

**PREVALENCE AND CAUSES OF DONOR  
DEFERRALS IN NATIONAL BLOOD  
CENTRE**

**BY**

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**DISSERTATION SUBMITTED IN PARTIAL  
FULLFILMENT OF THE REQUIREMENT  
FOR THE DEGREE OF MASTER IN  
MEDICINE (TRANSFUSION MEDICINE)**

**ADVANCED MEDICAL AND DENTAL  
INSTITUTE (AMDI)  
UNIVERSITI SAINS MALAYSIA  
2022**

## **DISCLAIMER**

I hereby declare that this research has been sent to the Universiti Sains Malaysia for the degree of Master of Medicine in Transfusion Medicine. It is not to be sent to any other universities. With that, this research might be used for consultation and can be photocopied as a reference.

Date: 22 November 2022

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P-IPM-0033/18

## ACKNOWLEDGEMENT

Bismillahirrahmanirrahim, Alhamdulillah and praise to Allah, peace and blessings be upon the Prophet Muhammad SAW. I praise the almighty Allah for providing me with the opportunity, courage, strength and good health to complete my master's degree by submitting my dissertation.

I would like to express my sincere gratitude to both of my parents, Ibrahim Osman and Nurhidah Othman, my siblings Dr. Izyana, Dr. Syamil and Dr. Syafira for their endless encouragement, support and love throughout my entire journey. I would never have gotten through this without them.

I would like to thank Dr. Siti Salmah Noordin for her never-ending patience, as well as Dr. Ernest Mangantig and Dr. Noryati Abu Amin, as my dissertation supervisor and co-supervisors, for their thoughtful comments, encouragement, feedback, and guiding me throughout the entire process of completing my thesis.

I would like to express our heartfelt gratitude to all the staff of the National Blood Centre, Kuala Lumpur for their cooperation and support throughout this study. I would also like to thank my Transfusion Medicine masters programme fellow colleagues Hidayah, Hazwani, Marlina, Nusaibah, Aklina, Azizul, Tuck Chyuan, and Ilyas for their assistance in completing this masters degree. I would not be writing this today if it were not for their encouragement and support. I would also like to thank Universiti Sains Malaysia and the Ministry of Health for their approval. I would also like to give special thanks to my best friend Dr Nazlinda, for always being the person I can rely on.

Finally, I would like to thank everyone who was directly or indirectly involved in my dissertation writing and contributed to the success of my research.

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## LIST OF ABBREVIATIONS

BBISv2	Blood Bank Information System Version 2
CI	Confidence Interval
HIV	Human Immunodeficiency Virus
HREC	Human Research Ethics Committee
HUSM	Hospital Universiti Sains Malaysia
MCO	Movement Control Order
MLR	Multiple logistic regression
NBC	National Blood Centre
NMRR	National Medical Research Register
OR	Odds ratio
ROC	Receiver Operating Characteristic
SD	Standard deviation
SLR	Simple logistic regression
SPSS	Statistical Package for the Social Sciences
USM	Universiti Sains Malaysia
WHO	World Health Organization

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## ABSTRAK

**Pengenalan:** Penangguhan penderma darah diwujudkan untuk memastikan keselamatan penderma darah dan pesakit. Penyelidikan ini menilai prevalens dan penyebab penangguhan pendermaan darah di Pusat Darah Negara, Malaysia.

**Kaedah:** Kajian rentas silang telah dijalankan terhadap 1103 penderma darah utuh yang telah ditangguhkan pendermaan mereka dari 1 Januari 2018 hingga 31 Disember 2020. Data diambil daripada rekod penangguhan penderma darah dan sistem maklumat tabung darah. Analisis logistik ringkas dan berganda digunakan untuk analisis statistik dan nilai  $p < 0.05$  dianggap signifikan.

**Keputusan:** Seramai 732,756 penderma darah telah berdaftar dan seramai 167,855 penderma telah ditangguhkan pendermaan. Kadar prevalens penangguhan penderma adalah sebanyak 22.9%, yang mana 95.4% adalah penangguhan sementara dan 4.6% adalah penangguhan kekal. Daripada 1103 penderma, lebih dari separuh penangguhan sementara adalah merupakan penderma wanita (66.3%). Hal ini berbeza dengan penangguhan kekal, yang mana majoritinya ialah penderma lelaki (76%). Faktor paling lazim untuk penangguhan sementara adalah paras hemoglobin rendah (52.3%), diikuti oleh tekanan darah tinggi (12.3%). Namun begitu, bagi penangguhan kekal, faktor paling lazim adalah disebabkan oleh penyakit perubatan (36%), dan diikuti oleh tingkah laku berisiko tinggi (30%). Wanita (OR diselaraskan = 5.220, 95% CI 2.657 – 10.25,  $p < 0.001$ ) dan penderma tetap/ berulang (diselaraskan OR = 6.470, 95% CI 1.929 – 21.70,  $p < 0.002$ ) menunjukkan kaitan yang signifikan dengan penangguhan pendermaan darah.

**Kesimpulan:** Penderma darah wanita dan penderma tetap/ berulang mempunyai kaitan yang signifikan dengan penanguhan pendermaan darah. Kesedaran dan pendidikan terhadap pendermaan darah dan penjagaan sebelum dan selepas pendermaan adalah penting untuk menurunkan kadar penanguhan pendermaan dan mencegah kehilangan penderma darah.

**Kata kunci:** penanguhan penderma, punca penanguhan, derma darah, transfusi

## ABSTRACT

**Introduction:** Blood donor deferral was established to ensure the safety of blood donors and patients. This research evaluated the prevalence and causes of blood donor deferrals in National Blood Centre, Malaysia.

**Methods:** A cross-sectional study was performed on 1103 whole blood donors that had been deferred from 1<sup>st</sup> January 2018 to 31<sup>st</sup> December 2020. Data were extracted from donor deferral reports and the blood bank information system. Simple and multiple logistic analysis were used for statistical analysis, and a p-value of < 0.05 was considered significant.

**Results:** A total of 732,756 blood donor were registered and 167,855 were being deferred. The prevalence of donor deferrals rate was 22.9%, in which 95.4% was temporary deferred and 4.6% was permanently deferred. From 1103 of deferred donors, more than half of the temporary deferrals were female donors (66.3%). In contrast, male blood donors were majority of being permanent deferred (76%). The most common reason for temporary deferral was low haemoglobin (52.3%), followed by high blood pressure (12.3%). However, for permanent deferrals, medical illnesses were the most frequently deferred (36%), followed by high risk behaviour (30%). Female (adjusted OR = 5.220, 95% CI 2.657 – 10.25, p < 0.001) and regular/ repeat donors (adjusted OR = 6.470, 95% CI 1.929 – 21.70, p < 0.002) were significantly associated with deferrals.

**Conclusion:** Female donors and regular/repeat donors were significantly associated with deferral. Blood donor awareness, education, and pre and post donation care are crucial in reducing blood donor deferrals and preventing blood donor loss.

**Keywords:** Donor Deferrals, Deferral causes, Blood Donation, Transfusion

CHAPTER ONE:  
INTRODUCTION

# **CHAPTER ONE**

## **INTRODUCTION**

### 1.1 Overview

This chapter covers the outline of the Study on Prevalance and Causes of Blood Donor Deferrals in National Blood Centre. This chapter also highlights the research justifications and research questions.

### 1.2 Background of study

The history of blood transfusion began in 1628, when William Harvey discovered blood circulation. However, Karl Landsteiner's ground breaking discovery of human blood groups A, B, and O in 1901 opened the way for allogeneic blood product transfusion [1]. Blood transfusion is an important component of health care in today's modern world. The journey to an efficient, safe, and uncomplicated transfusion technique has been difficult, but significant progress has been made over the years. It saves millions of lives each year in both routine and emergency situations. The evolution of blood transfusion services allows for the support of increasingly complex medical and surgical interventions while also improving patients' life expectancy and quality of life.

Around the world, approximately 117.4 million units of blood donations are collected. In high-income countries, age more than 65-year-olds were the most frequently transfused patient. In low-income countries, children under the age of five account for up to 52% of all transfusions [2].

The only source of blood that can be obtained is from human blood donors. While adequate blood supply is important in the blood transfusion service, the collection and transfusion protocol should not harm both the recipient and the donor [3]. Unpaid volunteers who are regular blood donors play a critical role in ensuring a safe and consistent supply of blood. Altruistic donors, according to various studies, have a lower prevalence of transfusion-transmissible infections [4].

Blood requirements are influenced by two factors: a country's health-care system's capacity and population coverage. Blood demand is increasing in affluent countries with modern health systems to support increasingly complex medical and surgical operations, trauma treatment, and blood disorder management. An increase in the number of elderly people who require more medical care has also resulted in increased blood demand [5].

Some donors, however, are deemed ineligible to donate, either to safeguard the blood supply or to protect the donor's health and are thus deferred [5]. Every year, approximately 5 to 24 percent of blood donors are deferred for various reasons, resulting in a significant loss of available blood units for transfusion in the country [6,7]. Deferrals had a significant impact on first-time donors, according to Custer et al., with only 25% of deferred donors returning, compared to 47% of non-deferred donors. The reason and timeframe for the deferral must therefore be understood to prevent a reduction in the retention of blood donors and the availability of eligible blood donors [8].

Each year, over 40,000 blood donors are deferred at the National Blood Centre (NBC) for various reasons. The large number of deferrals may have an immediate impact on blood collections, donor retention programmes, and the availability of blood to patients

in need of blood transfusion. However, not many studies were done focusing on blood donor deferrals in Malaysia. Therefore, this study focuses on the prevalence and causes of blood donor deferrals in NBC.

### 1.3 Literature review

A potential blood donor is deferred from donating blood or blood components, either temporarily or permanently, due to general health or medical conditions or the risk of pathogen exposure. Specific criteria were used to protect the donors' and transfusion recipients' health and safety [9].

Globally, approximately 81 million units of blood are collected each year, but only 39% of these are collected in developing countries, which account for 82% of the world's population [2]. Frequent donor deferral; particularly temporary deferrals, result in the loss of potential blood donors and many are hesitant to return for future donations due to the negative psychological impact. Many donors considered deferrals to be a negative experience because they felt rejected. Proper counselling could help to alleviate the fear of rejection and motivates the donor to return for future donations [10].

Donor deferral remains a social stigma that leads to the loss of potential blood donors, particularly in cases of temporary donor deferral. The impact of deferring donors on the available blood supply shows that donors who receive a temporary deferral have low return rates [5,6]. Halperin et al. found that deferred donors had a lower return rate (62%) when compared to a matched control group (80%) [11]. Blood donor deferral statistics worldwide range from 5-10% to 20-40% in various blood centres, which may be attributed to specific deferral patterns [12-16]. The variation in the number and types of

deferrals is most likely due to a combination of factors, including differences in the risk profiles of local donor populations and differences in eligibility criteria across jurisdictions [5,15].

Current policy in Malaysia states that blood donation must be from voluntary and non-remunerated blood donors [16]. These policies are parallel with WHO movements towards 100% voluntary blood donation throughout the world [4].

Several studies that have been done show diverse findings throughout the regions. A research by Shaz et al. in the United States estimated that between 2004 and 2008, about 79,214 (15.6%) of blood donors in Atlanta had been deferred [17]. Most deferrals were temporary with low haemoglobin levels, which was approximately 62.6% of total blood donation [18]. Low haemoglobin level also appeared as the most common cause for deferral in South India, with a total deferral rate of 14.9% [18]. Different findings were seen in the African regions. For example in Trinidad and Tobago, the deferral rates were approximately 35.6% with the major cause of deferral was due to high risk of HIV activity while the deferral rate in Nigeria was 8.7%; the most common cause of deferrals being Hepatitis B [12,19].

In Japan, the donor deferrals prevalence rate was 14%, involving mainly female donors with the main cause of deferral due to low haemoglobin [20]. In comparison to Singapore, Lim et al. observed a 14.4% deferral rate, with medication consumption being the most common cause [21]. A 2008 study at Hospital Universiti Sains Malaysia (HUSM) observed that the donor deferral rate was only 5.6%, with low haemoglobin levels being the most frequent cause for deferral. Nonetheless, the study's limitations include a small

number of blood donors and a racially homogenous donor population in Kelantan, in which the majority of the population is Malay [22].

The WHO declared the COVID-19 outbreak, which was caused by the coronavirus-2 that causes severe acute respiratory illness, to be a pandemic on March 11, 2020 (SARS-CoV-2) [23]. To date, 4,481,506 COVID-19 cases were reported in Malaysia with more than 30,000 deaths. Blood supply at the NBC and other blood banks in the nation reduced by 40% after the movement control order (MCO) was implemented, compared to the previous year [24]. Several precautions were taken during the donation process to protect both blood donors and blood bank personnel. All donors were given an extra blood donor screening questionnaire to assess risk of COVID-19 infection. The following deferral adjustment were introduced at both center-based and mobile blood drives: Donors returning from any national or foreign country area face a 14-day deferral period; ii) donors in close contact with confirmed COVID-19 cases were advised to reschedule blood donation; iii) donors with COVID-19 symptoms were not accepted; and iv) donors with a body temperature of 37.5 degrees Celsius are ineligible [24]. As a result of the implementation of the new deferral guidelines stemming from the COVID-19 pandemic and the implementation of movement control orders (MCO), even more blood donors were deferred.

Considering the gap and scarcity of Malaysian data, as well as the recent COVID-19 pandemic, the objective of this study was to assess the prevalence and causes of donor deferrals at the NBC, Malaysia's largest blood collection facility.

## 1.4 Research justification

With the dynamic of the socioeconomic climate and human factors, recruiting and retaining blood donors is a difficult challenge in blood transfusion services. The paucity of donors have always been a problem faced worldwide. South-East Asia has around 25% of the world's population, yet only 9% (7 million units) of blood is collected every year, compared to an estimated demand of 15 million units [2].

Prospective blood donors are deferred for a variety of reasons, and deferred donors are less likely to return for future blood donation. Even though the deferral rate was found to be similar, the major reasons for deferral vary - reflecting socioeconomic status disparities. Rates of donor deferral in blood centres range from 5% to 24%, and the reasons for deferral vary by region and centre [7,15]. Inappropriate deferral of blood donors can lead to a tremendous loss of potential donors and therefore will reduce the availability of blood in the country every year.

Furthermore, Malaysian studies regarding deferral rate, deferred donor characteristics and reasons for deferrals are scarce. Eventhough previous study had been done, it did not address the deferral into temporary and permanent deferral [22]. Therefore, it is essential to identify and understand the causes of deferral so that a targeted and a more customised approach for donor retention and recruitment can be made. For example, a short video and pamphlet that focuses on the common donor deferral criteria can be created and distributed to all blood mobile organisers prior to the blood donation campaign.

Enhanced knowledge of the causes of blood donor deferrals would also aid in ensuring an adequate, sustainable, and safe blood supply, as well as improving the return rate of temporarily deferred blood donors.

### 1.5 Research questions

- What is the prevalence of blood donor deferrals in the NBC?
- What are the causes of donor deferrals in the NBC?
- What are the factors associated with donor deferrals in the NBC?

# CHAPTER TWO: OBJECTIVE

## CHAPTER TWO

### 2.1 General objective

To study the prevalence and causes of blood donor deferrals in the National Blood Centre

### 2.2 Specific objective

- To determine the prevalence of blood donor deferrals in the NBC
- To determine the causes of blood donor deferrals in the NBC
- To determine the association between donors' sociodemographic characteristics (age, gender, ethnics, donation sites, and type of donor) with blood donor deferment status (temporary or permanent)

### 2.3 Alternative Hypotheses

There is a significant association between donor deferrals and the sociodemographic features.

### 2.4 Null hypothesis

There is no significant association between donor deferrals and the sociodemographic features.

# CHAPTER THREE: METHODOLOGY

## **CHAPTER THREE**

### **METHODOLOGY**

#### 3.1 Study background

This study focused on prevalence and causes of blood donor deferrals in the National Blood Centre (NBC). This study also evaluates the association between blood donor deferment status and sociodemographic characteristics.

#### 3.2 Study design

This was a study involving retrospective record review of donors that were deferred at the NBC from 1st January 2018 – 31st December 2020. The record review was performed using Blood Bank Information System version 2 (BBISv2).

#### 3.3 Study area

This study was conducted at the NBC, Kuala Lumpur. The NBC serves as the center of excellence for blood transfusion services in Malaysia. It is the largest centre of blood collection throughout Malaysia. In the year 2021, the total number of whole blood units collected were 232,440 units of blood and around 50,000 donors were deferred for various causes and the deferral trend was increasing each year. Therefore, it was expected that the demographic characteristics of blood donors would be more diverse. This made the NBC an ideal location for this research.

### 3.4 Study population

#### Reference population

Blood donors who donated blood in the NBC.

#### Target population

All blood donors in the NBC from 1st January 2018 – 31st December 2020.

#### Source population / sampling pool

All reported blood donor deferral cases in the NBC from 1st January 2018 – 31st December 2020.

#### Sampling frame

The list of all reported cases of blood donors that were deferred in the NBC.

### 3.5 Subject criteria

#### 3.5.1. Inclusion criteria

- Whole blood donors that were registered at the NBC.

### 3.5.2. Exclusion criteria

1. Blood donors that have been deferred due to cancellation of blood donation procedure.
2. Blood donors that have been deferred due to adverse donor reactions.
3. Incomplete or missing data.
4. Autologous blood donors.
5. Apheresis blood donors.

### 3.6 Sample size

**Specific objective 1:** To determine the prevalence of blood donor deferrals in the National Blood Centre

To estimate the prevalence of blood donor deferrals in the NBC, single proportion formula as the following was used to calculate the sample size:

$$n = \left(\frac{z}{\Delta}\right)^2 (P(1 - P))$$

where  $n$  = sample size

$z$  = the value to estimate the 95% confidence interval (1.96)

$P$  = true population proportion

$\Delta$  = precision or detectable difference of expected population proportion and true population proportion

The prevalence of blood donor deferral rate was 19.4% in Dubai between year 2010 and 2013 [25]. This study wishes to estimate the proportion of blood donors that were deferred in the NBC within 4% from true proportion with 95% confidence interval. The minimum sample size required with an additional 10% drop out rate was:

$$n = (1.96/0.04)^2 \times 0.194 (1-0.194)$$

$$= 376 + 10\% \text{ drop out rate}$$

$$= \mathbf{414 \text{ blood donors}}$$

**Specific objective 2:** To determine the causes of blood donor deferrals in the National Blood Centre.

A single proportion formula was used to calculate the sample size required to determine the causes of blood donor deferrals in the NBC:

Single proportion:

$$n = \left(\frac{z}{\Delta}\right)^2 (P(1 - P))$$

Where n = sample size

z = the value to estimate the 95% confidence interval (1.96)

p = true population proportion

$\Delta$  = precision or detectable difference of expected population proportion and true population proportion

According to Rabeya et al., low haemoglobin accounted for the majority of temporary deferrals, with 40% of donors deferred as a result [22]. Study done by Agnihotri et al reported that 6.9% of blood donors were deferred due to medication [7].

In terms of permanent deferral, S. Khurram et al, reported that 10.71% of donors were permanently deferred due to epilepsy [26]. While study by Vimal et al, shows that 16.1% were permanently deferred due to hypertension [18]. This study plans to identify the causes of temporary and permanent donor deferrals in the NBC with 5% to 2% from true proportion with 95% confidence interval. The minimum sample size required with an additional 20% drop out rate was:

**Table I. Sample Size for Causes of Temporary Deferral**

<b>Causes of Temporary Deferral</b>	<b>P</b>	<b>z</b>	<b><math>\Delta</math></b>	<b>n + 20%</b>	<b>Reference</b>
<b>Low Haemoglobin</b>	0.4	1.96	0.05	442	[22]
<b>On Medication</b>	0.06	1.96	0.05	118	[7]

**Sample Size for Causes of Permanent Deferral**

<b>Causes of Permanent Deferral</b>	<b>P1</b>	<b>z</b>	<b><math>\Delta</math></b>	<b>N + 20%</b>	<b>Reference</b>
<b>Hypertension</b>	0.16	1.96	0.05	248	[18]
<b>Epilepsy</b>	0.1071	1.96	0.02	1102	[26]

Hence, the sample size required was = **1102 blood donors**

**Specific objective 3:** To determine the association between sociodemographic characteristics of the donors (age, gender, ethnics, donation sites, and type of donor) with blood donor deferment status (temporary or permanent).

A two proportion formula was used to calculate the sample size required for association of blood donor deferment status and sociodemographic characteristics:

$$n = \frac{P_1(1 - P_1) + P_2(1 - P_2)}{(P_1 - P_2)^2} (Z_\alpha + Z_\beta)^2$$

Where  $P_1$  = proportion of exposure in cases

$P_2$  = proportion of exposure in controls

$Z_\alpha$  = Level of significance

$Z_\beta$  = Power of study to demonstrate association if one does exist

A study by Rabeya et al, has reported that the proportion of regular donors that have been deferred in Hospital Universiti Sains Malaysia was 64% and the proportion in new donors was 36% [22]. Using a significance level of 0.05 and a power of 80%, the minimum required sample size to determine the relationship of blood donor deferment status and sociodemographic characteristics was:

**Table III. Sample Size for Factors Associated with Blood Donor Deferral**

<b>Associated Factor</b>	<b>P1</b>	<b>P2</b>	<b>z<math>\alpha</math></b>	<b>z<math>\beta</math></b>	<b>Total N</b>	<b>Total N with additional 20%</b>	<b>Reference</b>
<b>Demographic Variables</b>	0.70	0.32	1.96	0.84	23 + 23 = 46	55	[20]
<b>Type of Blood Donor Variables</b>	0.40	0.64	1.96	0.84	64 + 64 = 128	154	[22]

Hence, the sample size required was = **154 blood donors**

### **Conclusion**

**The highest sample size was from objective 2 = 1102 blood donors**

#### **3.7 Sampling method and subject recruitment**

Systematic random sampling was performed to select the subjects based on the inclusion and exclusion criteria. The subject selection was made for every 100<sup>th</sup> donor that was deferred from the study period of 1st January 2018 – 31st December 2020. The starting number selected was 1 then the 100<sup>th</sup> donor deferred was selected and subsequently the 200<sup>th</sup>, 300<sup>th</sup>, 400<sup>th</sup>, 500<sup>th</sup> donor and so on from each year from the year 2018 until 2020.

### 3.8 Research tool

- Blood donors PROFORMA was prepared to ensure the data collection was complete and easy to be reviewed.
  - Reference number
  - Age
  - Gender
  - Ethnicity
  - Type of blood donor (New, regular, or lapsed)
  - Place of donation (centre, donation suites or mobiles)
  - Type of donor deferral (temporary or permanent)
  - Causes of donor deferral according to donor deferment type
- Blood donor deferment data was assessed from:
  - Reporting Form for Donor Deferral: Quality Form Donor Deferral: PDN/BP/QP-02/04
  - BBISv2: Blood Bank Information System version 2. (Computerized blood bank system)

### 3.9 Data collection method

Retrospective data review for blood donor deferrals were extracted from the BBISv2 and from manual donor deferral reports. All the information and parameters were recorded in the blood donors proforma form. The deferred donors were given unique identification number to ensure confidentiality.

### 3.10 Statistical analysis

Statistical analysis was performed using IBM SPSS version 27 for Window-software. Descriptive analysis was used to analyse the independent variables (social demographic characteristics such as age, ethnicity, gender). Numerical data will be presented as mean (SD) or median (IQR) based on their normality distribution. Categorical data will be presented as frequency (percentage). Simple and multiple logistic regression were used to determine the factors associated with donor deferral status (specific objective no 3). Variables with p-value <0.25 in univariable analysis would be selected for multiple logistic regression. The level of significance was set at p-value less than 0.05.

### 3.11 List of variables

- Dependent Variables:
  - Type of donor deferral (temporary or permanent)
- Independent Variable
  - Age
  - Gender
  - Ethnicity
  - Type of blood donor (New, regular, or lapsed)
  - Place of donation (centres, donation suites or mobiles)
  - Causes of donor deferral according to donor deferment type

### 3.12 Variable's definition

**Table IV: Variables Definition**

<b>Variables</b>	<b>Operational definition</b>	<b>Scale of measurement</b>
Donor Age criterias	All donors between age of 17 to 70 years old. As per Malaysian blood donor eligibility criterias [16].	Year
Gender	Gender of blood donors whom have been deferred	<ul style="list-style-type: none"> <li>• Male</li> <li>• Female</li> </ul>
Ethnicity	According to the Blood Donor Registry Form, Blood Transfusion Service, Ministry of Health Malaysia (PDN 3/2014). Ethnicity were divided into Malay, Chinese, Indian, Iban, Kadazan, Melanau, Murut, Bidayuh, Bajau and Others [16].	<ul style="list-style-type: none"> <li>• Malay</li> <li>• Chinese</li> <li>• Indian</li> <li>• Others</li> </ul>
Type of blood donors	<p>New Donor</p> <ul style="list-style-type: none"> <li>• A donor donating for the first time.</li> </ul> <p>Repeated or regular</p> <ul style="list-style-type: none"> <li>• Donor who has donated minimum of two times within 24 months in the same blood centre.</li> </ul> <p>Lapsed</p> <ul style="list-style-type: none"> <li>• Donor who has donated before but the last donation was more than 24 months in the same blood centre [16].</li> </ul>	<ul style="list-style-type: none"> <li>• New</li> <li>• Repeated or regular</li> <li>• Lapsed</li> </ul>
Place of donation	<p>A place where the procedure of blood donation is being held.</p> <p>Centre</p> <ul style="list-style-type: none"> <li>• National Blood Centre</li> </ul> <p>Blood Donation Suites</p> <ul style="list-style-type: none"> <li>• Static blood donation centres situated in strategic places. Situated in Midvalley Megamall, Pusanitapuri and One Utama Shopping Centre</li> </ul> <p>Mobile</p> <ul style="list-style-type: none"> <li>• Blood donation campaign in public places</li> </ul>	<ul style="list-style-type: none"> <li>• Centre</li> <li>• Blood Donation Suites</li> <li>• Mobile</li> </ul>
Donor Deferral	Suspension of the eligibility of an individual to donate blood or blood components, either on permanent or temporary basis [16].	<ul style="list-style-type: none"> <li>• Temporary</li> <li>• Permanent</li> </ul>
Causes of donor deferral	<p>Deferment criterias were adapted from The Transfusion Practice Guidelines for Clinical and laboratory Personnel (2016)</p> <p>In this study, the donor deferral causes are grouped as:</p> <ul style="list-style-type: none"> <li>• 'Medical illness' which represent all diseases that were deferred.</li> <li>• 'Blood letting procedure' which include acupuncture, body tattoo, body piercing and cupping.</li> <li>• 'High risk behaviour' which include homosexuality, multiple sexual partner, paying for sexual services and intravenous drug user (IVDU) grouped.</li> <li>• 'Travelling history' which include history of travelling to Zika endemic areas or recent travelling to SARS-Cov-19 area within 14 days</li> </ul>	

### 3.13 Ethical issue

Ethical approval was obtained from the National Medical Research Register (NMRR) (NMRR-20-3293-55883) and Human Research Ethics Committee (HREC) of Universiti Sains Malaysia (USM/ JEPeM/ 20080432).

### 3.14 Study flowchart

Figure 1. Study flowchart

