Section: Pathology

Original Research Article

EPIDEMIOLOGICAL STUDY AND STATISTICAL ANALYSIS OF DEFERRAL BLOOD DONORS: A 2 YEAR RETROSPECTIVE ANALYSIS OF CLINICAL AND LIFESTYLE BOTTLENECKS

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ABSTRACT

Background: Strict blood donor screening ensures recipient safety but limits the voluntary blood supply. To refine selection and reduce deferral, demographic predictors of donor rejection need to be identified. The objective is to categorize clinical reasons for donor exclusion and appraise the statistical association between donor age and deferral longevity (temporary vs. permanent). **Materials and Methods:** This study is a retrospective cross-sectional analysis of 520 consecutive donors. Pearson's Chi-Square (χ^2) test of independence ($\alpha = 0.05$) was used to analyse the associations between age cohorts (≤25 years vs. >25 years) and deferral classification. **Result:** The cohort (mean age: 26.88±9.58 years) comprised 441 (84.08%) males and 79(15.2%) females. 97.7% (n = 508) of the donors constituted temporary deferrals, whereas permanent medical conditions accounted for only 2.3% (n = 12). Anemia was the main cause of deferral overall (23.3%, n = 121), leading to 60.8% (n = 48) of all female exclusions. Recent cosmetic tattooing or piercing was responsible for 15.2% (n = 79) of the exclusions, mostly among younger individuals. Statistical modeling showed a highly significant association between donor age and the permanence of deferral ($\chi^2 = 14.312$; df = 1; p = 0.0001).Younger donors (≤25 years) were more likely to face temporary lifestyle-related exclusions rather than permanent medical conditions ($p < 0.001$). **Conclusion:** Over 97% of donor deferrals are temporary, preventable, and associated with younger demographics. Targeted community health initiatives, such as pre-donation nutrition advice, iron deficiency screening, and awareness campaigns about the post-tattoo waiting period, could help reintegrate most deferred donors and protect the active donor supply chain.

INTRODUCTION

A consistent supply of healthy, voluntary donors is essential for maintaining high-quality blood transfusion services. Strict donor selection criteria are implemented worldwide to reduce the risk of transmitting infections through blood transfusions and to ensure the well-being of donors.However, these criteria often result in the deferral of a significant number of potential donors. Deferrals can be temporary, allowing donors to return after a certain period, or permanent, which excludes them indefinitely. A thorough quantitative evaluation of donor characteristics provides deeper clinical insights compared to descriptive statistics, which only highlight general trends. Identifying localized epidemiological trends and numerical predictors through computer-assisted analysis is crucial for improving recruitment strategies and reducing donor loss.

Aims and Objectives: This study aims to evaluate the demographic features and specific clinical reasons for donor deferral within a rural medical college setting.

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MATERIALS AND METHODS

Study Design and Data Source: This study is a retrospective cross-sectional analysis based on secondary data.

Sampling: Non-probability sampling was used, with universal inclusion of all donors.

Study Procedure: The study included 520 consecutive registered donor candidates from institutional master registries, from entries 1 to 520. Baseline variables collected included age, sex, type of donor (first-time, repeat, institutional), deferral duration (temporary or permanent), and the specific clinical or lifestyle reason for deferral.

Statistical Analysis: Raw logs were cleaned and converted into an institutional dataset. Continuous data were presented as mean ± standard deviation (SD). Categorical data were converted into frequencies and percentages. Donors were grouped into age cohorts (≤25 years versus >25 years) for demographic analysis. The association between these age groups and deferral duration (temporary versus permanent) was investigated using the Pearson's Chi-Square (χ^2) test of independence. Fisher's Exact Test was used as a secondary validation method.Statistical significance was defined as a p value < 0.05.

RESULTS

Dataset Validation Metrics: The complete dataset was validated and confirmed to have a 100.0% data completion index (N = 520) with no missing or flagged records removed during analysis.

Cross Tabulation Matrices Cross-tabulation analysis revealed differences in demographics between younger and older donor groups. Donors aged ≤25 years made up 60.96% (n = 317) of the total group. The detailed distribution is shown in [Table 1].

Table 1: Contingency Matrix for Age Cohort versus Deferral Longevity

Demographic Age Distribution	Temporary Deferral (n)	Permanent Deferral (n)	Total
Younger age (≤ 25 Years	315	2	317
Older age (>25 Years)	193	10	203
Total	508	12	520

Cohort Proportions by Gender and Deferral Longevity: The baseline data showed a significant imbalance between male and female donors. Of the 520 donors, 441 (84.08%) were male and 79 (15.2%) were female.The data strongly indicated that most deferrals were temporary, with 508 cases (97.7%) classified as temporary, while 12 cases (2.3%) were permanent.

Table 2: Stratified Cohort Frequencies by Gender and Longevity (N=520)

Demographic Metric Group	Clinical Category Profile	Frequency Count (n)	Relative Percentage Distribution (%)
Biological Gender	Male	441	84.8%
	Female	79	15.2%
Exclusion Profile	Temporary Deferral	508	97.7%
	Permanent Deferral	12	2.3%

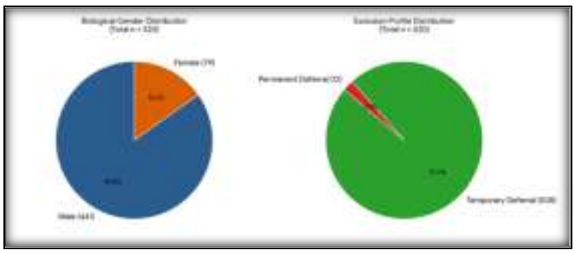

Figure 1: Pie charts showing the proportion of donor candidates by biological gender (left) and deferral classification (right), highlighting the dominance of temporary male exclusions.

Chronological Age Distribution Profile: The sample included a wide age range, from 15 to 65 years. The average age of the deferral cohort was 26.88 years (standard deviation = 9.58), with a median age of 23 years.This indicates a heavily right-skewed distribution, with deferrals concentrated among adolescents and young adults.

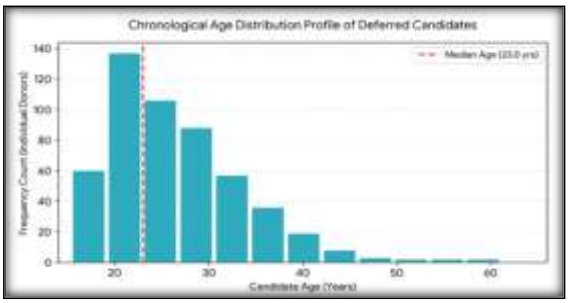

Figure 2: Histogram displaying the age distribution of deferred donors, showing a peak in the 18–25 age group, with a sharp decline in older age groups

Table 3: Granular Distribution of Deferral Reasons by Donor Sex (N = 520)

S. No	Clinical / Lifestyle Deferral Category	Male (n)	Female (n)	Total Cohort (n)	Relative Percentage (%)
1	Anemia (Low Hemoglobin)	73	48	121	23.27%

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2	Recent Tattooing / Ear Piercing	78	1	79	15.19%
3	Underweight Status (<45 kg)	35	10	45	8.65%
4	Systemic Hypertension	27	1	28	5.38%
5	Acute Febrile Illness (AFI)	23	0	23	4.42%
6	Inadequate Sleep Rest	16	0	16	3.08%
7	Anxiety / Stress Symptoms	11	3	14	2.69%
8	Recent Medication Intake	12	1	13	2.50%
9	Recent Dental Interventions	10	2	12	2.31%
10	Upper Respiratory Infections (URI)	11	0	11	2.12%
11	Recent Vaccinations	10	0	10	1.92%
12	Short-term Alcohol Ingestion	9	0	9	1.73%
13	Diabetes Mellitus	7	1	8	1.54%
14	Underage Presentation (<18 years)	6	1	7	1.35%
15	Recent Surgical Interventions	5	1	6	1.15%
16	Animal Bites (Rabies Post-Exp / ARV)	5	0	5	0.96%
17	Menorrhagia / Active Menstruation	0	5	5	0.96%
18	Cardiac Diseases / Valve Surgery	4	0	4	0.77%
19	Asthma (Chronic Pulmonary)	3	1	4	0.77%
20	Other Miscellaneous Causes	96	4	100	19.23%
21	Total cohort	441	79	520	100.00%

Proportional Distribution Analysis

The major reasons for excluding donors are shown in [Figure 3].

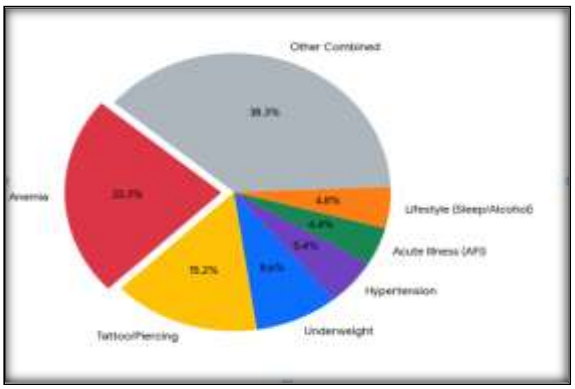

Figure 3: This pie chart shows the proportion of each main reason for deferral among all 520 candidates. Nutritional and iron deficiency-related issues, such as anemia, are the biggest category at 23.3%, followed by temporary skin exposure from tattoos or piercings at 15.2%.Together, these two factors that can be easily addressed account for over 38% of all donor exclusions in the regional system.

Inferential Statistical Analysis Output: A Pearson Chi-Square test was used to calculate the result, showing a value of 14.3 (df = 1) with a two-sided p-value of 0.0001. There is a strong statistical link between the age of the donor and the type of deferral. Younger donors, those under 25 years of age, are more likely to be deferred for temporary and changeable reasons, such as tattoos, short sleep, or low body weight, rather than permanent health issues (chi square = 14.312, $p < 0.001$).

DISCUSSION

This retrospective study of 520 consecutive donors found that most exclusions (97.69%) are temporary and can be reversed. The high rate of temporary deferrals is consistent with the principles promoted by the World Health Organization.[1] It also matches the findings of Agnihotri,[2] in Western India, where temporary reasons for exclusion are more common than permanent ones. However, local demographics influence the physical and behavioral patterns observed in any study.

The Anemia Factor and Nutritional Trends: In our study, anemia was the reason for 23.27% of deferrals. Moreover, 60.8% of all female exclusions were linked to lower hemoglobin levels. This highlights the serious public health concern associated with this issue. The prevalence of anemia as a cause of deferral matches observations by Charles et al,[3] in multi-ethnic tropical populations and by Bahadur et al,[4] in tertiary audit studies. In both cases, nutritional iron deficiency anemia was the leading cause of female donor exclusion. In a US-based study by Zou et al,[5]anemia was also a major reason for deferral, although its prevalence was lower than in our study. In that study, travel history and specific medication use were among the main reasons for exclusion. Newman,[6] and Custer et al,[7] recommend that strategies such as counseling and iron supplements should be introduced before donation to lower anemia rates and reduce the number of deferrals.

Cosmetic Body Modifications and Lifestyle Dynamics: The second most common cause of temporary deferral in our study was recent cosmetic procedures, such as tattoos and ear piercings, accounting for 15.19% of all cases. This highlights the need to focus on young populations in health awareness efforts, especially those involved in body modifications. Similar to the findings of Rabeya et al,[8] in Malaysian university hospitals, our study found that students with tattoos or piercings were often excluded due to a lack of knowledge about infection incubation periods. While Western donor communities report fewer cases due to the use of regulated tattoo parlors with short term deferral policies, regional areas require a more cautious approach. Therefore, the blood collection community should be aware that the standard deferral period for tattoos or other body modifications is three to twelve months. This aligns with the warnings from Shastry, Chaudhari, and

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Bhat,[9] who note that temporary exclusions can significantly affect young donors. Non-compliance with restrictions such as tattoo-related deferrals (3.08%) or sleep deprivation (3.08%) leads to a high rate of donor loss due to permanent ineligibility. The recommended strategy is to implement public health campaigns to educate young people about eligibility rules before donation.

Demographic Predictors of Deferral Permanence: One key finding of this study is the link between a donor's age and the likelihood of being excluded temporarily or permanently ($p = 0.0001$). This trend was statistically significant (chi square = 14.3) and supports the findings of Kumar et al,[10] regarding the distribution of deferral reasons across different age groups. According to our results, younger donors (≤25 years old) are unlikely to be permanently excluded due to temporary factors, such as body weight, stress, or anxiety. In contrast, older donors are more likely to face long-term deferrals due to chronic conditions like severe hypertension, diabetes, or heart problems. Most permanently deferred donors were aged 55 or older, a pattern also seen in international literature on blood donation. This trend underscores the differences between young and old populations, as well as their distinct attitudes toward health. Therefore, targeted measures are needed to reduce attrition rates in the donor community. For younger individuals, emphasis should be on community involvement and health education, while older individuals should be encouraged to adopt healthier lifestyles.

CONCLUSION

Our study highlights some important trends like male predominance to female donors. In rural areas where low female literacy rate, low awareness of blood donor programmes, high house hold pressures is prevalent accounts to apparent male predominance. There fore gender comparison for the deferral reasons was not made as the ratio was not equal and comparable. These demographic variations still do not preclude the introduction of anemia control programmes or implementation of tattoo regulation practices to reduce donor deferrals.

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