

Analysis of Deferred Blood Donor Candidates at Dr. Sardjito Hospital, Yogyakarta, Indonesia

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History

- Submission Date: 02-01-2023;
- Review completed: 18-02-2023;
- Accepted Date: 24-02-2023.

DOI : 10.5530/pj.2023.15.50

Article Available online

<http://www.phcogj.com/v15/i6>

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ABSTRACT

Background: The selection of blood donor candidates contributes to the safety of donors and donor recipients. An understanding of the characteristics, demographic characteristics, and types of potential blood donors are essential to obtain an accurate picture of the donor donors, thereby guiding recruitment strategies and providing benchmarks to assess the success of blood donation. **Objective:** This scientific work aims to analyze the deferred blood donor candidates annually based on the required blood donor characteristics at the Blood Transfusion Unit (BTU) of Dr. Sardjito Hospital, Yogyakarta, Indonesia, from 2017 to 2019. **Method:** This observational analytic study applied a retrospective design and was conducted at Dr. Sardjito Hospital, Yogyakarta. The data were collected from the donor registration information system and database in the blood request system for the 2017-2019 period. The statistical analysis was conducted using the Chi-Square test in the SPSS version 22. **Results:** The deferred blood donor candidates in 2017-2019 amounted to 618 (0.82%) out of 75,067 total blood donors, most of whom were female, reaching an annual percentage of 50.7% in 2017, 50.9% in 2018, and 59.1% in 2019. The age range of both male and female deferred blood donor candidates was 17-30 years. The Hb levels of < 12.5 g/dL were mostly found in female blood donors, reaching a peak of 82.4% in 2017, 83.9% in 2018, and 85.4.6% in 2019. Voluntary blood donors accounted for 94.7% (in 2017), 98.6% (in 2018), and 100% (in 2019) of the female deferred blood donor candidates. All analytical tests resulted in a p-value of < 0.0001. Most of the deferred blood donor candidates had blood type O with a p = 0.026. The most common cause of deferral was high or low Hb levels in female blood donors with an age range of 17-30 years. **Conclusions:** The deferred blood donor candidates in 2017-2019 amounted to 618 (0.82%) out of 75,067 total blood donors, most of whom were female with the most common deferral reason of Hb levels < 12.5 g/dL in the age range of 17-30 years. **Key words:** Donors rejected, Transfusion, Hemoglobin.

INTRODUCTION

A blood transfusion service refers to a health service effort that utilizes human blood as a basic material for humanitarian purposes. The primary responsibility of blood transfusion services is to provide a safe, adequate, and timely supply of blood and blood products. In fulfilling this responsibility, the blood transfusion service unit must ensure that the blood donation process is safe and does not harm the donors. Therefore, the eligibility of all blood donor candidates must be assessed every time they want to donate their blood. The safety of blood transfusion services must be ensured at every stage of activity, starting from the recruitment and preservation of blood donors, collection and labeling of blood, prevention of disease transmission, blood processing, blood storage and blood destruction, blood distribution and delivery, as well as medical procedures for transfusing blood to those who need it. It must also be ensured in apheresis and plasma fractionation services.¹⁻⁴

Blood donor selection is the assessment process of a person's eligibility to donate blood or blood components according to predetermined selection standards. This process consists of donor registration, pre-donation information, filling out donor questionnaires, donor interviews and pre-donation counseling, donor health and risk assessment, and informed consent. All of these aspects will indicate the donor's health and history,

which will help determine whether the donor is at risk for blood-borne infections and ensure that all questionnaires are answered in a relevant manner.^{5,6}

Deferred blood donors refer to those who do not meet the selection criteria and must be deferred temporarily or permanently. All deferred donors must be treated confidentially, informed of the reasons for the deferral, and given an opportunity to ask questions. They must be informed whether the deferral is for the protection of their own health and or that of the recipient because it is the responsibility of the blood transfusion service to ensure that the blood donors deferred due to medical conditions are referred for further appropriate investigation and management. Previous studies reported that deferral negatively impacts future blood donor returns, especially first-time donors and those who are deferred for more than one year. Understanding the characteristics, demographic characteristics, and types of blood donors are essential to obtain an accurate picture of the donor donors, thereby guiding recruitment strategies and providing benchmarks to assess the success of blood donation.^{1,2}

This scientific work aims to analyze the deferred blood donor candidates annually based on the required blood donor characteristics at Dr. Sardjito Hospital, Yogyakarta, from 2017 to 2019.

METHODS

This observational analytic study applied a retrospective design. The data were collected from

Cite this article: Triyono T, Afifah T, Sukorini U. Analysis of Deferred Blood Donor Candidates at Dr. Sardjito Hospital, Yogyakarta, Indonesia. *Pharmacogn J.* 2023;15(2): 333-337.

the blood donor database at the Blood Transfusion Unit of Dr. Sardjito Hospital, Yogyakarta. The subjects included 618 deferred blood donor candidates at the Blood Transfusion Unit of Dr. Sardjito Hospital, Yogyakarta, in 2017-2019. The inclusion criteria included blood donors who did not meet the donor selection criteria according to the Regulation of the Minister of Health of the Republic of Indonesia Number 91 of 2015 concerning Blood Transfusion Service Standards. The statistical analysis was conducted utilizing the Chi-Square test in the SPSS version 22, and the results are presented in graphs and tables. The statistical test was considered significant if $p < 0.05$. Ethical approval for this study was obtained from the Ethics Committee of the Faculty of Medicine, Public Health and Nursing (FK-KMK), Universitas Gadjah Mada (UGM) (No: KE/FK/1021/EC/2020).

RESULTS

In this study, a total of 618 (0.82%) out of 75,067 total blood donor candidates were deferred, consisting of 272 male donors (44%) and 346 female donors (56%). The median age of the deferred blood donor candidates was 26 years, with the youngest being 18 years old and the oldest being 66 years old. The largest age range was 17-30 years, consisting of 411 blood donor candidates (66.1%). Most of the deferred blood donor candidates had blood type O, as many as 228 donors (37.2%), followed by those with blood type B, as many as 188 donors (30.7%), blood type A, as many as 141 donors (23%), and blood type AB, as many as 56 donors (9.1%). Voluntary blood donors accounted for 93.7% (581 donors) of the total blood donor candidates, while replacement blood donors accounted for only 6.3% (39 donors) (Table 1).

In 2017, the deferred blood donor candidates amounted to 256 donors or 1.08% of the total 23,630 donors, consisting of 126 male donors (49.3%) and 130 female donors (50.7%). In 2018, it decreased to 120 donors or 0.48% of a total of 24,550 donors, consisting of 47 male donors (49.1%) and 73 female donors (50.9%). In 2019, it resurged to 242 donors or 0.9% of a total of 26,887 donors, consisting of 99 male donors (40.9%) and 143 female donors (59.1%), with a p-value of < 0.0001 (Graphs 1 and Table 2).

Table 1: Characteristics of deferred blood donor candidates (n = 618).

Variables	n (%)
Sex	
Male	272 (44)
Female	346 (56)
Age	
17-30 years	411 (66.1)
31-40 years	98 (15.8)
41-50 years	71 (1.4)
51-60 years	36 (5.8)
> 60 years	6 (1.0)
Blood type	
A	141 (23)
B	188 (30.7)
AB	56 (9.1)
O	228 (37.2)
Hemoglobin level (g/dL)	
< 12.5 g/dL	256 (67.2)
12.5-14 g/dL	43 (11.3)
14.1-15.5 g/dL	35 (9.2)
15.6-17.9 g/dL	24 (6.3)
> 17.9 g/dL	23 (6.0)
Donor Status	
Replacement	39 (6.3)
Voluntary	581 (93.7)

The data is presented in n (%)

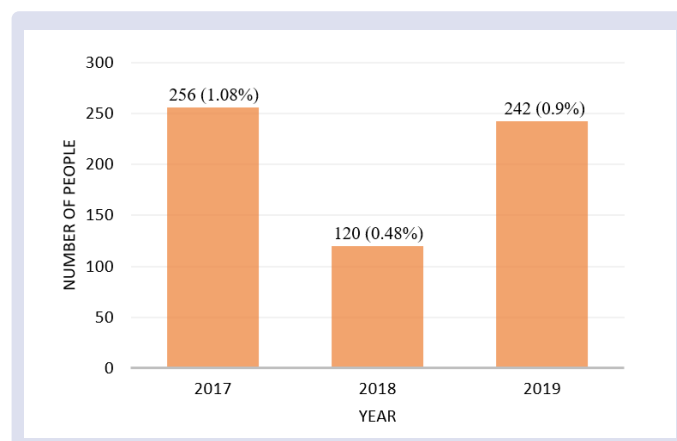


Figure 1: Number of deferred blood donor candidates in 2017-2019.

In 2017, most of the deferred blood donor candidates belonged to the age range of 17-30 years, consisting of 49 male donors (38.9%) and 107 female donors (82.3%). In 2018 and 2019, most of the deferred blood donor candidates also belonged to the same age range, consisting of 26 male donors (55.3%) and 58 female donors (79.5%) in 2018 and 48 male donors (48.5%) and 121 female donors (84.6%) in 2019, with a p-value of 0.000 (Table 3).

From 2017 to 2018, most of the deferred blood donor candidates, both male and female, had blood type O, amounting to 42 males (33.9%) and 47 female donors (37%) in 2017, 19 males (39.6%) and 31 female donors (43.1%) in 2018. In 2019, most of the deferred male blood donor candidates had blood type O, amounting to 48 donors (48%), while most of the deferred female blood donor candidates had blood type B, amounting to 51 donors (35.9%), with a value of $p = 0.026$ (Table 4).

A low Hb level of < 12.5 g/dL is one of the most common causes of the deferral of female blood donor candidates, accounting for 82.4% (56 donors), 83.9% (47 donors), and 85.4% (105 donors) of the total donors in 2017, 2018, and 2019, respectively. Most of the male blood donor candidates in 2017 had a Hb level of > 17.9 g/dL, amounting to 17 donors (37.8%). Meanwhile, those in 2018 and 2019 had a Hb level of < 12.5 g/dL, amounting to 15 donors (55.6%) and 25 donors (41.7%), respectively, with a p-value = 0.000 (table 5).

From 2017 to 2019, most blood donor candidates, both male and female, were voluntary donors, amounting to 98 male (78.4%) and 125 female donors (94.7%) in 2017, 46 (95.8%) male and 72 female donors (98.6%) in 2018, and 98 (98%) male and 142 female donors (100%) in 2019. The voluntary donors were dominated by female donors each year with a p-value of < 0.0001 (Table 6).

The most common cause of deferral was high or low Hb levels, accounting for 46.3% (118 donors), 61.2% (74 donors), and 60.7% (147 donors) of the total blood donor candidates in 2017, 2018, and 2019, respectively. The second most common cause of deferral was high/low blood pressure, accounting for 24.3% (62 donors) of the total blood donor candidates in 2017, and others (including fainting, inadequate blood donation interval, menstruation, lack of sleep/rest, and dizziness), accounting for 24.8% (30 donors) and 21.1% (51 donors) of the total blood donor candidates in 2018 and 2019, respectively, resulting in a p-value of < 0.001 (Table 7).

The most common cause of deferral was high or low Hb levels, amounting to 210 female donors (64.2%) and 116 (35.5%) male donors, with the highest age range of 17-30 years those were 234 donors (71.6%) (Table 8).

Table 2: Number of deferred blood donor candidates by sex in 2017-2019.

Sex	2017		2018		2019		P-value*
	n	%	n	%	n	%	
Male	126	49.3	47	49.1	99	40.9	< 0.0001
Female	130	50.7	73	50.9	143	59.1	

*Chi-square test

Table 3: The age range of the deferred blood donor candidates in 2017-2019.

Age (years)	2017		2018		2019		P-value*
	Male	Female	Male	Female	Male	Female	
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	
17-30	49 (38.9)	107 (82.3)	26 (55.3)	58 (79.5)	48 (48.5)	121 (84.6)	< 0.0001
31-40	31 (24.6)	7 (5.4)	11 (23.4)	8 (11)	28 (28.3)	12 (8.4)	
41-50	25 (19.8)	11 (8.5)	4 (8.5)	5 (6.8)	17 (17.2)	8 (5.6)	
51-60	18 (14.3)	4 (3.1)	5 (10.5)	2 (2.7)	6 (6.1)	2 (1.4)	
> 60	3 (2.4)	1 (0.8)	1 (2.1)	0 (0)	0 (0)	0 (0)	

*Chi-square test

Table 4: Blood types of the deferred blood donor candidates in 2017-2019.

Blood type	2017		2018		2019		P-value*
	Male	Female	Male	Female	Male	Female	
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	
A	34 (27.4)	28 (22)	12 (25)	13 (18.1)	15 (15)	39 (27.5)	0.026
B	36 (29)	41 (32.3)	10 (20.8)	25 (34.7)	25 (25)	51 (35.5)	
AB	12 (9.7)	11 (8.7)	7 (14.6)	3 (4.2)	12 (12)	11 (7.7)	
O	42 (33.9)	47 (37)	19 (39.6)	31 (43.1)	48 (48)	41 (28.9)	

*Chi-square test

Table 5: Hb levels of blood donor candidates by sex in 2017-2019.

Hb level (g/dL)	2017		2018		2019		P-value*
	Male	Female	Male	Female	Male	Female	
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	
< 12.5 g/dL	6 (13.3)	56 (82.4)	15 (55.6)	47 (83.9)	25 (41.7)	105 (85.4)	0.000
12.5-14 g/dL	3 (6.7)	9 (13.2)	2 (7.4)	5 (8.9)	11 (18.3)	13 (10.6)	
14.1-15.5 g/dL	8 (17.8)	2 (2.9)	6 (22.2)	1 (1.8)	13 (21.7)	5 (4.1)	
15.6-17.9 g/dL	11 (24.4)	1 (1.5)	3 (11.1)	1 (1.8)	8 (13.3)	0 (0)	
> 17.9 g/dL	17 (37.8)	0 (0)	1 (3.7)	2 (3.6)	3 (5)	0 (0)	

*Chi-square test

Table 6: Statuses of blood donor candidates by sex in 2017-2019.

Donor status	2017		2018		2019		P-value*
	Male	Female	Male	Female	Male	Female	
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	
Replacement	27 (21.6)	7 (5.3)	2 (4.2)	1 (1.4)	2 (2)	0 (0)	< 0.0001
Voluntary	98 (78.4)	125 (94.7)	46 (95.8)	72 (98.6)	98 (98)	142 (100)	

*Chi-square test

Table 7: Causes of the deferral of blood donor candidates in 2017-2019.

Causes of deferral	2017		2018		2019		P-value*
	n	%	n	%	n	%	
Blood pressure (high/low)	62	24.3	14	11.6	37	15.3	< 0.0001
Hemoglobin level (high/low)	118	46.3	74	61.2	147	60.7	
Incompatible blood type	21	8.2	1	0.8	0	0.0	
Use of medication	11	4.3	1	0.8	3	1.2	
Risky behavior	2	0.8	0	0.0	2	0.8	
Others	33	1.9	30	24.8	51	21.1	

*Chi-square test

Table 8: Causes of the deferral of blood donor candidates by age.

	Causes of deferral											
	Blood pressure (high/low)		Hemoglobin level (high/low)		Use of medication		Risky behavior		Un-matched blood type		Others	
	n	%	n	%	n	%	n	%	n	%	n	%
Sex												
Male	58	49.2	116	35.5	9	69.2	5	55.6	2	66.7	21	45.7
Female	60	50.8	210	64.2	4	30.8	4	44.4	1	33.3	25	54.3
Age												
17-30 years	75	63.6	234	71.6	6	46.2	4	44.4	2	66.7	33	71.7
31-40 years	14	11.9	45	13.8	3	23.1	4	44.4	1	33.3	8	17.4
41-50 years	19	16.1	30	9.2	4	30.8	0	0.0	0	0.0	2	4.3
51-60 years	9	7.6	17	5.2	0	0.0	1	11.1	0	0.0	2	4.3
> 60 years	1	0.8	1	0.3	0	0.0	0	0.0	0	0.0	1	2.2

DISCUSSION

In general, to donate blood, donor candidates are required to be in good health and meet certain criteria according to predetermined parameters. It can be ensured by medical history verification, observation, and simple tests. In this study, deferred blood donor candidates amounted to 272 male donors (44%) and 346 (56%) female donors in 2017-2019 (Table 1). There is an increase in the number of deferred female blood donor candidate's year after year compared to deferred male blood donors (Table 2). This study also complies with a study conducted by Elsafi in 2020 and Shaer *et al.*, reporting that 13.7% of female blood donor candidates were deferred from the total female donors of 44%.^{7,8}

Female donors could have had iron deficiency anemia caused by menstruation and pregnancy. A study conducted by Hillgrove *et al.* suggested that most of the deferred blood donor candidates, due to low hemoglobin levels, did not return to try to donate their blood again. Only about 21% of them returned within three years, and about 70% never returned. Low hemoglobin levels are a common cause of the deferral of blood donor candidates, resulting in great and even permanent loss of blood donor candidates.⁹⁻¹¹

One way to get an adequate blood supply is to have a great number of voluntary donors. In this study, most of the deferred blood donor candidates were voluntary donors, which accounted for 89.5% (67,200) of the total 75,067 blood donor candidates. The motivation of voluntary blood donors to donate blood comes from their altruistic character, their moral responsibility to help others, and the positive impacts of donating blood on their own health.¹²

In this study, there are six causes of the deferral of blood donor candidates, namely high or low blood pressure, high or low hemoglobin level, incompatible blood type, use of medication before donating, risky behavior, and others (Tables 7 and 8). Blood pressure is declared high or low when it is outside the range of 90-160 mmHg for systolic blood pressure and 60-100 mmHg for diastolic blood pressure, and the difference between systolic and diastolic blood pressure reaches more than 20 mmHg. Hemoglobin level is declared high or low when it is less than 12.5 g/dL or more than 17.9 g/dL. The incompatible blood type referred to in this study is when a replacement blood donor candidate and the recipient candidate have different blood types, and the blood donor candidate refuses to become a voluntary donor. A history of taking medication such as aspirin, NSAIDs, retinoid acid groups, antibiotics, and so on will make a blood donor candidate deferred temporarily, while consumption of illegal drugs included in narcotics will make a blood donor candidate deferred permanently. A blood donor candidate is considered to have risky behavior when they have a lifestyle that puts them at high risk of getting serious infections

transmittable through blood, such as tattoos, body piercings, and high-risk sexual behavior. Others refer to other causes, including fainting, inadequate blood donation interval, menstruation, lack of sleep/rest, and dizziness.^{1,2}

The most common causes of the deferral of blood donor candidates in the age range of 17-30 years were high or low hemoglobin levels and the donor's clinical conditions, such as fainting, dizziness, menstruation, and lack of rest. It is in line with the results of a study by Parvin *et al.*, indicating that 33.01% of donors had anemia, and most of whom were women (48.73%).¹³

The large number of deferred blood donor candidates for various reasons can decrease the number of donors. Lack of understanding about blood donation, misunderstanding that blood donation is dangerous, or lack of appreciation cause some blood donor candidates not to come back.^{14,15}

CONCLUSIONS

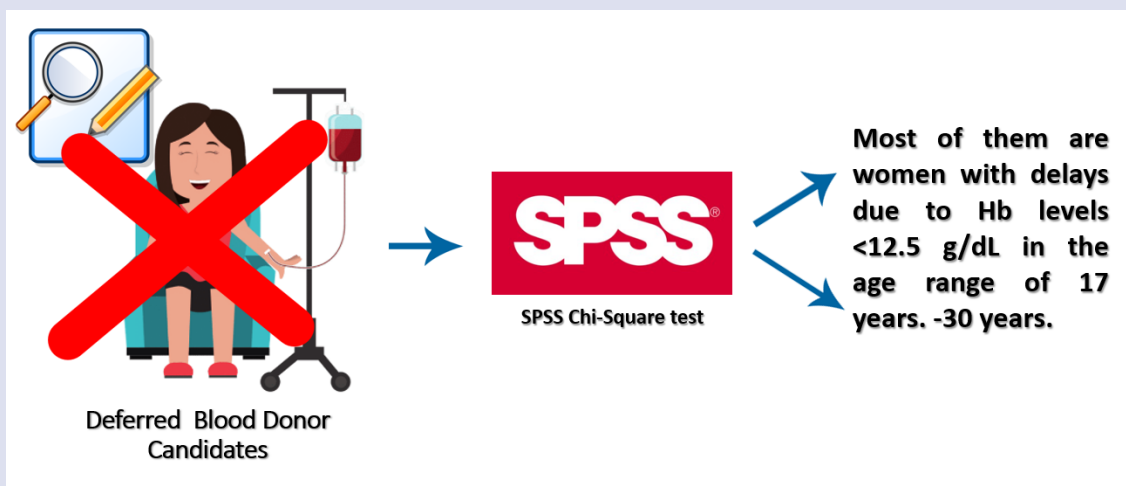
The deferred blood donor candidates in 2017-2019 amounted to 618 (0.82%) of the 75,067 total blood donors. Most of the deferred blood donor candidates were female ($p < 0.0001$) with an age range of 17-30 years, mostly due to their low hemoglobin levels of < 12.5 g/dL ($p = 0.000$).

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GRAPHICAL ABSTRACT



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Cite this article: Triyono T, Afifah T, Sukorini U. Analysis of Deferred Blood Donor Candidates at Dr. Sardjito Hospital, Yogyakarta, Indonesia. *Pharmacogn J.* 2023;15(2): 333-337.