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Blood donation in young people: estimation of education and awareness in Rome high school students using translated questionnaires

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SUMMARY

Background: Ensuring a stable blood supply is a critical public health challenge, with young adults representing a vital pool of potential donors. Education and awareness are key to fostering positive attitudes and behaviors toward blood donation among youth.
Objectives: This study aimed to assess the impact of educational interventions on the willingness of high school students in Rome to donate blood and to validate the Italian translation of two established questionnaires measuring knowledge and motivation related to blood donation.
Materials and methods: An observational, prospective, cross-sectional study was conducted among senior students at the "Democrito" high school in Rome during the 2022–23 academic year. Eligible students (aged 18 or older) completed two validated and translated questionnaires before and after a series of educational lectures on blood donation. The reliability and content validity of the translated instruments were evaluated, and changes in students' intentions and attitudes were analyzed using the McNemar test.
Results: Of 54 students with matched pre- and post-intervention responses, the proportion expressing a positive attitude toward blood donation increased from 57.4% to 75.9% following the educational sessions (p = 0.0213), indicating a statistically significant improvement. Motivations for donation included altruism, health benefits, social approval, and practical incentives. Despite increased willingness, only a small fraction of students who expressed intent ultimately donated blood, highlighting a gap between intention and action. The translated questionnaires demonstrated high content validity (CVI: 0.975 and 0.908) and were well-understood by the target population.
Conclusions: Educational interventions significantly enhanced students' willingness to donate blood, underscoring the importance of targeted awareness campaigns in schools. However, bridging the gap between intention and actual donation remains a challenge, necessitating further strategies to address logistical and psychological barriers. The validated Italian questionnaires provide reliable tools for future research and program evaluation in this context.

Keywords: blood donors; blood donation; delivery of healthcare; surveys and questionnaires; schools.

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INTRODUCTION

Blood donation is vital, as it saves lives. Regular blood donation by healthy individuals is necessary to ensure that blood is always available. Globally, around 118.54 million blood donations are collected annually [1]. Blood is an essential resource, and there is currently no sustainable alternative that can replace it [2]. The safety and availability of blood and its derivatives for transfusion use require the involvement of voluntary, unpaid, and carefully selected donors [3]. In Italy, individuals must be at least 18 years old to donate blood and plasma, as minors are not permitted to do so, even with parental consent [4]. Data from the Italian Health Ministry and National Blood Centre, updated in 2023, show that the number of blood donations is increasing (1,677,698 people) compared to previous years, but it is still inferior to the pre-pandemic years [5]. Notably, the number of young donors in 2023, aged 18 to 35, increased compared to 2022 (492,059 people, +1.3%). The aging of the population is evident in the data, as the number of donors older than 46 years changed from 650,202 to 787,156 between 2012 and 2021 [6]. Recruiting and retaining young people as blood donors is increasingly important to ensure an adequate supply of blood products for healthcare services [7]. Enhancing education and awareness about the need for blood within the population can empower even those unable to donate to become active advocates for blood donation. Research has shown that individuals with higher levels of education are more likely to donate blood, underscoring the importance of instilling proper knowledge on the topic at a young age [8]. In addition, it is crucial to motivate first-time donors to become usual donors [2, 3, 5, 6–8]. This study, conducted in collaboration with the Transfusion Centre of the Giovan Battista Grassi Hospital in Rome, primarily aimed to evaluate whether the lecture increased students' willingness to donate blood. A secondary objective was to validate the Italian translation of two questionnaires assessing the prevalence and motivation for blood donation among young people. To achieve these objectives, the study analyzed students' perspectives and knowledge on the topic at two key points: before and after the designated lectures.

MATERIALS AND METHODS

Study design

The study employed an observational design with a prospective, cross-sectional approach and a pre-post analysis.

Sampling

A non-probabilistic convenience sample was drawn from the senior students at the "Democrito" high school in Rome during the 2022–23 scholar year, allowing for the inclusion of all students in their final year. The eligibility criteria were: age 18 years or more, willingness to participate, provision of informed consent and acceptance of personal data processing. All eligible students were invited to take part in the project, with the decision whether to participate or not based on their own will.

Ethical approval

The students' participation was initially approved by the high school headmistress. Later, a school communication was released [9]: it clearly and concisely reported the nature of the study, its phases, the goals, and the students' involvement. This notification served as informed consent for students who were of legal age (18 years or older), enabling them to make an informed decision about their participation in the current study. Students had the freedom to withdraw at any given moment and for any reason. The high school teachers involved were notified in advance by the school about the planning of the study and provided their collaboration.

The protocol of the study was submitted to the Ethics Committee of the A. Gemelli Hospital in Rome, to confirm the validity of the protocol and ensure the protection and safety of the students involved. The study was approved with Opinion ID 5671/2023 [10].

Choice and Italian translation of the questionnaires

To find the most suitable questionnaires, we conducted a literature review on the PubMed/Medline database in October 2023. The research question "Is there a tool that assesses knowledge and motivations for/against blood donation?" led to the development of the following two search strings: 1) (high school students) AND (inquiry instrument) AND (information on blood donation; motivation to donate blood). 2) (population) AND (survey) AND (blood donation).

Subsequently, we inserted these filters: Publication date - 10 years; Human species; Language – Italian, English. With these criteria, the search produced 443 articles. We then performed a title and abstract screening, and then a full text screening according to the chosen inclusion and exclusion criteria (Table 1).

Based on the characteristics of the studies obtained from the literature review, we chose the two questionnaires to translate and use considering their construction, the variables investigated, the ease of compilation, the method of administration, and the population sample identified for the study. The first chosen questionnaire was selected from a German study by Greffin et al. in 2021 that investigated knowledge and prevalence of blood donation [11], and the second one was selected from a Spanish study about motivations behind donating by Romero-Dominguez et al [12]. Since the administration of the questionnaires was for young people (18-35 years old)

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Table 1. Literature review for the questionnaire choice: inclusion and exclusion criteria

Inclusion criteria	Exclusion criteria
— Full text available; — Survey; — Availability or possibility to rebuild the questionnaires; — Blood donation; — Male and female population; — Knowledge of and motivation for blood donation.	— Covid-19 studies; — Survey on infectious diseases, epidemics or pathologies in general; — Participation of health workers only; — Organ donation; — Study population chosen based on sexual orientation, ethnicity or migration status; — Data managing methods; — Studies on blood tests levels.

Table 2. CVI calculation per Item and of the whole questionnaires

1st questionnaire (Greffin, Schmidt, Schönborn, Muehlan, 2021)		2nd questionnaire (Romero-Domínguez, Martín-Santana, Sánchez-Medina, Beerli-Palacio, 2021)	
Item I. have you ever donated blood?	CVI =0.96	**Item V**. Solidarity	CVI =0.95
Item II. Based on your answer, we would like you to describe in your own words. What, so far, your personal reasons were for donating blood or not? Please try to answer this question as accurately as possible.	CVI =1	**Item VI**. Health benefit	CVI =0.78
Item III. Do you intend to donate blood within the next 12 months?	CVI =0.94	**Item VII**. Appreciation	CVI =0.90
Item IV. Based on your answer, we would like you to describe in your own words. What are your personal reasons for donating blood or not in the future? Please try to answer this question as accurately as possible.	CVI =1	**Item VIII**. Marketing stimuli	CVI =0.97
		Item IX. Social approval	CVI =0.94
Tot 1st questionnaire	CVI =0.975	Tot 2nd questionnaire	CVI =0.908

in Italy, it was necessary to translate them into Italian; for this purpose, we used the WHO Guidelines on Translation "Process of translation and adaptation of instruments" [13]. The content validity index (CVI) was calculated following WHO guidelines (Table 2).

The translation was performed only after receiving the authors' permission [11,12]. The translation of the questionnaires from English to Italian was not literal, but priority was given to the logical concept of the sentence. The sentences were short, simple and essential; we avoided scientific terms considering the target population. An Expert Committee of six professionals (a medical doctor in psychiatry, a medical doctor in hematology, a nursing university teacher, a community nurse, an Italian literature and Latin teacher and a psychologist) checked the content validity, using a 5-point Likert scale measurement (1=completely unrelated; 5=strongly related) [14, 15] based on the applicability of content and clarity of phrasing.

Using Likert scale assessments [14, 15], the CVI was calculated for each item (question), as the number of scores >3 divided by the total number of experts; a value >0.7 was considered acceptable. The CVI of the entire questionnaire (united CVI) was estimated by calculating the average content validity indices of all items. The scores were 0.975 and 0.908 respectively. To ensure the correct interpretation of the concepts, a translation check was carried out starting from Italian and returning to English using the Word Reference platform. This step showed no change in questionnaire content or meaning. The request for pre-testing of the translated questionnaires was submitted

to the Ethics Committee of the Agostino Gemelli University Hospital (Prot N. 0014209/23) [10]. The pre-testing was carried out on a representative sample of the population. Once the survey was complete, the participants were interviewed to evaluate their actual understanding of the topic covered, of the correct formulation of the sentences and any misunderstanding due to the translation process. None of the students had difficulties in understanding or answering the questions and we did not receive complaints about the clarity, simplicity and expression of questions and answers in Italian. So, the translation was found suitable and adequate for the objective of this study. The Italian translation of the questionnaires is present in Table 3.

Table 3. Italian translation of the questionnaires

Questionario 1: *(Greffin, Schmidt, Schönborn, Muehlan, 2021)*
1. Hai mai donato il sangue? No, non ho mai pensato di donare il sangue. No, ma ho pensato di donare il sangue. No, ma ho provato a donare il sangue e non mi è stato permesso. Si, ho già donato il sangue. 2. Basandoti sulla risposta precedente descrivi in poche parole, quali sono le ragioni personali per cui HAI o NON HAI donato il sangue? 3. Pensi di donare il sangue nei prossimi 12 mesi? Assolutamente no Probabilmente no Preferirei di no Preferirei di si Probabilmente si Assolutamente si 4. Basandoti sulla risposta precedente descrivi in poche parole, quali sono le motivazioni per cui DONERAI o NON DONERAI il sangue in futuro?
Questa parte propone una scala olistica ed integrativa sulle motivazioni per cui eventualmente donare il sangue. *(Romero-Domínguez, Martín-Santana, Sánchez-Medina, Beerli-Palacio, 2021)* Per favore segna se una tra le seguenti motivazioni potrebbe motivarti ad aumentare il numero di donazioni che fai annualmente (scegliere un opzione per gruppo)
1. Solidarietà Solidarietà umana, aiutare gli altri o salvare vite. Adempiere doveri sociali o doveri morali nell'aiutare le altre persone. Donare il sangue non costa niente. Visto che il sangue non può essere creato artificialmente, dobbiamo collaborare. Soddisfazione personale derivata dall'aiutare gli altri. Donare il sangue mi fa sentire necessari* e di aiuto per la società. Eventualmente io o i miei familiari potremmo avere bisogno di sangue in futuro. 2. Benefici per la salute E' bene per la mia salute. Avere i risultati degli esami del sangue. Sapere se ho una malattia infettiva. Ricevere pareri medici sulla mia salute. 3. Apprezzamento Ricevere regali simbolici per avere donato il sangue (magliette, spille, asciugamani, tazze, etc). Ricevere premi simbolici per la mia storia di donatore di sangue. Avere 1-2 ore di tempo libero da lavoro (scuola) per andare a donare il sangue. Acquisire il riconoscimento sociale associato all'essere un regolare donatore di sangue (eventi pubblici, attestati, medaglie, certificati, etc). 4. Stimoli di marketing Una chiamata urgente per la donazione di sangue. Vedere o sentire una campagna pubblicitaria in TV, radio o social media. Ricevere una chiamata o messaggio dal centro di donazione sangue. Conoscere la testimonianza di persone che hanno ricevuto una trasfusione di sangue. Autoemoteche vicino casa, lavoro/scuola o in luoghi affollati. 5. Approvazione sociale Gli altri avranno una buona opinione di me. La mia religione o credenze mi incoraggiano a donare. Donare il sangue è una tradizione di famiglia.

Validation of the questionnaire

The sample size was determined based on the final number of items included in the questionnaire. For exploratory factor analysis and internal reliability estimation, a rule of thumb frequently adopted in the literature is a minimum ratio of 5 participants per item (31-33) [16-19]. Although there is no universally agreed threshold for sample size, this ratio is commonly used as a reference in the preliminary stages of psychometric validation, especially when working with new instruments. As Osborne and Costello [18] point out, "a minimum subject to item ratio of at least 5:1 is recommended in exploratory factor analysis," while recognizing that higher ratios are desirable, when possible, based on the characteristics of the data and the expected factor structure. Considering these indications and the logistical limitations associated with the fact that only students in their final year of high school could be involved, given the requirement to be of legal age to donate blood, the use of the minimum ratio appeared valid. In our study, the questionnaires included 4 questions and 1 question with 5 items, respectively. A 5-item questionnaire would therefore require the participation of at least 25 subjects, a criterion that was fulfilled in our study.

Phases of the study

The study consisted of several phases, and students were free to engage in any of them based on their preferences and their attendance at school on the designated days.

The following phases were accomplished.

Phase 1. Administration of two surveys on prevalence and motivation for blood donation among young adults

The two surveys consisted of the two selected and translated questionnaires about knowledge [11] and motivations [12] for blood donation. The two surveys were administered twice: before (October 2022) and after (December 2022) the lectures (November 2022). Senior students received an email containing a QR code that linked to the two surveys. Responses were collected using Google Forms. An external collaborator was assigned the task of gathering responses and generating a unique numerical identification for each student, enabling us to access only the birth date and gender without disclosing names. Such pseudonymized data were then transferred to Excel (Supplementary material 1).

Phase 2. Lectures about blood donation

The approach included sensitizing and informing students about blood donation through three educational/motivational interventions held at the high school, despite our objective not being to assess any improvement in students' knowledge. The school conference room hosted the lectures, which were conducted over three days by a nurse. During these sessions, digital materials (slides), informational brochures, and custom pins were distributed. Topics covered included the nature of blood and its irreplaceability, benefits of blood donation for donors, recipients and community, current blood donation statistics in Italy, eligibility criteria for donors, temporary disqualifiers, the donation process, and donation locations. Although the collection of such information was not the main objective of this study, an observer recorded additional data on students' reactions during the lectures. These observations were useful for assessing students' actual level of engagement. This was done using an observational chart with a 5-point Likert scale (1=never; 5=always) to classify behaviors. The elements assessed included: "concentration," "active participation (questions, comments, observations)", "external interruptions", "distractions (cell phone use, whispering) or lack of interest" and "indifference". Two additional polls were conducted: one pre-lecture to gauge initial interest, and one post-lecture to assess perceived usefulness.

The initiative also emphasized the importance of maintaining their own health and promoting a healthy lifestyle

Phase 3. Blood donation at the Transfusion Centre.

Organizing specific days at the Transfusion Centre served to involve and encourage young adults to begin regular blood donation. All senior students who wished to donate blood and met the eligibility criteria were invited to participate in designated donation days. These criteria, explained during the lectures, included being over 18 years old, weighing more than 50 kg, being in good health (free from flu, colds, or similar conditions, and not taking medications such as cortisone, antihistamines, antibiotics, or anxiolytics), and maintaining a healthy lifestyle (no tattoos or piercings, no use of narcotics or alcohol, and no sexual promiscuity) [20]. To facilitate student participation, several measures were implemented: a notification was sent to all teachers to avoid scheduling class assignments or tests on donation days; students were reassured that the Transfusion Centre would provide a certificate to justify their absence from school, which also counted towards school credits; and the Volunteer Association announced structured scholarship opportunities.

Statistical analysis

Descriptive analysis of qualitative variables was performed, presenting data as absolute frequencies (number of subjects) and percentage frequencies. To assess changes in questionnaire responses before

and after the lessons, a McNemar test (a statistical test used on paired nominal data) was applied to compare response percentages. It is applied to 2 × 2 contingency tables with a dichotomous trait, with matched pairs of subjects, to determine whether the row and column marginal frequencies are equal. Statistical analyses were conducted using Stata software, version 18 (StataCorp LLC, College Station, TX, USA).

We attempted to use a statistical analysis to determine whether our health promotion lectures affected students' attitudes toward blood donation and their propensity to donate. To determine whether or not the lectures had a positive impact on the students, matching the answers was required. Although 135 students answered the pre-lesson survey and 119 answered the post-lesson survey, the matching of unique student codes yielded only 54 corresponding responses.

We took into consideration the responses to Greffin et al.'s [11] first two questions during this process: "Have you ever donated blood?" (Question 1) and "Do you intend to donate blood within the next 12 months?" (Question 2). The first question had four possible answers: 1) No, I can't imagine donating blood yet; 2) No, although I can imagine donating blood; 3) No, but I have already tried donating blood and I was not allowed to donate; 4) Yes, I've already donated blood. The first response was regarded as "Negative," but the second, third, and fourth responses were included as "Positive" due to the small sample size. There were six possible responses to the second question: 1) Definitely not; 2) Maybe not; 3) Would rather not; 4) Would rather; 5) Probably; and 6) Definitely. The first three responses were included as "Negative" due to the small sample size, while the fourth, fifth, and sixth responses were regarded as "Positive". After analyzing the total responses, the students were also separated based on their sex. For T1 we indicated the pre-lessons questionnaire, while for T2 we indicated the post-lessons questionnaire.

RESULTS

As shown in Table 4, the students who answered positively at T1 and confirmed their positive answer at T2 were 28, while there were 3 students who answered positively at T1 but changed their answer into a negative one at T2. Instead, there were 10 students who answered negatively at T1 and confirmed their negative answer at T2, while there were 13 students who answered negatively at T1 but changed their answer into a positive one at T2. With this data we built the 2x2 contingency table for the McNemar test as following.

In the pre-lesson questionnaires, 31 out of 54 students (57.4%) answered positively, while in the post-lessons questionnaire there were 41 out of 54 positive answers (75.9%), with a difference of 18.5%. The test gave a p-value of 0.0213, statistically significant. This means that the lectures had a positive impact on students' perspectives on the subject, making them understand the importance of being a blood donor.

In Table 5, we tried to apply the McNemar test to the male population of our study. Since the p-value would not be reliable with this very small sample, we provided only a description with absolute numbers. As we can see, there were 10 students who answered positively at T1 and confirmed their positive answer at T2, while only 1 student answered positively at T1 but changed his answer into a negative one at T2. Instead, there were 8 students who answered negatively at T1 and confirmed their negative answer at T2, while there were 7 students who answered negatively at T1 but changed their answer into a positive one at T2. But subgroup analyses are purely descriptive and should not be interpreted as statistically meaningful.

In Table 6, we tried to apply the McNemar test to the female population of our study. Since the p-value would not be reliable with this very small sample, we provided only a description with absolute numbers. As we can see, there were 18 students who answered positively at T1 and confirmed their positive answer at T2, while 2 students answered positively at T1

Table 4. McNemar test for overall students (N=54)

		POST-LECTURES	
		POSITIVE	**NEGATIVE**
PRE-LECTURES	POSITIVE	28	3
	NEGATIVE	13	10

McNemar's test: Difference: 18.52%; 95% Confidence Interval: 4.87% to 32.17%; p-value: 0.0213

Table 5. Absolute frequency in questionnaire responses before and after the lessons (male subjects; N=26)

		POST-LECTURES	
		POSITIVE	**NEGATIVE**
PRE-LECTURES	POSITIVE	10	1
	NEGATIVE	7	8

Table 6. Absolute frequency in questionnaire responses before and after the lessons (female subjects; N=28)

		POST-LECTURES	
		POSITIVE	**NEGATIVE**
PRE-LECTURES	POSITIVE	18	2
	NEGATIVE	6	2

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but changed their answer into a negative one at T2. Instead, there were 2 students who answered negatively at T1 and confirmed their negative answer at T2, while 6 students answered negatively at T1 but changed their answer into a positive one at T2. Since the p-value would not be reliable with this very small sample, we provided only a description with absolute numbers. But subgroup analyses are purely descriptive and should not be interpreted as statistically meaningful.

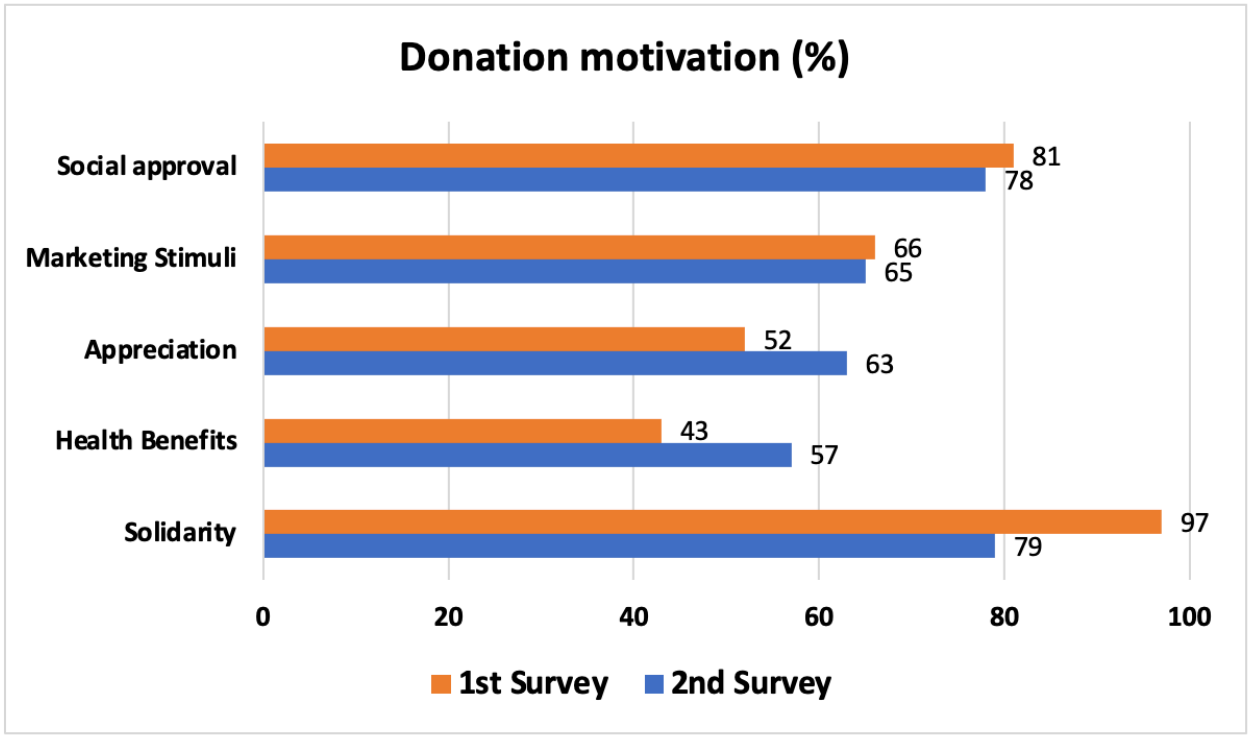
The overall analysis shows that, of the students who responded to the questionnaire given prior to the lessons, 31 out of 54 (57.4%) gave a positive response to the first question, while 23 gave a negative response. Out of the 31, 14 gave a negative response to the second question, while 17 gave a positive response as well. Only 14 students responded negatively to the questionnaire given after the lessons, while 41 out of 54 students (75.9%) responded favorably to the first question. Of these 41 students, 30 also responded favorably to the second question. Ultimately, four of these thirty students donated blood.

The motivations for donating blood included solidarity, health benefits, appreciation, marketing stimuli, and social approval (figure 1). The most common reasons were "human solidarity, helping others, or saving lives" (1st survey: 97 students; 2nd survey: 79 students), "getting medical advice about my health" (1st survey: 43 students; 2nd survey: 57 students), "receiving symbolic gifts for donating blood" (1st survey: 52 students), "having 1-2 hours of free time at work to donate blood" (2nd survey: 63 students), "knowing the testimony of people who have received a blood transfusion" (1st survey: 66 students; 2nd survey: 65 students), and "others will have a good opinion of me" (1st survey: 81 students; 2nd survey: 78 students). Survey results showed that three-quarters of the students wanted to participate in the lectures, and 107 out of 119 students found them helpful. The observer, using a Likert scale (1=never; 5=always), reported that all classes showed "concentration" and "active participation" scores between 3 and 5, while "distraction" and lack of interest scored between 1 and 3. Ultimately, 32 students, representing 17% of the total surveyed, signed up to donate blood on the designated days, but only 22 were eligible and able to proceed with the donation.

DISCUSSION

In Italy, blood shortages present a significant public health challenge. Understanding young people's knowledge and attitudes about blood donation can help identify effective strategies to increase their motivation to donate. Young adults are considered a crucial potential pool of blood donors; thus, insights into their perceptions of blood donation can aid in long-term recruitment efforts. The results of this study indicate that educational interventions can positively influence students' attitudes towards blood donation. The McNemar test, applied to the overall student population, revealed a statistically significant shift towards positive responses regarding both past blood donation experience and future intentions following the

Figure – Questionnaire on motivations on blood donation (Romero-Dominguez L., Mar-tin-Santana J.D., Sanchez-Medina A.J., Beerli-Palacio A., 2021)



educational lessons (p-value = 0.0213). This suggests that the lectures effectively conveyed the importance of blood donation and prompted students to reconsider their stance on the subject. While the overall impact of the intervention appears positive, the analysis of responses by sex presents a more nuanced picture. Although the small sample sizes for both male and female groups preclude reliable statistical analysis using the McNemar test, the descriptive data from the 2x2 contingency tables offer some insights. Both male and female students demonstrated a trend towards increased positive responses after the lectures. However, the magnitude of this shift varied, with a seemingly more pronounced change among female students. Having said that, various literature evidence show how donating blood is more common among males, because many women avoid donating due to perceived ineligibility or past rejections due to low body weight and anemia [21]. They recommend increasing female donor numbers through iron supplementation and personalized monitoring [22–25]. This approach should be supported by clear information, reassuring women that deferral is temporary and encouraging them to return once their hemoglobin levels stabilize [26]. Bani M. and Giussani B. [27] reported that perceived anxiety correlates with adverse reactions and impacts the likelihood of female donors returning [27, 28]. Strategies to reduce adverse reactions include fluid intake before donation, muscle tension exercises, audiovisual materials, and social support [27]. Further research with larger sample sizes is needed to explore potential gender-specific responses to blood donation education. It's important to note that a positive shift in attitude does not necessarily translate into actual blood donation behavior. Despite a significant increase in positive intentions, only four out of the 30 students who expressed positive intentions post-lectures ultimately donated blood. This discrepancy highlights the gap between intention and action, a common phenomenon in health behavior research. Several factors contribute to this gap, including logistical barriers, fear of needles, unforeseen personal circumstances, or anxiety [28]. The context in which blood donation is proposed can significantly impact anxiety, attitudes, subjective norms, self-efficacy, and intention to donate [29, 30]. Tailored brochures can reduce donor anxiety according to a study by Newman B. et al. [31]. Future studies could investigate these factors to identify potential strategies for bridging the intention-behavior gap and increasing actual blood donation rates. The survey results also shed light on the motivation behind students' decisions to donate blood. Altruistic motives, such as "human solidarity" and "helping others," emerged as prominent factors. However, other motivations, including health benefits, symbolic gifts, and social approval, also played a role. Understanding these diverse motivations can inform the development of targeted recruitment campaigns that appeal to a broader range of potential donors. Finally, the positive feedback received from students regarding the lectures themselves underscores the importance of engaging and informative educational interventions in promoting blood donation. The high levels of concentration and active participation observed during the lectures suggest that the educational content was well-received by the students. However, the negative reactions observed in two classes highlight the need for ongoing evaluation and refinement of educational materials to ensure their effectiveness across diverse student populations.

Despite the challenges inherent in conducting innovative research within a real-world school environment, our study is distinguished by several key strengths. First and foremost, the project's innovative approach—integrating a novel educational intervention into the established routines of a high school—demonstrates both creativity and adaptability. Successfully implementing this intervention amidst the complexities of school scheduling highlights the feasibility of such programs and sets a valuable precedent for future health promotion initiatives in educational settings.

Additionally, while the study focused exclusively on senior students from a single high school, this concentrated approach enabled us to engage deeply with participants, maintain rigorous control over the intervention, and ensure consistent delivery of educational content. This focus facilitated close monitoring of student responses and allowed for a thorough evaluation of the intervention's impact.

Although the sample size was limited, with many students participating in only one questionnaire, the study nonetheless achieved statistically significant results. These findings provide compelling preliminary evidence of the intervention's positive effect on students' intentions to donate blood, offering a strong foundation for future, larger-scale research. The project's design and demonstrated outcomes present a scalable and adaptable framework that can be extended to other schools, underscoring its potential to promote blood donation among young people on a broader scale.

While further studies are necessary to confirm the generalizability of these results, our research highlights important factors for success and points to areas for future improvement. Subsequent investigations could examine the specific elements that influenced student reactions and refine strategies to enhance the effectiveness of blood donation education.

CONCLUSION

This study provides valuable insights into the attitudes and motivations of young adults toward blood donation. The educational intervention appears to have positively influenced students' perceptions, particularly among female participants. However, bridging the intention-behavior gap remains a significant challenge. Ongoing efforts to address logistical barriers, reduce

anxiety, and leverage diverse motivations are crucial for enhancing blood donation rates among the youth. Further research with larger, more representative samples is needed to validate these findings and explore gender-specific strategies for promoting blood donation.

AUTHOR CONTRIBUTIONS

Conceptualization, S.R., S.M. and P.L.; methodology, V.D.V., D.P.M. and M.C.N.; software, D.P.M.; validation, P.L.; formal analysis, V.D.V. and D.P.M.; investigation, S.R.; data curation, V.D.V., B.C., L.M. and S.R.; writing—original draft preparation, S.R., R.M. and S.M.; writing—review and editing, V.D.V., D. P. M. and D. P.; supervision, V.D.V., P.L. and G.D.; project administration, P.L.. All authors have read and agreed to the published version of the manuscript.

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INSTITUTIONAL REVIEW BOARD STATEMENT

The Ethics Committee of the Agostino Gemelli University Polyclinic Foundation was involved for the development of this study (Delibera ID 5671. Prot N. 0014209/23 del 08/05/2023). The research was conducted ethically, with all study procedures being performed in accordance with the requirements of the World Medical Association's Declaration of Helsinki.

INFORMED CONSENT STATEMENT

Written informed consent was obtained from each participant/patient for study participation and data publication.

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DATA AVAILABILITY STATEMENT

The data that supports the findings of this study are available in the supplementary material of this article.

CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

COVERING LETTER

The manuscript has been seen and approved by all authors, it is not under active consideration for publication, has not been accepted for publication, nor has it been published, in full or in part (except in abstract form).

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