screened by a physician according to criteria of blood donor selection and guidelines of Drug and Cosmetic Act (1945). Basic data including age, gender and nationality (Saudi or non-Saudi) of the patient were collected for all donors. Five milliliters of blood were collected from each donor for hemoglobin estimation and TTIs screening tests. Donors who have history of jaundice were excluded from the study. A total of 361 blood donors were tested from different nationalities and ages. The study donors were divided into age groups as follows: < 20, 20–29, 30–39, 40–49 and > 50 years[10]. Serum samples were tested by using ELISA for detection of HIV, HCV, hepatitis B surface antigen (HBsAg), hepatitis B surface antibody (HBsAb) and hepatitis B core antibody (anti-HBc)[10]. HTLV ELISA screening involves detection of specific antibody to both HTLV-I and HTLV-III[5]. Syphilis was detected in serum samples by using rapid plasma reagin, *Treponema pallidum* haemagglutination assays for blood screening of specific treponemal antibodies and enzyme immunoassays[11].

3. Results

3.1. Number of cases

Three hundred and sixty-one blood donors, 80% male and 20% female, who attended Maternity and Childhood Hospital of Hail Province, Kingdom of Saudi Arabia between 2014 and 2015, were enrolled in this study. A total of 276 blood donors were normally non-infected and 85 were TTIs infected. The number of donors who were infected with HCV was 26 (7.2%) while the number of donors infected with HIV was 17 (4.7%). There were eight donors infected with HTLV-I/II and three donors infected with syphilis. HBsAg was detected in 8.6% of donors while HBsAb and anti-HBc were positive in thirty-one blood donors as shown in Table 1.

3.2. Age distribution

The age of donors ranged from less than 20 to more than 50 years. The majority (41.83%) of blood donors occurred in the group aged from 20 to 29 years. Number of blood donors markedly declined for the group aged more than 50 years. The lowest rate was found in blood donors more than 50 years (1.66%). And 36.84% were in 30–39 years and 17.73% were in group 40–49 years (Table 2). Till more than fifty years, the number of male blood donors was higher than that of female (Figure 1). About 80% were male and 20% were females. Hepatitis B core increased with age; the age group (40–49 years) was significantly higher at the risk of being HBcAb positive compared to the younger age group (< 20 years) as shown in Figure 2. Donors of 40–49 years were highly significant of being

Table 1
Seroprevalence of HBV, HCV, HIV, HTLV-I/II and syphilis among blood donors. n (%).

Month/year	Total number of blood donors	Number of normal non-infected donors	HBV			HCV	HIV	HTLV-I/II	Syphilis		
			HBsAg	HBsAb	Anti-HBc				RPR	TPHA	EIAs
Mar-14	97 (26.9)	78 (80.4)	5 (5.2)	8 (8.2)	8 (8.2)	7 (7.2)	1 (1.0)	2 (2.1)	1 (1.0)	1 (1.0)	1 (1.0)
Dec-14	141 (39.1)	114 (80.9)	10 (7.1)	10 (7.1)	10 (7.1)	10 (7.1)	5 (3.5)	1 (0.7)	2 (1.4)	1 (0.7)	1 (0.7)
Mar-15	59 (16.3)	36 (61.0)	7 (11.8)	7 (11.8)	7 (11.8)	4 (6.8)	9 (15.1)	3 (5.1)	1 (1.7)	0 (0.0)	0 (0.0)
Dec-15	64 (17.7)	48 (75.0)	9 (14.1)	6 (9.4)	6 (9.4)	5 (7.8)	2 (3.1)	2 (3.1)	2 (3.1)	1 (1.6)	1 (1.6)
Total	361 (100.0)	276 (76.5)	31 (8.6)	31 (8.6)	31 (8.6)	26 (7.2)	17 (4.7)	8 (2.2)	6 (1.7)	3 (0.8)	3 (0.8)

RPR: Rapid plasma reagin; TPHA: *Treponema pallidum* haemagglutination assay; EIA: Enzyme immunoassay.

HCV positive compared to younger age group (20–29 years) as shown in Figure 3. HIV and syphilis infections increased with age; the 30–39 age group was significantly higher at the risk of being HIV and syphilis positive compared to the younger age group (20–29 years). While HTLV-I/II infection was significantly higher at risk in the age group (40–49 years) as shown in Figure 4.

Table 2
Distribution of blood donors according to age.

Age (years)	Number of donors	Percentage
< 20	7	1.94
20–29	151	41.83
30–39	133	36.84
40–49	64	17.73
> 50	6	1.66
Total	361	100.00

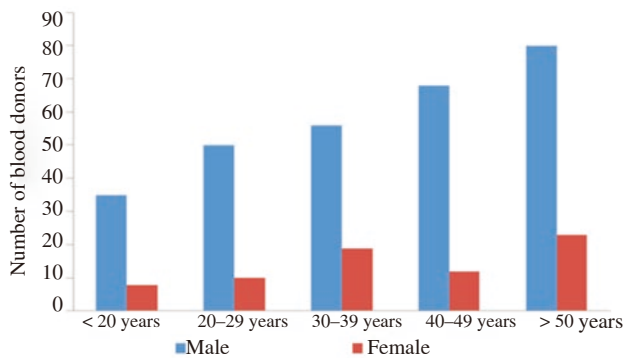


Figure 1. Distribution of age and sex of blood donors from 2014 to 2015.

3.3. Nationality distribution

By comparison of the infection rate between Saudi and non-Saudi donors, we have noticed differences inside the age groups. Indeed, at age group (less than 20 years), 89.70% of the blood donors were Saudi and only 10.30% were non-Saudi. However, in the age group (20–29 years), the rates in the two nationalities were mostly equal. About 88.10% were Saudi and 11.90% were non-Saudi in age group from 30 to 39 years. While in age group 40–49 years, Saudi donors were 95.30% and 75.10% Saudi donors were in age group more than 50 years. In fact, 80.80% were Saudi and 19.20% were non-Saudi (Figure 5). Seroprevalence of HBV positivity was significantly higher among Saudi (25%) compared to other nationalities. Among Egyptian

donors, HCV positivity was significantly higher (35%) compared to other nationalities. HIV and syphilis seropositivity were the highest (41% and 67%, respectively) among Indian donors while HTLV-I/II seropositivity was the highest (38%) among Bangladesh donors. Figure 6 shows nationality and number of blood donors who infected with TTI from 2014 to 2015.

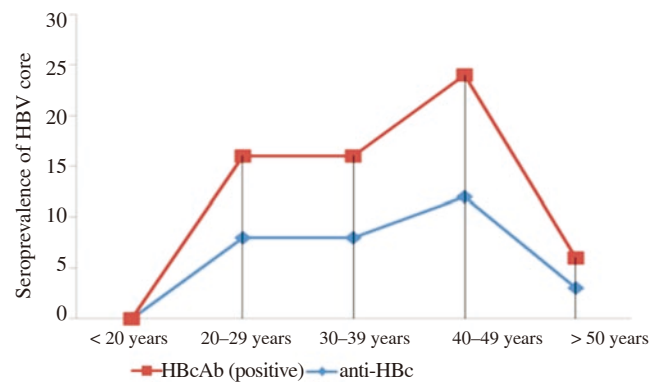


Figure 2. Age and seropositivity of hepatitis B core among blood donors.

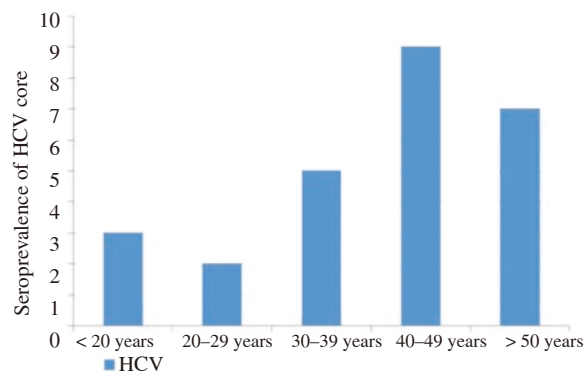


Figure 3. Age and seropositivity of HCV core among blood donors.

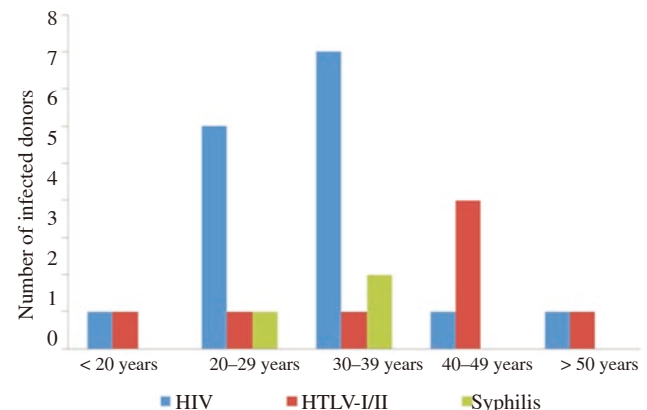


Figure 4. Age and seropositivity of HIV, HTLV-I/II and syphilis among blood donors.

3.4. Residence and geographical distribution of cases

All districts of Hail province were involved, with large variation in the distribution of blood donors. According to the type of residence in which the donors lived, 60.7% ($n = 237$ donors) of them lived in urbanized areas in Hail City. Whereas 25.7% ($n = 124$ donors) were from rural settlements, mainly from Baqaa (20.5%; $n = 25$ donors), Jubbah (17%, $n = 21$ donors) and Shinan village (7%, $n = 9$ donors) (Table 3). For the other villages, only few sporadic cases were reported. The distribution of cumulative blood donors by districts, number of cases and nationality proportions were shown in Figure 7. Seropositivity of TTIs was compared in Hail Region and other areas in Saudi Arabia including Riyadh, Jeddah, Makkah, Taif, Dammam, Jazan, Aseer and Tabuk, as shown in Table 4.

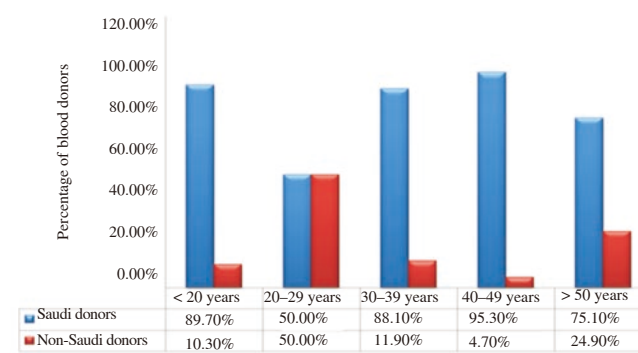


Figure 5. Nationality and age of blood donors from 2014 to 2015.

Table 3

Distribution of the reported blood donors infection between 2014 and 2015 according to the geographical origin and TTIs.

Geographical origin	Normal (no infection)	HBV	HCV	HTLV-I/II	Syphilis	HIV	Total
Hail City	202	15	8	3	2	7	237
Ghazala	3	2	1	0	0	1	7
Shenan	0	1	3	1	1	3	9
Jubbah	16	0	2	1	0	2	21
Alkhuttah	2	3	0	0	0	0	5
Sulaimy	2	1	0	0	0	1	4
Shamly	3	0	0	0	0	0	3
Baqaa	15	4	3	2	0	1	25
Alhumaira	4	0	0	0	0	0	4
Turabah	3	1	2	0	0	1	7
Murrayfig	4	1	1	0	0	0	6
Mugag	2	0	0	0	0	0	2
Elgaied	3	0	1	0	0	0	4
Samira	2	0	0	0	0	0	2
Al Subaihia	3	2	1	1	0	1	8
Eigda	3	0	0	0	0	0	3
Tabah	4	1	2	0	0	0	7
Hait	0	0	1	0	0	0	1
Hulayfa	2	0	0	0	0	0	2
Om Al Qolban	3	0	1	0	0	0	4
Total	276	31	26	8	3	17	361

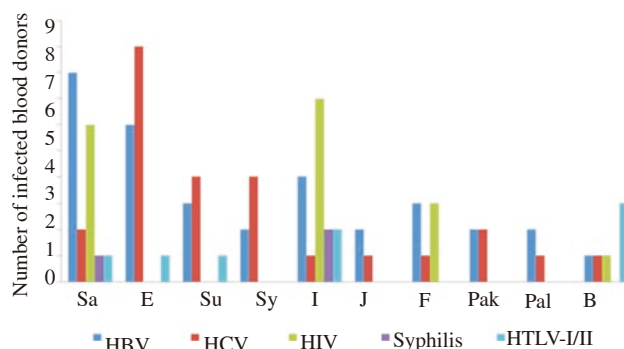


Figure 6. Nationality and seropositivity of TTI among blood donors from 2014 to 2015.

Sa: Saudi; E: Egyptians; Su: Sudanese; Sy: Syrians; I: Indians; J: Jordanians; F: Filipino; Pak: Pakistanis; Pal: Palestinians; B: Bangladesh.

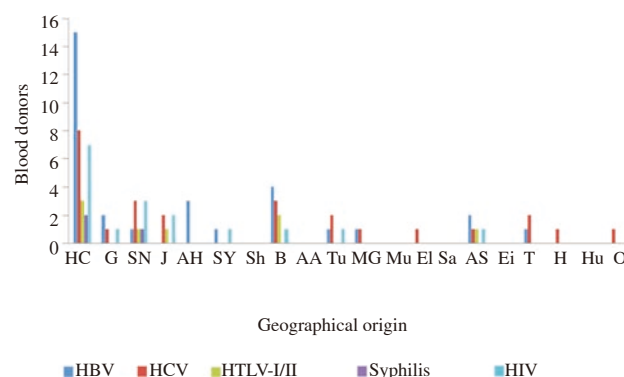


Figure 7. Geographical distribution of TTIs among blood donors in Hail, Saudi Arabia, from 2014 to 2015.

The figure showing distribution of blood donors by districts of Hail Region. The biggest number of blood donors are located in center of Hail and, Baqaa City is the most endemic region with the biggest number of TTI cases. HC: Hail City; G: Ghazala; SN: Shenan; J: Jubbah; AH: Alkhuttah; SY: Sulaimy; Sh: Shamly; B: Baqaa; AA: Alhumaira; Tu: Turabah; MG: Murayfig; Mu: Mugag; El: Elgaied; Sa: Samira; AS: Al Subaihia; Ei: Eigda; T: Tabah; H: Hait; Hu: Hulayfa; O: Om Al Qolban.

Table 4

Comparison of TTI prevalence rates among different regions of Kingdom of Saudi Arabia. %.

Province	Location	Anti-HBc	Anti-HCV	Anti-HIV
Hail	Northwestern	8.60	7.20	4.70
Mekkah	Western	6.70	0.44	0.07
Jeddah	Western	21.50	1.00	1.00
Taif	Western	11.50	0.63	0.15
Riyadh	Central	NA	0.40	NA
Dammam	Eastern	9.15	0.83	0.03
Jazan	Southwestern	5.70	0.41	NA
Aseer	Southwestern	6.14	0.07	NA
Tabuk	Northwestern	18.70	0.70	NA

NA: Not available.

4. Discussion

The long-term mortality and morbidity associated with infections caused by hepatitis C and B viruses, HTLV as well as HIV have imposed a great burden on the health care system around the world including Kingdom of Saudi Arabia. It is imperative to monitor the prevalence of TTIs to assess the risk in donor pool, by inference, the risk in general to Saudi population receiving blood donations. Currently, there is a paucity of information about an updated burden of HBV, HIV and HCV in Kingdom of Saudi Arabia[12]. All blood units must be screened for markers of TTIs, including HIV I/II, HIV p24 antigen, HBsAg, anti-HBc, anti-HBs, human T-lymphotropic virus (anti-HTLV-I/II), anti-HCV in addition to using a serological test for malaria and syphilis[13].

In this study, we characterized the prevalence of HBV, HTLV, HCV, syphilis and HIV serologically in blood donors of Hail region between 2014 and 2015. Overall, seroprevalence of HBV, HCV, HTLV, HIV and syphilis during the study period were 8.6%, 7.2%, 4.7%, 2.2% and 0.8%, respectively. To the best of our knowledge, this is the first epidemiological study of TTIs among blood donors in Hail Province, Kingdom of Saudi Arabia. This retrospective study allows us to get epidemiological data from 361 blood donors. Because our study covers a two year time frame, we were able to compare detected results to other regions in Saudi Arabia where possible and to past published data (Table 4).

Several studies published more than a decade ago, which reported that HBsAg was found in 11 (3%) donors in Saudi Arabia. The risk factor for HBV was heterosexual transmission in 8 (73%) patients, followed by blood/blood product transfusion in 2 (18%) patients[14]. Similar to our data, HBV seroprevalence has been reported by recent studies including southwestern rural areas in Saudi Arabia revealing a 1.03%[15], 1.5% in the central city of Riyadh[16], 6.7% in the western city of Makkah, where Makkah boasts one of the lowest TTIs seroprevalence in Saudi Arabia[11]. However, a significantly higher (21.50%) anti-HBc seroprevalence has been reported in the western region of Jeddah[15,17], as well as 18.7% in the northwestern region of Tabuk. Thus, Jazan seems to boast one of the lowest anti-HBc seroprevalence rates (5.7%) [12]. HCV seroprevalence seems to be in a higher rate of 7.2% in Hail Region. As our study reported, however, we observed a much lower prevalence (0.07%), of anti-HCV as compared to the city of Aseer[12,18].

To our knowledge, there is limited data in literature to enable comparison of HIV seroprevalence amongst different Saudi Arabia regions; scarce studies exist with respect to anti-HIV prevalence. The overall seroprevalence of anti-HIV (4.7%) in Hail Region, remains lower as 0.03% in eastern region of Saudi Arabia[12,19], an elevated 4.7% in Hail Region, 1% in western region of Jeddah[20], and 0.15% in neighboring city of Taif.

To our knowledge, no Saudi or regional studies have addressed

donor profiles hindering our ability to make national level comparisons. However, similarity with data available from other countries could be a starting point in hope of analogous prospective Saudi studies. First, our data has revealed a significant number of donors positive for anti-HBc representing the highest (8.6%) donor profile of TTI infection. On the other hand, the anti-HBc levels observed among our blood donors are significantly higher than those reported in the USA (0.32%)[21]. Comparable levels on the other hand were observed at 7.8% in Egypt and 8% in Iran[22,23]. The age range 21–29 years old constituted the largest population among blood donors. In addition, majority of the donors were males and there were very little number of female blood donors during period of this study. The percentage of Saudi donors was high. A similar study conducted on blood donors in Saudi Arabia by Antar *et al.*[23], also showed that the largest group of donors was those at age range 20–29 years old and female donors were as low as 1.2% at the year 2000 and declined to reach 0.7% by the year 2002. The analysis of the TTI distribution among the age groups has demonstrated that HBcAg, HTLV-I/II and HCV were significantly higher in age group of 40–49 in comparison with, the younger age group (< 20 years). While HIV and syphilis infections increased in the 30–39 age group. Moreover, by comparison of TTI in both genders, we have noticed that there is no significant difference encountered between the rate in males and females. Data show that globally 30% of blood donations are given by women, although this ranges widely. In 20 of the 111 reporting countries, less than 10% donations are given by female donors[3].

Concerning the nationality of the donors, both Saudi and non-Saudi, it is important to highlight that seropositivity of HBV was highly significant among Saudi (25%) compared with other nationalities. While HCV positivity was significantly higher (35%) among Egyptian donors. However, HIV and syphilis seropositivity were the highest (41% and 67%, respectively) among Indian donors while HTLV-I/II seropositivity was the highest (38%) among Bangladesh donors. On the other hand, Kurdi *et al.*[24] reported that, the overall prevalence of HBsAg was 9.02%, HBcAb was 9.02%, HBsAb was 7.93% and hepatitis B DNA was the highest one (9.29%).

Geographical distribution of TTI among blood donors, in Hail Province has shown that the biggest number is located in center of Hail and only few cases were reported in the other villages. This result could not reflect the endemicity level of TTI among Hail villages. During this retrospective study, data were recorded from Maternity Hospital in Hail. Among Hail City neighborhoods, Baqaa city was the most endemic region with the biggest number of TTI cases. Unfortunately, the lack of data concerning TTI among blood donors in this focus make it difficult to explain the observed discrepancy concerning the geographical distribution of the TTI among blood donors. So more investigations concerning

the TTI among blood donors in Hail Region are crucial to follow up the spatio-temporal evolution of the infection and to establish an effective control strategy.

In conclusion, blood donation remains a high risk factor for the spread of blood-borne infections. Therefore, improvements are needed to strengthen both availability and safety of blood. The overall seropositivity of HIV, HBV, HCV, syphilis and HTLV-I/II were 4.7%, 8.6%, 7.2%, 0.8% and 2.2%, respectively.

Conflict of interest statement

We declare that we have no conflict of interest.

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