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Seroprevalence and Trends in Human Immunodeficiency Virus Among Voluntary Non-Remunerated Blood Donors in a Teaching Hospital: Nine-year Retrospective Study

Bir Eğitim Hastanesindeki Gönüllü, Karşılıksız Kan Bağışçıları Arasında İnsan İmmün Yetmezlik Virüsü Seroprevalansı ve Eğilimleri: Dokuz Yıllık Retrospektif Çalışma

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¹Department of Hematology, School of Medical Sciences, Universiti Sains Malaysia, Kelantan, Malaysia

²Transfusion Medicine Unit, Hospital Universiti Sains Malaysia, Kelantan, Malaysia

³School of Dental Sciences, School of Medical Sciences, Universiti Sains Malaysia, Kelantan, Malaysia

ABSTRACT

Objective: Human immunodeficiency virus (HIV) infection, which causes acquired immune deficiency syndrome, is a significant public health problem. HIV infection through blood transfusion remains at the top of any other risk exposure because blood carries a much higher level of HIV than other routes of infection. The aim of this study was to describe the seroprevalence of HIV infection from 2010 to 2019 among donors screened at the transfusion medicine unit in Northeastern Malaysia.

Methods: A retrospective study was conducted on voluntary blood donors at the Transfusion Medicine Unit, Hospital Universiti Sains Malaysia, from January 2011 to December 2019. Data such as age, gender, marital status, frequency of donations, and serological results were obtained from the computer system of the blood bank and analyzed.

Results: A total of 98,874 individuals donated blood and were screened for HIV infections. Only 29 donors were positive for HIV. Therefore, the overall seroprevalence of HIV infection in blood donors was only 0.03% in the nine consecutive years. The trend of HIV infection among our donors decreased initially but increased again from 2014 to 2019.

Conclusion: The prevalence in Northeastern Malaysia province was low compared with previous studies conducted in other regions worldwide. The application of standard operating procedures, with updated equipment, and planning for the use of molecular methods are necessary for the blood transfusion service to monitor transfusion-transmitted infections.

Keywords: Transfusion transmitted infections, human immunodeficiency virus, blood donors, seroprevalence, transfusion

ÖZ

Amaç: Edinsel immün yetmezlik sendromuna neden olan insan immün yetmezlik virüsü (HIV) enfeksiyonu önemli bir halk sağlığı sorunudur. Kan nakli yoluyla HIV enfeksiyonu, diğer tüm risk maruziyetlerinin en üstünde yer alır çünkü kan, diğer enfeksiyon yollarından çok daha yüksek düzeyde HIV taşır. Bu çalışmanın amacı, Kuzeydoğu Malezya'daki transfüzyon tıbbi ünitesinde taranan bağışçılar arasında 2010'dan 2019'a kadar HIV enfeksiyonunun seroprevalansını tanımlamaktır.

Yöntemler: Ocak 2011'den Aralık 2019'a kadar, Sains Malaysia Üniversite Hastanesi Transfüzyon Tıbbi Birimi'nde gönüllü kan bağışçıları üzerinde retrospektif bir çalışma gerçekleştirildi. Kan bankasının bilgisayar sisteminden yaş, cinsiyet, medeni durum, bağış sıklığı ve serolojik sonuçlar gibi veriler elde edilerek analiz edildi.

Bulgular: Toplam 98.874 kişi kan bağışında bulundu ve HIV enfeksiyonları açısından tarandı. Sadece 29 donörde HIV pozitif çıktı. Bu nedenle, kan donörlerinde HIV enfeksiyonunun genel seroprevalansı art arda dokuz yılda yalnızca %0,03 idi. Bağışçılarımız arasındaki HIV enfeksiyonu eğilimi başlangıçta azaldı ancak 2014'ten 2019'a kadar yeniden arttı.

Sonuç: Kuzeydoğu Malezya eyaletindeki yaygınlık, dünya çapında diğer bölgelerde yürütülen önceki çalışmalarla karşılaştırıldığında düşüktü. Güncellenmiş ekipmanlarla standart operasyon prosedürlerinin uygulanması ve moleküler yöntemlerin kullanımına yönelik planlama, kan transfüzyonu hizmetinin transfüzyonla bulaşan enfeksiyonları izlemesi için gereklidir.

Anahtar Sözcükler: Transfüzyonla bulaşan enfeksiyonlar, insan immün yetmezlik virüsü, kan bağışçıları, seroprevalans, transfüzyon

Address for Correspondence/Yazışma Adresi: Noor Haslina Mohd Noor, MD, Department of Hematology, School of Medical Sciences, Universiti Sains Malaysia, Kelantan, Malaysia

E-mail / E-posta: drhaslina@usm.my

ORCID ID: orcid.org/0000-0001-8357-1850

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INTRODUCTION

Blood transfusion is a routine therapeutic intervention in hospitals that can be lifesaving. However, this intervention is related to several transfusion-related infections, which are very serious complications of blood transfusion.

The human immunodeficiency virus (HIV) is an important viral agent and one of the significant public health problems associated with transfusion transmitted infection (TTI). HIV infections are still the main cause of morbidity and mortality in developed countries. Choosing healthy donors with a low risk of blood contamination is an important measure for protecting blood safety (1).

HIV/AIDS prevalence during more than a decade indicates that its prevalence is getting increasingly serious, and the rapid spread of HIV infection exists with the characteristics of regional and age differences (2).

The aim of this study was to describe the prevalence of HIV from 2010 to 2019 among donors screened at the transfusion medicine unit in northeastern Malaysia. These data from approximately 10,000 donors annually provide estimates of the temporal trends of HIV infection in a group of donors in this region.

MATERIALS AND METHODS

A retrospective study was conducted at the Transfusion Medicine Unit, Hospital Universiti Sains Malaysia, from January 2011 to December 2019. The study population comprised all voluntary blood donors who donated blood at Transfusion Medicine Unit, Hospital Universiti Sains Malaysia during that period. The donors were those who weighed not less than 50 kg, were 18 years old, and fulfilled the standard donor criteria set by the Malaysia National Blood Centre.

Data from the volunteers who donated blood were included in the analysis. Sociodemographic data, such as age, gender, marital status, occupation, serological results, and frequency of donations, were obtained from the blood bank's computer system. To preserve the privacy of donors required by law, donor names were not disclosed by the blood bank and were individualized by donation number. Frequency of donation, i.e., first-time donors, lapsed donors, and regular donors, were also included in the study. First-time donors are those who donated for the first time at our unit, lapsed donors who donated blood twice or less and had not donated within the last 24 months, and regular donors are those who donated three or more times in a 12-month period.

Ethical clearance was obtained from the Universiti Sains Malaysia Ethical Committee (USM RUI grant; 1001/PPSP/812187), and verbal consent was obtained from the Blood Bank administration before the start of data collection. Confidentiality of the information was ensured as the blood donation number was registered on the data collection format instead of the names of the subjects.

Statistical Analysis

All tests were performed using the ARCHITECT HIV Ag/Ab Combo assay (Abbott Diagnostics, Chicago, IL) according to the manufacturer's instructions and validated standard operating procedures. The ARCHITECT HIV Ag/Ab Combo assay is a chemiluminescent microparticle immunoassay for the simultaneous qualitative detection of HIV p24 antigen and antibodies to HIV

type 1 and/or type 2 (HIV-1/HIV-2) in human serum or plasma. The ARCHITECT HIV Ag/Ab Combo assay is intended to be used as an aid in the diagnosis of HIV-1/HIV-2 infection and as a screening test for donated blood and plasma.

RESULTS

During the nine years, 98,874 individuals donated blood and were screened for HIV infections. The majority of the blood donors were aged 17-24 years with a male-to-female ratio of 1:1.21. Most of our donors were Malay (79.66%) and single (78.2%), with only 21.8% being married. Regular, lapsed and first-time donors were 12.89%, 27.54% and 59.55%, respectively.

The study showed that there were only 29 HIV-positive blood donors. Therefore, the overall seroprevalence of HIV infection in blood donors was found to be only 0.03% over nine consecutive years. The trend of HIV infection increased from 2010 to 2011, decreased from 2011 to 2013, and increased in 2013 and 2014. The trend decreased again from 2014 to 2018; however, it increased again in 2019 (Figure 1). Considering age, the age groups of 26-30 had the highest contribution of HIV infection (Chart 1). The male-to-female ratio was 4.8:1. The majority of our seroprevalence of HIV donors were from Malay, students, single and first-time donors, which was 75.9%, 41.4%, 62% and 55.2%, respectively (Chart 2). Twenty donors admitted they had a history of sexual promiscuity [MSM (n=10), multiple heterosexual partner (n=10)] and nine donors denied the risk factor.

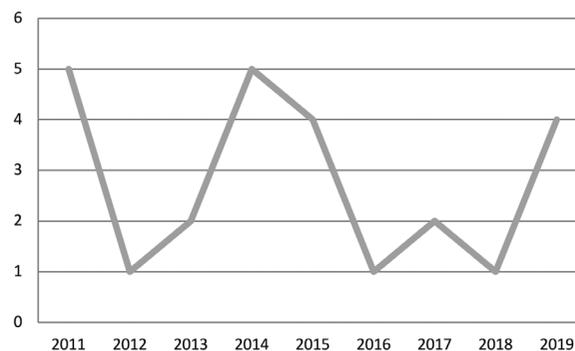


Figure 1. Trends in HIV seroprevalence.

HIV: Human immunodeficiency virus.

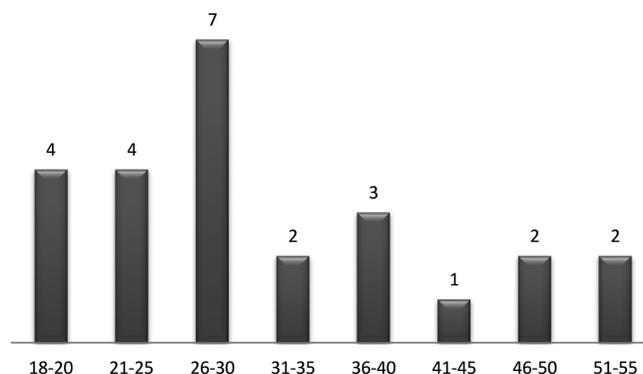


Chart 1. Age of donors who are HIV positive.

HIV: Human immunodeficiency virus.

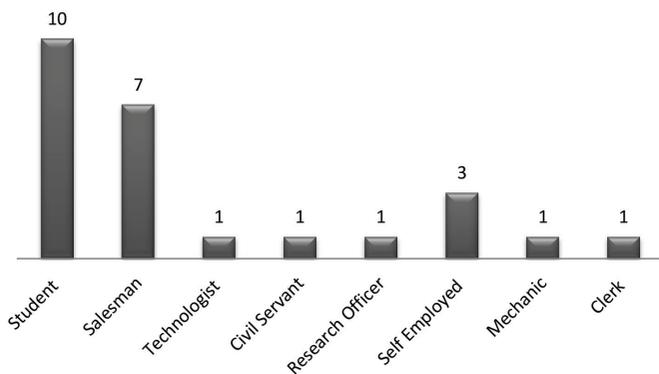


Chart 2. Occupation of donors who were HIV positive.

HIV: Human immunodeficiency virus.

DISCUSSION

Blood transfusion is considered a potential risk factor for the transmission of viruses, such as HIV, which can be life-threatening and have global public health importance. A substantial percentage of blood donors harbor TTIs. Despite stringent donor selection and testing practices, safe blood free from TTIs remains an elusive goal because the threat of TTI agents entering the blood supply is not static (3). Voluntary donations and comprehensive screening of donors' blood for transfusion-transmitted viruses using standard methods to safeguard the blood recipient should be emphasized (4).

The overall prevalence of HIV infection among our blood donors was very low (0.03%). Low seroprevalence results were also seen among voluntary blood donors in Uttar Pradesh, southeast Iran, and Pakistan (1,4,5). The trend of HIV infection among our donors decreased initially but increased again from 2014 to 2019. Seroprevalence for HIV showed increasing patterns ranging from 6.34 to 16.74% per 100,000 per person-years, with only four cases detected in 2004 and 2005 to 12 cases in 2008 (three-fold increase) (6).

This variation in HIV prevalence could be due to differences in high-risk behavior, training programs, prevention methods, and the use of appropriate and safe methods in blood transfusion centers in different countries (7). Pre-donation counseling was recognized as one of the important strategies to reduce and prevent the donation of blood by individuals who might be at risk for HIV and other TTIs (8). Low seroprevalence of HIV infection among our donors might be due to the decreasing trend of HIV infection in Malaysia and/or that the donors who had risk behaviors related to HIV infection were screened before donation.

Considering age and sex, we found that the age groups 21-25 had the highest contribution of HIV infection, with a male to female ratio was 4.8:1. RN Makroo reported a high rate of HIV positivity in male donors (97.4%) compared with females in India, and 54.9% was seen in the age group of 18-30 years (9). A study among Chinese blood donors also reported more males (81% vs. 64%) and a higher proportion of 26-35 years old were found in HIV-positive than HIV-negative donors (41.9% vs. 26.9%) (10). Epidemiological analysis of HIV prevalence by Qiao et al. (2) reported higher risk existed in the young and middle-aged populations, especially in 30- to 40-year-old people. In Chiangmai, the proportion of male donors (80.6%) was more than female donors, with a mean age of 28.9 and 28.8 years,

respectively (11). However, in Nigeria, it was reported that an age range of 29 and below has a lower prevalence of HIV antibodies than other age groups, and this is an indication of success on the part of Nigerian government agencies and non-governmental organizations in the fight against new HIV infections (12). HIV-positive blood donors in Germany that were included in the analysis were significantly younger (median age; 28 years) and lived more frequently in a metropolis (13).

Qiao et al. (2) analyzed the epidemiologic characteristics and concluded that the regional and age differences in HIV prevalence were significant, and this result may provide basic data for the prevention and control of sexually transmitted diseases (STDs). More effective and efficient control programs with expanded geographical and aged population coverage are required (2).

We observed that the majority of our seroprevalence of HIV donors were from Malay, students, and single donors (75.9%, 41.4%, and 62% respectively). A study by the National Blood Centre reported that the majority of HIV-positive blood donors in their institution were students, unmarried, and first-time donors (41.4%, 62% and 55.2% respectively). This finding may be due to a low level of awareness among students regarding the TTI risk before blood donation, a current lifestyle that might contribute to the seropositivity, and an increasing number of donations made by students compared with others (6). The association of HIV status with younger age at sexual debut may be due to more lifetime partners. This increase could result from a longer sexual life. Prevention of HIV infection should include efforts to delay age at first sex (14).

A study by Rich et al. (10) observed that donors with less high school education (38.2% vs. 15.5%) and divorced/separated/widowed donors (14% vs. 4%) were higher in the HIV-positive than in the HIV-negative group. A study among Malawi blood donors reported that HIV-positive results were significantly associated with age above 25 years and being out of school (15). Nafishah et al. (6) observed that the higher the educational level, the lower the rate of seroconversion in TTI. Donors who finished primary education only had higher anti-HIV prevalence than donors who finished secondary level and higher education (1.82%, 0.52% and 0.22% respectively). This evidence supports that individuals with low education have higher risk behaviors, such as tattooing, intravenous drug abuse, and extramarital sex relations without condom use (16).

We reported higher HIV seroprevalence among donors who were single. A larger proportion of HIV-positive donors were also reported among divorced, separated, or widowed donors in China, suggesting the importance of understanding the psychosocial characteristics of HIV-positive donors and the implementation of behavioral and therapeutic interventions to prevent further spread of the infection (10). Donors recruited at workites and community halls had higher HIV seroprevalence (18.9% and 18.7%, respectively) than donors recruited at the National Blood Transfusion Service (NBTS) headquarters, schools, or clubs (7.9%) (17).

The majority of our seroprevalence of HIV donors were first-time donors, which was 55.2%. Regular and lapsed donors accounted for approximately 44.8% of HIV-positive donors. A study conducted on 130 first-time blood donors in Nigeria found that 6.2% were HIV-positive donors. This indicates that HIV is still being actively transmitted among the most productive age bracket in the Nigerian

community (12). The seroprevalence of HIV infection among voluntary non-remunerated blood donors in Malawi was also higher in first-time blood donors. The prevalence of HIV infections in repeat blood donors showed a reducing trend (15).

McFarland et al. (17) reported that HIV seropositivity among first-time blood donors in Zimbabwe was 51%. A study among blood donors in Brazil reported that the greatest number of cases with HIV infection was from the first-time donation (18). Among men, repeat donors had a lower overall HIV prevalence (2.47%) than first-time donors (3.64%; $p < 0.0001$) (11).

We reported 69% of the HIV-positive donors admitted to having sexual promiscuity [MSM ($n=10$) and multiple heterosexual partners ($n=10$)] and nine donors denied the risk factor. Sexual contacts were the most prominent reported risk factors among HIV-infected donors in Germany, reported as either MSM or heterosexual risk contacts, or both (13). Zeng et al. (19) reported that a man who has sex with men was associated with the highest odds of HIV infection. Not using a condom, having sex with HIV-infected individuals or partners with STDs, or having more than two sex partners were all associated with more than five times higher odds of having HIV (19). According to a study by Nafishah et al. (6), when asked regarding why they still donated even though they already knew they were involved in high-risk activities and could transmit infections through blood donations, the majority of respondents admitted they practiced safe sex and would never be infected, and most of the respondents thought that high-risk activities asked during the pre-donation interview only concerning recent activities. One of the preventive measures implemented at the National Blood Centre to prevent TTI is to delay donors with the potential to spread viruses, such as those involved in high-risk activities (6).

Wand and Ramjee (14) observed that an appropriate HIV/STD risk reduction program may be important in shaping the sexual behavior of young adolescents before or at the beginning of their sexual lives. Risk factors that serve as the most efficient donor deferral criteria may also change over time as the HIV epidemic evolves. Transfusion centers should not rely solely on exclusion by risk factors to ensure the safety of blood supply. An important part of a multifaceted strategy to maximize blood safety includes exclusion by HIV risk factors and universal HIV antibody screening (17).

Although most criteria for (temporary) deferral only target the prevention of window phase donations, improved recording of transmission risks could reduce the risk of undetected infections among donors (13). Another important issue is when the main source of replacement donors is recruited from a patient's family or acquaintances who hide their health conditions from their relatives. Thus, the selection of donors and their proper screening are key factors to ensure safe transfusion (3).

Study Limitations

Nevertheless, there are some limitations to this study. As the study subjects involved only blood donors in a teaching hospital in Kelantan, the results may not be reflective toward the whole population of Malaysia. Furthermore, the ethnic population in this study were mostly Malay, is mainly reflected the general population

of Northeastern Malaysia whereas, other part of Malaysia, there are more indigenous ethnic groups such as Chinese, Indian, Kadazan, Dusun, Iban etc.

CONCLUSION

The lower seroprevalence of TTI among our blood donors as compared to previous studies carried out in other regions worldwide could be due to stringent pre-donation selection, increased donor understanding regarding self-deferral policy, improved donors' understanding on safe blood donation, and recruitment of voluntary non-remunerated donors. Application of standard operating procedures, with updated equipment, as well as planning for the use of molecular methods are necessary for the Malaysia Blood Transfusion Organization to monitor blood-transmitted infections.

Health education to the community could strengthen their awareness about the mode of transmission and prevention of HIV infection. Conducting further community-based studies to identify societal risk factors of HIV infection could interrupt the transmission and be valuable in recruiting potential volunteer non-remunerated blood donors. Public awareness about blood-borne diseases should be increased, especially in citizens with a low level of education, and free experiments should be set up for patients with low-income levels.

The results and data generated would be useful in updating the policy regulation on donor testing in our center. We also advocate that a national surveillance program against TTI be established through the NBTS.

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Ethics

Ethics Committee Approval: Ethical clearance was obtained from the Universiti Sains Malaysia Ethical Committee (USM RUI grant; 1001/PPSP/812187).

Informed Consent: Verbal consent was obtained from the Blood Bank administration before the start of data collection.

Authorship Contributions

Surgical and Medical Practices: M.A.Z., N.H.M.N., M.R., M.N.H., Z.Z., S.I., R.B., S.M.Y., W.S.W.A.R., M.A., Concept: M.A.Z., N.H.M.N., M.R., M.N.H., Z.Z., S.I., R.B., S.M.Y., W.S.W.A.R., M.A., Design: M.A.Z., N.H.M.N., M.R., M.N.H., Z.Z., S.I., R.B., S.M.Y., W.S.W.A.R., M.A., Data Collection or Processing: M.A.Z., N.H.M.N., M.R., M.N.H., Z.Z., S.I., R.B., S.M.Y., W.S.W.A.R., M.A., Analysis or Interpretation: M.A.Z., N.H.M.N., M.R., M.N.H., Z.Z., S.I., R.B., S.M.Y., W.S.W.A.R., M.A., Literature Search: M.A.Z., N.H.M.N., M.R., M.N.H., Z.Z., S.I., R.B., S.M.Y., W.S.W.A.R., M.A., Writing: M.A.Z., N.H.M.N., M.R., M.N.H., Z.Z., S.I., R.B., S.M.Y., W.S.W.A.R., M.A.

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