# Assessing the Prevalence of Blood Donation Deferrals Due to Low Hemoglobin Levels: A Quantitative Study

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**Abstract**

**Background:** Blood donation deferrals due to low hemoglobin levels significantly impact donor retention and blood supply. This study aimed to assess the prevalence of hemoglobin-related deferrals and identify key demographic and physiological factors influencing these deferrals in a tertiary hospital.

**Methods:** A cross-sectional study was conducted with data from 5,000 donation attempts over six months. Hemoglobin levels, age, gender, BMI, and donation frequency were analyzed. Descriptive statistics and logistic regression were used to identify predictors of deferral.

**Results:** Of the 5,000 donors, 850 (17%) were deferred due to low hemoglobin. Female donors (24%) were more likely to be deferred than male donors (10%). Younger donors (18-30 years) had a deferral rate of 22%, while frequent donors had a 20% deferral rate. Logistic regression revealed that female gender (OR: 2.83, $p < 0.001$), younger age (OR: 1.56, $p < 0.001$), and frequent donation (OR: 1.63, $p < 0.001$) were significant predictors of deferral.

**Conclusions:** Low hemoglobin deferrals are prevalent, particularly among women, younger donors, and frequent donors. Interventions such as iron supplementation and tailored donation intervals may help reduce deferral rates and improve donor retention.

**Keywords:** Blood donation, Hemoglobin deferral, Iron deficiency, Donor retention, Blood supply, Gender differences, Donation frequency

## Introduction

Blood donation plays a critical role in healthcare systems worldwide, supplying essential blood products for a wide range of medical procedures, including surgeries, trauma care, and the treatment of chronic conditions such as anemia and cancer. However, maintaining an adequate pool of eligible donors remains a significant challenge due to various deferral criteria that aim to ensure the safety of both donors and recipients. Among these criteria, low hemoglobin levels are one of the most common reasons for donor deferral, significantly impacting both individual donors and blood donation centers (Shi et al., 2014).

Hemoglobin, a protein that facilitates oxygen transport in the blood, must meet minimum thresholds for a person to be considered eligible to donate. The standard minimum hemoglobin levels are typically set at 12.5 g/dL for women and 13.0 g/dL for men, although these thresholds may vary slightly depending on regional guidelines (Mast et al., 2010). Potential donors who fail to meet these criteria are deferred, often

leading to frustration and potentially reducing the likelihood of their returning for future donations (Ferguson, 2015). This, in turn, places additional pressure on blood banks, as deferrals reduce the pool of eligible donors and may contribute to blood shortages.

Several factors contribute to low hemoglobin levels, which disproportionately affect certain groups of potential donors. Women, in particular, face higher deferral rates due to menstruation and pregnancy, both of which can lead to lower iron stores and hemoglobin levels (Hillgrove et al., 2011). Additionally, frequent donors are at increased risk of low hemoglobin due to insufficient time for iron levels to recover between donations (Cable et al., 2012). Understanding these factors is crucial for developing strategies to mitigate deferrals and improve donor retention.

This study aims to assess the prevalence of blood donation deferrals due to low hemoglobin levels by analyzing data from several donation centers. Furthermore, it seeks to identify demographic and physiological factors, such as gender, age, and donation frequency, that contribute to these deferrals. By providing insights into the prevalence and causes of low hemoglobin deferrals, this research intends to inform blood donation centers on how to better manage donor eligibility and maintain a steady blood supply.

## Literature Review

### Importance of Blood Donation and Deferral Criteria

Blood donation is a vital component of healthcare systems, providing lifesaving products for a wide range of clinical applications, from surgeries to managing chronic diseases like cancer and sickle cell anemia (Shi et al., 2014). However, ensuring a safe and adequate blood supply depends on stringent donor screening protocols, including deferral criteria that protect both the donor's health and the safety of the collected blood. Deferrals can arise from various factors, including infections, recent travel, and chronic medical conditions, but low hemoglobin is consistently one of the most prevalent reasons for disqualifying potential donors (Mast et al., 2010). Research shows that the minimum hemoglobin levels set for donation—typically 12.5 g/dL for women and 13.0 g/dL for men—serve as a protective measure to prevent exacerbation of pre-existing anemia and other health complications for donors (Ferguson, 2015).

### Prevalence of Low Hemoglobin Deferrals

Several studies have explored the prevalence of low hemoglobin deferrals in different populations, often noting that these deferrals constitute a significant percentage of total deferrals. Mast et al. (2010) found that in the United States, around 10% of first-time donors and 15% of repeat donors were deferred due to low hemoglobin levels. Similarly, Hillgrove et al. (2011) identified a high prevalence of hemoglobin-related deferrals among Canadian blood donors, particularly among women. These findings highlight a persistent challenge for blood donation services, as deferring donors due to low hemoglobin not only reduces the donor pool but also poses challenges for retaining eligible donors.

### Factors Contributing to Low Hemoglobin Levels in Donors

The literature indicates that several demographic and physiological factors can influence hemoglobin levels and increase the risk of deferral. Women, especially premenopausal women, are at greater risk of being deferred due to naturally lower hemoglobin levels linked to menstruation and pregnancy (Hillgrove et al., 2011). Cable et al. (2012) further demonstrated that female donors are more frequently deferred than male donors due to low hemoglobin, suggesting that gender-specific factors must be considered when developing strategies to mitigate deferrals. Another important factor is the frequency of donations. Studies have shown

that frequent blood donors, especially those who donate whole blood, are more likely to experience a drop in hemoglobin and iron stores, leading to deferrals (Cable et al., 2012). Iron deficiency, in particular, has been identified as a significant contributor to hemoglobin deferrals among repeat donors.

Diet and nutrition also play a critical role in maintaining adequate hemoglobin levels. Poor dietary intake of iron, particularly non-heme iron found in plant-based foods, can lead to iron deficiency anemia, further increasing the likelihood of donor deferrals (Mast et al., 2010). The importance of dietary counseling for donors, especially frequent donors, has been highlighted as a potential intervention to reduce hemoglobin-related deferrals (Hillgrove et al., 2011).

Impact of Low Hemoglobin Deferrals on Donor Retention

Hemoglobin deferrals not only reduce the immediate pool of eligible donors but can also have long-term consequences on donor retention. Deferred donors often experience frustration and may be less likely to return for future donations. In a study conducted by Ferguson (2015), it was observed that approximately 30% of donors deferred due to low hemoglobin did not attempt to donate again within the following year. This trend poses a significant challenge for blood donation centers that rely on repeat donors to maintain a stable blood supply. Addressing the underlying causes of low hemoglobin levels, such as providing iron supplements or dietary recommendations, may help mitigate deferrals and improve donor retention rates (Hillgrove et al., 2011).

Interventions to Reduce Hemoglobin Deferrals

Various interventions have been proposed to reduce the prevalence of low hemoglobin deferrals among potential donors. One approach involves the implementation of iron supplementation programs for frequent donors. Cable et al. (2012) found that providing iron supplements to repeat donors significantly reduced the incidence of hemoglobin deferrals. Other interventions include adjusting the donation frequency for individuals at higher risk of low hemoglobin, such as women and frequent donors, to allow more time for iron stores to replenish between donations (Mast et al., 2010).

Furthermore, the use of point-of-care hemoglobin testing to assess potential donors' hemoglobin levels before donation has been widely adopted by many blood donation centers (Ferguson, 2015). This quick and non-invasive test allows for the identification of donors with borderline hemoglobin levels, enabling donation centers to offer recommendations for improving hemoglobin levels before the next donation attempt.

Gaps in the Literature

Despite the existing research on hemoglobin deferrals, there are gaps in understanding the interplay between various factors such as age, lifestyle, and health conditions in predicting low hemoglobin levels. Additionally, while some studies have focused on the impact of hemoglobin deferrals on donor retention, there is limited research on the effectiveness of different interventions aimed at reducing deferral rates across different populations. This study aims to address these gaps by conducting a comprehensive analysis of the prevalence of low hemoglobin deferrals and identifying key demographic and physiological factors that contribute to these deferrals.

**Methodology**

Study Design

This quantitative, cross-sectional study was conducted at the blood donation center of a tertiary hospital over a six-month period. The primary objective was to assess the prevalence of blood donation deferrals due to low hemoglobin levels and to identify the demographic and physiological factors influencing these deferrals. Data were collected from donors who attempted to donate blood during the study period, using existing hospital records and hemoglobin screening results.

Study Population

The study included all individuals who presented themselves as potential blood donors at the hospital's donation center. A total of 5,000 donation attempts were recorded during the study period. Donors ranged in age from 18 to 65 years and included both first-time and repeat donors. Donors were excluded from the study if they had incomplete data or if they were deferred for reasons other than low hemoglobin levels, such as medical history, recent travel, or other disqualifying criteria.

Data Collection

Data for this study were collected retrospectively from the hospital's blood donation records. For each donor, the following variables were extracted:

- Hemoglobin level (measured using point-of-care hemoglobin testing devices)
- Age
- Gender
- Body Mass Index (BMI)
- Frequency of prior donations (categorized as first-time donor, occasional donor, and frequent donor)
- Time since last donation
- Deferral status (whether the donor was deferred due to low hemoglobin)

In cases of hemoglobin-related deferrals, the specific hemoglobin value was recorded along with any accompanying recommendations provided to the donor (e.g., dietary advice or supplementation).

Hemoglobin Testing and Deferral Criteria

Each donor underwent pre-donation screening, which included a hemoglobin test performed using a point-of-care hemoglobin device. The cutoff levels for donation eligibility were set at 12.5 g/dL for female donors and 13.0 g/dL for male donors, in accordance with the hospital's donation guidelines and international standards (Mast et al., 2010). Donors with hemoglobin levels below these thresholds were deferred from donating on that day.

Statistical Analysis

Data were analyzed using SPSS version 25. Descriptive statistics were used to calculate the prevalence of deferrals due to low hemoglobin levels, reported as percentages with 95% confidence intervals. Chi-square tests were employed to assess the association between hemoglobin deferral status and categorical variables such as gender, age group, and donation frequency. Additionally, independent sample t-tests were conducted to compare the mean hemoglobin levels across different donor groups (e.g., male vs. female, frequent vs. first-time donors).

Logistic regression analysis was performed to identify the predictors of low hemoglobin deferrals. The outcome variable was donor deferral due to low hemoglobin (yes/no), while the independent variables

included age, gender, BMI, and donation frequency. Odds ratios (OR) with 95% confidence intervals (CI) were calculated to quantify the strength of associations between these variables and the likelihood of deferral due to low hemoglobin.

Ethical Considerations

Ethical approval for this study was obtained from the hospital's ethics committee prior to data collection. All donor data were anonymized to protect the privacy of individuals, and only aggregate data were used in the analysis. The study adhered to the principles of the Declaration of Helsinki and followed all institutional guidelines for the use of patient data in research. As the data were collected retrospectively from hospital records, no informed consent from donors was required; however, the confidentiality of all donor information was strictly maintained.

Limitations

One limitation of this study is that it relied on retrospective data, which may have introduced biases related to incomplete records or variations in hemoglobin measurement techniques. Additionally, the study was conducted at a single tertiary hospital, limiting the generalizability of the findings to other donation centers. Future studies should consider including multiple centers to obtain a more representative sample of donors.

**Findings**

Prevalence of Low Hemoglobin Deferrals

During the six-month study period, a total of 5,000 donation attempts were recorded at the hospital's blood donation center. Of these, 850 donors (17%) were deferred due to low hemoglobin levels. The prevalence of low hemoglobin deferrals was higher among female donors (25%) compared to male donors (10%).

**Table 1: Prevalence of Low Hemoglobin Deferrals by Gender**

| Gender | Total Donors | Donors Deferred (n) | Donors Deferred (%) |
|---|---|---|---|
| Male | 2,500 | 250 | 10% |
| Female | 2,500 | 600 | 24% |
| Total | 5,000 | 850 | 17% |

Demographic and Physiological Factors Associated with Deferrals

The analysis showed a significant association between gender and hemoglobin-related deferrals ($p < 0.001$), with women being more likely to be deferred. Age also played a role, as donors aged 18-30 had a higher prevalence of deferrals (22%) compared to older age groups (12% among donors aged 51-65). Furthermore, frequent donors were at a higher risk of deferral due to low hemoglobin compared to first-time and occasional donors.

**Table 2: Prevalence of Low Hemoglobin Deferrals by Age Group**

| Age Group | Total Donors | Donors Deferred (n) | Donors Deferred (%) |
|---|---|---|---|
| 18-30 | 1,500 | 330 | 22% |
| 31-50 | 2,000 | 350 | 17% |
| 51-65 | 1,500 | 170 | 11% |
| Total | 5,000 | 850 | 17% |

**Table 3: Prevalence of Low Hemoglobin Deferrals by Donation Frequency**

| Donation Frequency | Total Donors | Donors Deferred (n) | Donors Deferred (%) |
|---|---|---|---|
| First-time Donors | 2,000 | 300 | 15% |
| Occasional Donors | 1,500 | 250 | 17% |
| Frequent Donors | 1,500 | 300 | 20% |
| Total | 5,000 | 850 | 17% |

Predictors of Low Hemoglobin Deferral

Logistic regression analysis identified several significant predictors of low hemoglobin deferral. Female gender was the strongest predictor, with women having 2.8 times the odds of being deferred compared to men (OR: 2.83, 95% CI: 2.32-3.44). Younger age (18-30 years) and frequent donation history were also significant predictors. The odds of deferral were 1.6 times higher for frequent donors compared to first-time donors (OR: 1.63, 95% CI: 1.29-2.07).

**Table 4: Logistic Regression Analysis of Predictors of Low Hemoglobin Deferral**

| Variable | Odds Ratio (OR) | 95% Confidence Interval (CI) | p-value |
|---|---|---|---|
| Female Gender | 2.83 | 2.32-3.44 | <0.001 |
| Age (18-30) | 1.56 | 1.25-1.94 | <0.001 |
| Frequent Donors | 1.63 | 1.29-2.07 | <0.001 |
| BMI | 1.12 | 0.95-1.32 | 0.134 |

## Discussion

The findings from this study provide valuable insights into the prevalence of blood donation deferrals due to low hemoglobin levels in a tertiary hospital and identify key demographic and physiological factors influencing these deferrals. The overall deferral rate due to low hemoglobin was found to be 17%, which aligns with previous studies that reported deferral rates ranging from 10% to 25%, depending on the population and region studied (Mast et al., 2010; Hillgrove et al., 2011). This relatively high deferral rate underscores the need for targeted strategies to reduce hemoglobin-related deferrals and improve donor retention.

Gender and Hemoglobin Deferrals

Consistent with previous research, this study found that female donors were significantly more likely to be deferred due to low hemoglobin than male donors, with 24% of female donors being deferred compared to 10% of male donors. This gender disparity can be largely attributed to biological differences, such as menstruation and pregnancy, which can deplete iron stores and lead to lower hemoglobin levels in women (Hillgrove et al., 2011). This finding is supported by Cable et al. (2012), who also identified a higher risk of hemoglobin deferral among female donors.

To address this issue, blood donation centers may consider implementing targeted interventions for female donors. For example, offering iron supplementation to women who donate regularly or providing dietary counseling to increase iron intake could help mitigate the impact of low hemoglobin levels and reduce deferrals (Mast et al., 2010). Additionally, adjusting donation intervals for women based on their iron status may allow more time for iron recovery and improve eligibility rates for future donations.

Age and Hemoglobin Deferrals

The study also revealed a higher prevalence of low hemoglobin deferrals among younger donors, particularly those aged 18-30 years. Younger donors were deferred at a rate of 22%, compared to 11% among donors aged 51-65. This trend may be related to lifestyle factors, such as dietary habits and iron consumption, which tend to vary by age group. Younger adults may have lower dietary intake of iron-rich foods, increasing their risk of iron deficiency and low hemoglobin levels (Cable et al., 2012).

Blood donation centers may benefit from focusing on educational interventions for younger donors, emphasizing the importance of maintaining adequate iron levels through diet and supplementation. This approach could help reduce the prevalence of hemoglobin-related deferrals in this age group and encourage long-term donor participation.

Donation Frequency and Hemoglobin Deferrals

Frequent donors were found to have a higher risk of deferral due to low hemoglobin compared to first-time and occasional donors. Frequent donors had a 20% deferral rate, which is consistent with previous research showing that frequent donation can deplete iron stores, leading to lower hemoglobin levels over time (Cable et al., 2012). This is particularly concerning because frequent donors are often the most reliable source of blood for donation centers, and deferrals in this group can have a substantial impact on the overall blood supply.

To address this issue, donation centers should consider implementing routine hemoglobin and iron status monitoring for frequent donors. Iron supplementation programs for frequent donors have been shown to significantly reduce deferral rates due to low hemoglobin (Mast et al., 2010). Additionally, adjusting donation intervals for individuals at higher risk of low hemoglobin, such as frequent donors and women, could help ensure adequate recovery of iron levels between donations.

Implications for Donor Retention

Low hemoglobin deferrals not only affect the immediate eligibility of donors but may also impact long-term donor retention. Previous studies have shown that donors who are deferred due to low hemoglobin are less likely to return for future donations, often due to frustration and a lack of understanding about how to improve their hemoglobin levels (Ferguson, 2015). This study supports those findings, emphasizing the need for donation centers to provide clear communication and education to deferred donors. Offering practical advice on improving hemoglobin levels, such as through diet or iron supplements, may encourage deferred donors to return once they meet the eligibility criteria.

Limitations and Future Research

While this study provides valuable insights into the factors influencing hemoglobin deferrals, it is not without limitations. The study was conducted at a single tertiary hospital, which may limit the generalizability of the findings to other blood donation centers or regions. Additionally, the study relied on retrospective data, which may have introduced biases related to incomplete records or variations in hemoglobin measurement techniques. Future research should consider expanding the study to multiple centers to obtain a more representative sample of donors.

Another area for future research is to investigate the effectiveness of different interventions aimed at reducing hemoglobin-related deferrals. For example, studies could explore the long-term impact of iron supplementation programs or dietary counseling on donor eligibility and retention. Understanding which

strategies are most effective in reducing deferrals and promoting donor retention will be critical for optimizing blood donation programs.

**Conclusion**

This study highlights the prevalence of low hemoglobin deferrals in a tertiary hospital blood donation center and identifies key demographic and physiological factors contributing to these deferrals. Female donors, younger donors, and frequent donors were found to be at higher risk of deferral, suggesting the need for targeted interventions to mitigate these risks. By addressing the underlying causes of low hemoglobin levels, blood donation centers can improve donor eligibility and retention, ultimately enhancing the stability of the blood supply.

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