

Special article

Deferral and complications from blood donation in educational institutions

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Introduction

Blood donation is essential for saving lives and strengthening national health systems. This relies on voluntary, non-remunerated donors (VNRD). The World Health Organization (WHO) reports that many developing countries collect only about 5 donations per 1,000 population, below the recommended minimum of 10 donations per 1,000 population per year.¹⁻³ Recruiting new donors, especially youth and university students, is crucial because this group is generally healthy and can become regular donors.

However, the donation rate among students remains low due to insufficient knowledge, misconceptions, and gaps in outreach, such as fear of infection, assumptions of ineligibility, and myths about health impacts.⁴⁻⁷ Young donors and students also have higher deferral rates and more adverse events, linked to lifestyle, sleep, diet, stress, and anxiety, which may discourage donor return, particularly among first-time donors.⁸⁻¹¹ Despite these concerns, national data on blood donation in Thailand, including from mobile collection units at educational institutions, remain limited.

We conducted a cross-sectional analysis of whole-blood donation records collected between January and June 2025 by the National Blood Centre, Thai Red Cross Society. Donation sites included in-house collections, fixed stations, and mobile units. Outcomes were deferral rates, non-standard blood volume events, and donation-related complications. Comparisons among sites were performed using the chi-square test, with pairwise comparisons using the Z-test for two proportions with

Bonferroni correction ($p < 0.05$). Mobile units served as the reference group because institutional donations are operationally categorized under this setting. Mobile units were further stratified by venue type (temples, department stores, hospitals, educational institutions, and private companies/other organizations). Stratified analyses were conducted when mobile unit rates were significantly higher than other sites, and schools were compared with universities within the educational institution group.

Study population and donation site characteristics

Between January and June 2025, a total of 375,322 whole-blood donations were analyzed from in-house, fixed, and mobile donation units of the National Blood Centre, Thai Red Cross Society. Comparisons of deferral, non-standard blood volume events, and donation-related complications across donation sites are summarized in Tables 1-3.

Deferral and non-standard blood volume events

The leading causes of deferral were anemia (16,976), procedural interventions (4,862), underlying diseases (3,920), high blood pressure (2,979), medication use (2,246), and high-risk sexual behaviors (1,723). Among non-standard blood volume events, inadequate blood volume collection was the most frequently reported (1,578). Mobile donation units demonstrated significantly higher deferral rates due to high blood pressure, medication use, underlying diseases, high-risk sexual behaviors, and recent procedural interventions compared with in-house or fixed site donations.

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Table 1 Deferral rates by donation site with mobile units used as a reference

Cause of deferral	Mobile units (%)	In-house donations (%)	p-value	Fixed stations (%)	p-value
High blood pressure	1.8	0.1	< 0.001	0.4	< 0.001
Anemia (male)	0.3	0.3	0.23	0.6	< 0.001
Anemia (female)	4.1	3.1	< 0.001	6.2	< 0.001
Medications	0.8	0.5	< 0.001	0.4	< 0.001
Underlying diseases	1.6	0.8	< 0.001	0.4	< 0.001
High-risk sexual behaviors	0.6	0.4	< 0.001	0.3	< 0.001
Procedural interventions	1.5	1.2	< 0.001	1.1	< 0.001

Table 2 Non-standard blood volume events by donation site with mobile units used as a reference

Event	Mobile units (%)	In-house donations (%)	p-value	Fixed stations (%)	p-value
Under volume	0.5	0.4	< 0.001	0.6	0.002

Table 3 Complication rates by donation site with mobile units used as a reference

Complication	Mobile units (%)	In-house donations (%)	p-value	Fixed stations (%)	p-value
Bruise/Hematoma	1.7	1.3	< 0.001	0.1	< 0.001
Onsite VVR	3.9	1.2	< 0.001	1.1	< 0.001

Table 4 Deferral rates by mobile unit type with educational institutions used as a reference

Cause of deferral	Educational institutions (%)	Temples (%)	p-value	Department stores (%)	p-value	Hospitals (%)	p-value	Company & others (%)	p-value
High blood pressure	1.6	2.4	< 0.001	0.9	< 0.001	1.3	0.180	1.9	< 0.001
Medications	1.3	0.4	< 0.001	0.5	< 0.001	1.0	0.084	0.8	< 0.001
Underlying diseases	2.5	1.7	0.002	0.8	< 0.001	1.9	0.004	1.6	< 0.001
High-risk sexual behaviors	0.9	0.5	< 0.001	0.4	< 0.001	0.6	0.034	0.6	< 0.001
Procedural interventions	2.1	0.3	< 0.001	1.0	< 0.001	1.5	0.002	1.5	< 0.001

Table 5 Complication rates by mobile unit type with educational institutions used as a reference

Complication	Educational institutions (%)	Temples (%)	p-value	Department stores (%)	p-value	Hospitals (%)	p-value	Company & others (%)	p-value
Bruise/Hematoma	2.1	1.0	< 0.001	0.7	< 0.001	2.1	0.93	1.7	0.011
Onsite VVR	6.5	2.4	< 0.001	0.7	< 0.001	3.5	< 0.001	3.9	< 0.001

Within mobile unit stratification, educational institutions contributed 19.0% of all new donors but demonstrated the highest overall deferral rate (27.6%). Deferral rates at educational institutions were significantly higher for medication use, underlying conditions, high-risk sexual behaviors, and procedural interventions (Table 4).

Donation related complications

The most frequently reported complications were onsite vasovagal reactions (VVR) (6,853 cases) and bruising/hematoma (4,072). Rates were significantly

higher in mobile units than in fixed-site donations, with educational institutions showing the highest rates among mobile settings (Table 5).

Comparison between schools and universities

Within educational institutions, subgroup analysis revealed no significant differences between schools and universities in deferral rates related to medication use, underlying diseases, high-risk sexual behaviors, or procedural interventions (Table 6). However, onsite VVR occurred significantly more frequently among university

Table 6 Deferral rates: Schools vs Universities

Cause of deferral	Schools (%)	Universities (%)	p-value
High blood pressure	1.6	1.4	0.624
Medications	1.1	1.6	0.074
Underlying diseases	2.7	2.0	0.081
High-risk sexual behaviors	1.0	0.8	0.548
Procedural interventions	2.1	2.2	0.784

Table 7 Complication rates: Schools vs Universities

Complication	Schools (%)	Universities (%)	p-value
Bruise/Hematoma	2.1	2.2	0.859
Onsite VVR	5.4	7.0	0.022

donors than school donors. No significant difference was observed between the two groups for bruising/hematoma (Table 7).

Discussion

This national analysis demonstrates that low hemoglobin is the major contributor to overall whole blood donation deferrals. However, deferrals related to medication use, underlying diseases, high-risk sexual behaviors, and recent procedural interventions were particularly prominent in educational institution settings, which contributed 19.0% of new donors. These findings are consistent with international literature showing that younger and first-time donors are more frequently deferred due to temporary health- and behavior-related reasons.¹²⁻¹⁶ Such patterns may reflect limited health literacy, incomplete understanding of eligibility criteria, and suboptimal physical readiness among adolescents and young adults.

Complication rates, especially VVR and bruising/hematoma were also significantly higher in educational settings. These likely reflect the predominance of new or inexperienced donors who may move the arm excessively or apply insufficient post-needle pressure, promoting subcutaneous bleeding and ecchymosis.¹⁷⁻¹⁹ Onsite VVR was most frequent in educational settings, consistent with prior studies, and may be influenced by younger age, first-time donor status, donor inexperience, insufficient sleep, heightened fear, stress, and anxiety.²⁰⁻²⁴

In this study, onsite VVR occurred significantly more often among university donors compared with school donor, possibly reflecting higher stress, anxiety, poorer sleep quality or other physiological factors in this group. However, the limited availability of detailed demographic and anthropometric data precluded comprehensive subgroup analyses, particularly given that VVR risk is known to vary by donor sex, age, and body weight.^{12,25,26}

From an operational perspective, these findings highlight the need for tailored strategies in educational settings to balance recruitment efficiency with donor safety. Targeted measures include clear pre-donation education on eligibility and preparation, adolescent-appropriate and privacy-sensitive questionnaires, and staff training in youth-centered communication and counseling.²⁷⁻³¹ Preventive approaches, such as encouraging pre-donation water intake combined with applied muscle tension (AMT) and providing structured observation and follow-up for donors at risk of syncope individuals (e.g., those with a history of syncope) may help reduce complication rates and improve donor experience.^{20,32-35}

A major strength of this study is the large, nationally representative dataset, which enhances the generalizability of findings and supports evidence-based planning for blood collection services. Nevertheless, several limitations should be acknowledged. The cross-sectional design limits causal inference. Reliance on routinely collected operational data restricted access to detailed demographic and clinical variables, limiting detailed risk stratification and adjustment for potential confounders.

Conclusion

Educational institutions are key sources of new donors yet have higher deferral and complication rates than other venues, driven by medication use, underlying conditions, high-risk sexual behaviors, procedural interventions, bruising and hematoma, and onsite vasovagal reactions patterns associated with modifiable health and behavioral factors among adolescents. Given limited donor demographic data (e.g., age, gender, body weight, donor status, prior donation history), further research should link donor characteristics to these outcomes. Targeted interventions such as advance health education, youth-appropriate questionnaires, mobile team communication training, and structured on-site recovery and follow-up may improve quality and retention.

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