Applying a modified and extended theory of planned behavior to predict blood donation intentions among Chinese university students: An empirical investigation

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ABSTRACT

Background: The blood shortage in China has become a nationwide issue, which poses a threat to critical medical treatments and puts patients at risk. To address this problem, blood donation recruitment and retention campaigns have been launched, with university students being recognized as an important target audience. To recruit this particular population effectively, it is crucial to comprehend their motivations for donating blood.

Methods: This study used a modified and extended Ajzen's Theory of Planned Behavior to explain the determinants of blood donation intention among $N = 1165$ China's young adults through an online cross-sectional survey, utilizing a snowball sampling technique to recruit participants.

Results: In line with previous TPB-based studies, we found positive associations between attitude ($\beta = 0.071$, $p < .01$), subjective norms ($\beta = 0.264$, $p < .001$), and self-efficacy ($\beta = 0.536$, $p < .001$) with blood donation intention. Attitude and self-efficacy mediated the relationships between anxiety, altruism, and social norm with blood donation intention ($\beta = 0.817$, $p < .01$, 95% CI [0.737, 0.909]; $\beta = 1.31$, $p < .01$, 95%CI [1.203, 1.409]; $\beta = 1.301$, $p < .01$, 95%CI [1.209, 1.403]). Attitude also mediated the relationship between altruism and social norm with blood donation intention ($\beta = .456$, $p < .01$, 95%CI [0.38, 0.53]; $\beta = 0.447$, $p < .01$, 95%CI [0.374, 0.52]).

Conclusion: Our results highlight the significance of utilizing communication strategies, such as promoting altruism and reducing donation anxiety, as well as creating a supportive social environment. These strategies can improve attitudes and intentions toward blood donation, leading to an increase in blood donation rates.

Blood donation is crucial for saving lives, especially for those undergoing surgery, cancer treatments, or blood-related diseases like sickle cell anemia. However, China faces an unresolved public health concern due to inadequate blood supply, primarily caused by insufficient donation. The current blood donation rate of 11.1 per 1000 people falls below the WHO recommendation [1], resulting in delayed critical treatments and patient risks. To address this nationwide shortage, China requires a substantial increase in eligible donors.

Understanding the motivations of university students, military personnel, and healthcare workers—who are the most active donors— is essential for effective recruitment. Previous studies using the Theory of Planned Behavior (TPB) framework have identified

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factors like attitude, social norms, and perceived behavioral control that influence blood donation intention [2–8]. While the TPB framework has shown promise in predicting blood donation intention, health communication researchers have suggested the level of blood donation activity can vary depending on additional factors such as donation anxiety and altruism [9–16]. Therefore, this study aimed to expand on existing research by examining how TPB predictors, along with donation anxiety and altruism, influenced university students' motivations for voluntary non-remunerated blood donation. Gaining this understanding is crucial for developing targeted interventions and strategies that encourage participation, address barriers, and ultimately involvement, address obstacles, and ultimately alleviate China's blood shortage.

1. The theory of planned behavior

The Theory of Planned Behavior (TPB) has been widely applied in blood donation research and has been extensively supported by empirical evidence [17,18]. According to the TPB, the formation of behavioral intention and subsequent behavior are linked to one's attitude towards the behavior, subjective norms, and perceived behavioral control. Individuals who exhibit a positive attitude towards voluntary non-remunerated blood donation, possess a strong sense of control, and experience social pressure from significant individuals are more inclined to engage in the act of blood donation. Previous research has shown that attitude, social norms, and perceived behavioral control (or self-efficacy) are important predictors of blood donation intention or willingness to communicate the donation decision [2–8]. Perceived self-efficacy, which refers to an individual's belief in their ability to control their level of functioning and the events that impact their lives [19]. This construct has been suggested to be closely linked to perceived behavioral control, as recognized by Ajzen [20–22]. Within the domain of blood donation research using TPB, Chen surveyed $N = 208$ respondents aged between 18 and 60 years old and found that attitude toward non-remunerated blood donation and subjective norm were positively related to blood donation intention [2]. Besides, Masser and her colleagues conducted a longitudinal study among first-time donors to examine if TPB predictors affected first-time donor retention [7]. They found that attitudes toward blood donation, perceived behavioral control, and donor identity elicited greater blood donation retention among first-time donors. Further, France et al. surveyed $N = 227$ college students who were experienced blood donors [3]. They found that attitude, subjective norm, and self-efficacy were significantly associated with blood donation intention among experienced college donors. It is also important to note that Giles et al. surveyed $N = 100$ undergraduate students and found out that self-efficacy exerted a more substantial influence on the prediction of blood donation intention compared to the other primary independent variables in the model, such as attitude and subjective norm [22].

Earlier studies have also revealed significant associations between attitude, subjective norms, and self-efficacy [23,24]. These results suggest that a heightened sense of perception or awareness of the social expectations, beliefs, and opinions of others regarding blood donation is also positively associated with a more favorable attitude towards engaging in blood donation and higher perceived behavioral control towards taking action. In regards to blood donation initiatives, a perception that significant others support such activities may be essential in forming advantageous opinions and confidence before individuals progress to undertake pertinent actions.

One method for promoting positive behavior changes (e.g., engaging in voluntary non-remunerated blood donation) among young adults is through behavior change interventions with appropriate theory-driven messages [25]. It is crucial to develop a thorough theoretical understanding of the health behavior in order to better design and deliver health behavior campaigns [26]. Therefore, incorporating TPB into blood donation campaign message design may increase the chances of having an impact (especially among active donors, such as university students in China). Based upon the review of the theory and the literature discussed, the following hypotheses were put forth.

H1. University students' attitude (H1a), subjective norm (H1b), and self-efficacy (H1c) towards voluntary non-remunerated blood donation will be positively associated with their blood donation intention.

2. Donation anxiety, altruism, and blood donation intention

The sufficiency of the TPB has received considerable attention in the field of health communication, leading to the proposition of numerous supplementary constructs [27]. Ajzen himself has also acknowledged the potential for enhancing the model by identifying more influential proximal factors [28]. Two crucial intrinsic factors that may affect blood donation practices are donation anxiety and altruism, which have been proposed to influence blood donation practices in a number of studies [7,9–16]. Donation anxiety, characterized by non-donors experiencing distress and/or physiological arousal in response to the potential adverse consequences of blood donation, is often accompanied by feelings of tension, uneasiness, stress, dread, and other negative affective states [29]. This psychological phenomenon constitutes a noteworthy impediment to engaging in blood donation. Research has shown that potential donors may be frightened by exposure to needles and blood, leading to anxiety about donating blood [28]. Previous research has generated mixed findings concerning the effects of donation anxiety on blood donation intention, with some studies reporting a direct impact of donation anxiety on intention, while others have found an indirect influence [7,15,30–32]. For example, in a cross-sectional survey study conducted by Robinson et al. ($N = 195$ residents of Queensland, Australia), it demonstrated that there was a direct negative association between donation anxiety and blood donation intention [15]. Besides, Masser et al. surveyed $N = 263$ blood donors who were residents of Queensland, Australia. They found that donation anxiety affected blood donation intention indirectly via attitude [7]. Further, Gilchrist et al. surveyed $N = 347$ individuals (269 nondonors and 78 donors) and found that donation anxiety donation anxiety exhibited both direct and indirect associations (via self-efficacy and attitude) with blood donation intention [31].

Altruism refers to "A moral norm [which] implies certain social expectations of helping others in different social contexts" [33]. Donating blood voluntarily and without remuneration is widely considered as an exemplification of altruistic behavior. Recruitment/retention campaigns for blood donation often highlight the importance of altruism to increase the donation rate [9]. However, previous research on the impact of altruism on blood donation has yielded mixed results [11,13,14,16,34]. For example, Lemmens et al. found that altruism was indirectly associated with blood donation intention through moral norm [13]. Glynn and his colleagues analyzed data from a 1998 survey of 92,581 U S. blood donors and found that the act of blood donation was primarily motivated by altruistic tendencies across all demographic cohorts [14].

On the basis of previous blood donation research, the current study proposed the inclusion of donation anxiety and altruism to enhance the predictive utility of the model. Given the inconsistent findings regarding the effects of blood donation anxiety and altruism on blood donation intention, this study tested both the direct and indirect effects of blood donation anxiety and altruism on blood donation intention.

Research question 1 & 2. How do donation anxiety (RQ1) and altruism (RQ2) predict blood donation intention?

3. Method

3.1. Participants

This study employed a cross-sectional online survey using a snowball sampling technique to recruit participants from Chinese universities. Prior data collection, a power analysis [35] was used to calculate the initial sample estimation based on an alpha of .05. The results indicated that the proposed design requires $N = 753$ participants to yield an 80% chance of obtaining statistical significance.

From June 2020 to April 2021, we reached out to 2500 full-time university students who were members of an online discussion group for Chinese university students. We received a total of 1313 responses, resulting in a response rate of 52.52%. After removing invalid questionnaires, the final sample consisted of 1165 university students (65.9% female) aged between 18 and 24 years ($M =$ 20.459, $SD = 1.385$) who completed the survey online. This study underwent review and received approval from the Institutional Review Board (IRB) of Jinan University (IRB Approval No. CX20315). Prior to participating in the survey, all participants provided informed consent by acknowledging and agreeing to answer the survey questionnaire.

3.2. Measures

3.2.1. Subjective Norm

Subjective norm was measured using four items based on Masser et al. [7]. Participants answered a set of questions to indicate their subjective norm scaled from (1) strongly disagree to (5) strongly agree, including: 1. My relatives would recommend that I donate blood. 2. My peers would recommend me that I donate blood. 3. If I were to donate blood, my relatives would. 4. If I were to donate blood, my peers would. Higher scores indicated higher levels of subjective norm of donating blood. ($M = 3.046$, $SD = 0.746$, $α =$ 0.827).

3.2.2. Attitude

Attitude was measured using two items based on Liu et al. [36]. Participants answered a set of questions to indicate their attitude of use scaled from (1) strongly disagree to (5) strongly agree, including: 1. Taking part in a blood donation is a rewarding thing to do. 2. I feel good about participating in the blood donation. Higher scores indicated higher levels of attitude of donating blood. ($M = 3.939$, $SD = 0.762$, $r = 0.66$, $p < .01$).

3.2.3. Self-efficacy

Self-efficacy was measured using two items based on Liu et al. [36]. Participants answered a set of questions to indicate their self-efficacy scaled from (1) strongly disagree to (5) strongly agree, including: 1. It's a very simple task for me to donate blood. 2. I'm confident that I can donate blood in the next 3 months if necessary. Higher scores indicated higher levels of self-efficacy of donating blood. ($M = 3.34$, $SD = 0.909$, $r = 0.604$, $p < .01$).

3.2.4. Intention

Intention was measured using two items based on Liu et al. [36]. Participants answered a set of questions to indicate their intention scaled from (1) strongly disagree to (5) strongly agree, including: 1. I intend to donate blood in the next 6 months. 2. I will donate blood in the next 6 months. Higher scores indicated higher levels of intention of donating blood ($M = 3.081$, $SD = 1.03$, $r = 0.855$, $p < .01$).

3.2.5. Donation anxiety

Donation anxiety was measured using four items based on Liu et al. [36]. Participants answered a set of questions to indicate their donation anxiety scaled from (1) strongly disagree strongly to (5) strongly agree, including: 1. I may feel sluggish if I participate in blood donation. 2. I may feel dizzy if I participate in a blood donation. 3. I may get a headache if I participate in a blood donation. 4. I may feel unconscious if I participate in a blood donation. Higher scores indicated higher levels of participant's donation anxiety. ($M =$ 3.039, $SD = 0.886$, $α = 0.918$).

3.2.6. Altruism

Altruism was measured using eleven items based on Rushton et al. (e.g., "I have offered my seat on a bus or train to a stranger who was standing") [37]. Items were rated on a five-point Likert scale, with responses ranging from (1) strongly disagree to (5) strongly agree. Higher scores indicated higher levels of altruism among participants ($M = 3.607$, $SD = 0.641$, $\alpha = 0.882$).

3.3. Data analysis strategy

Path analysis was performed to examine the relationships between the variables in the proposed model. Model fit was assessed using the goodness-of-fit indices including Comparative Fit Index (CFI ≥ 0.90 is acceptable, ≥ 0.95 is good) [38], Root Mean Square Error of Approximation (RMSEA ≤ 0.08 recommended) and Standardized Root Mean Residual (SRMR ≤ 0.08 recommended [39,40]). Analyses were performed using AMOS 23.0 program [41]. Standardized coefficients are reported.

4. Results

There were 1165 participants (18–24 years, $M = 20.459$, $SD = 1.385$) included in final analysis. Of these, 65.9% were female ($n = 768$), 33.4% were male ($n = 389$), and 0.7% were unidentified ($n = 8$). On average, participants reported a blood donation intention score of $M = 3.081$ ($SD = 1.03$), with a range of 1 (not at all) to 5 (very likely).

As can be seen in Table 1, correlational analyses revealed that all of the measured variables were significantly related to reported blood donation intention (all p values $< .001$). Self-efficacy showed the strongest positive relationship to blood donation intention ($r = 0.719$, $p < .001$), followed by subjective norm ($r = 0.575$, $p < .001$), attitude ($r = 0.44$, $p < .001$), and altruism ($r = 0.208$, $p < .001$). Donation anxiety was found to be negatively related to intention to donate ($r = -0.14$, $p < .001$).

The initial SEM model was saturated, without a Chi-square value, which required model modification. Upon careful analysis of each pathway, one specific path connecting altruism and blood donation intention was found to be statistically insignificant. According to prior research, non-significant paths could be pruned to seek more parsimonious explanation for a certain phenomenon [42]. Therefore, this insignificant path was deleted for better parsimony. The final SEM model had a satisfactory fit, $\chi^2(2) = 13.243$, $p < .01$, CFI $= 0.995$, TLI $= 0.96$, RMSEA $= 0.069$ (90%CI: 0.037, 0.107), SRMR $= 0.017$, and the results of each path are shown in Fig. 1. Table 2 demonstrated the direct and indirect predictors of the model's endogenous variables. Consistent with previous studies using TPB as the theoretical framework to predict behavioral intention, we also found that attitude ($\beta = 0.071$, $p < .01$), subjective norms ($\beta = 0.264$, $p < .001$), and self-efficacy ($\beta = 0.536$, $p < .001$) were positively related to blood donation intention (see Fig. 2). Thus, H1 was supported.

Findings from this study also demonstrated that anxiety ($\beta = -0.133$, $p < .001$), subjective norm ($\beta = 0.351$, $p < .001$), and altruism ($\beta = 0.36$, $p < .001$) were significantly associated with attitude toward blood donation. Attitude ($\beta = 0.288$, $p < .001$), subjective norm ($\beta = 0.439$, $p < .001$), and anxiety ($\beta = -0.254$, $p < .001$) were found to be significantly related to self-efficacy. However, anxiety was not directly associated with blood donation intention ($\beta = -0.035$, $p = .089$). See Fig. 2 and Table 2 for more details.

We also found that attitude and self-efficacy significantly mediated the relationships between anxiety and blood donation intention ($\beta = 0.817$, $p < .01$, 95%CI[0.737, 0.909]), between altruism and blood donation intention ($\beta = 1.31$, $p < .01$, 95%CI[1.203, 1.409]), between social norm and blood donation intention ($\beta = 1.301$, $p < .01$, 95%CI[1.209, 1.403]). Attitude significantly mediated the relationship between altruism and blood donation intention ($\beta = .456$, $p < .01$, 95%CI[0.38, 0.53]), between social norm and blood donation intention ($\beta = 0.447$, $p < .01$, 95%CI[0.374, 0.52]).

5. Discussion

In China, blood shortage is a significant issue that poses a challenge to public health. A reduction in blood donation has been identified as a significant factor to this shortage. The aim of this study was to identify effective communication strategies that can improve public understanding and support for blood donation among young adults (university students in particular) in China. To achieve this goal, we employed a modified and extended TPB model to explore the factors that determine blood donation intention among Chinese young adults. Specifically, we used an online cross-sectional survey to examine how attitude, subjective norm, attitude,

Table 1
Factors associated with blood donation behavioral intention. Dash lines indicate non-significant paths.

	1	2	3	4	5	6
1.Subjective norm		.257***	.095**	.407***	.532***	.575***
2.Altruism			.173***	.364***	.245***	.208***
3.Donation anxiety				−.070*	−.233***	−.140***
4.Attitude					.484***	.440***
5.Self-efficacy						.719***
6.Intention						
Mean	3.046	3.607	3.039	3.939	3.34	3.081
SD	0.746	0.641	0.886	0.762	0.909	1.03

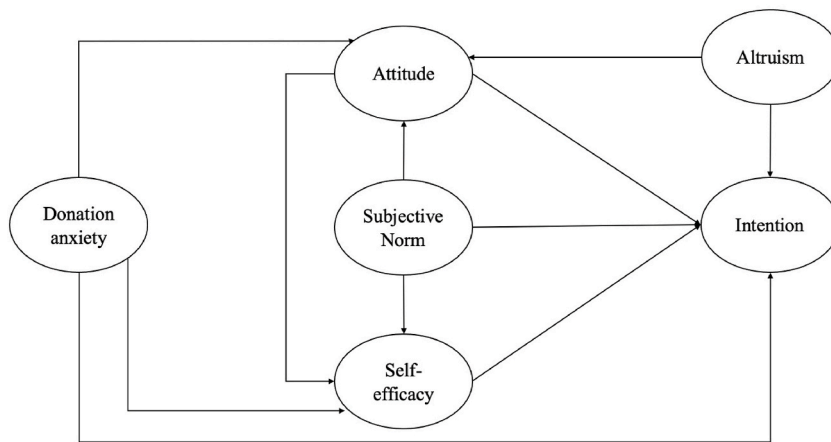Note. *$p < .05$ **$p < .01$. ***$p < .001$.
SD = standard deviation.

Fig. 1. Conceptual framework.

Table 2
Predictors of endogenous variables in SEM ($N = 1165$).

	Effect	Attitude	Self-efficacy	Intention
Subjective norm	Direct	.344***	.439***	.264***
	Indirect		.12**	.107***
Altruism	Direct	.303***		
	Indirect		.123**	.11**
Donation Anxiety	Direct	−.155***	−.254***	−.035
	Indirect		−.046**	−.041**
Attitude	Direct		.288***	.071**
	Indirect			.208**
Self-efficacy	Direct			.536***
	Indirect			

Note. *$p < .05$ **$p < .01$. ***$p < .001$.
Coefficients are standardized.
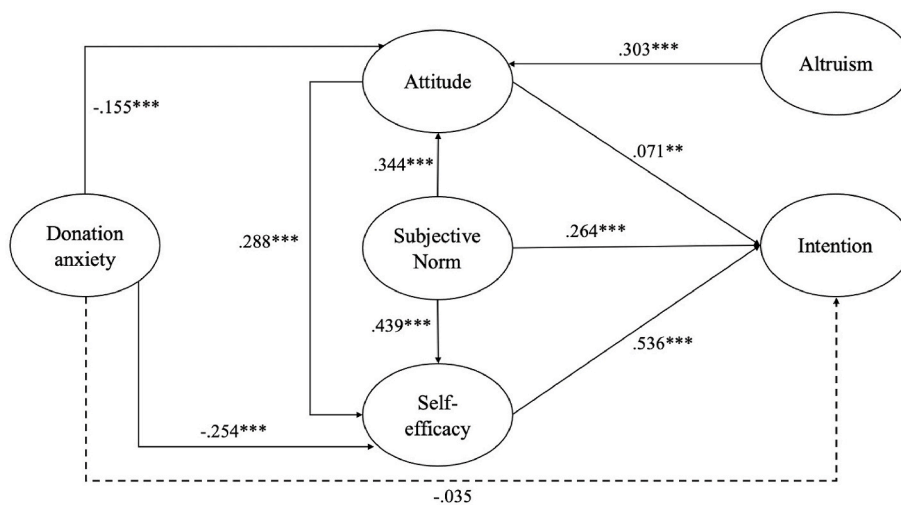The reported indirect effect pertain to the total indirect effect (TIE) of one variable on another.

Fig. 2. Final model with standardized path coefficients.
Note. *$p < .05$ **$p < .01$. ***$p < 0.001$
Dash lines indicate non-significant paths.

self-efficacy, altruism, donation anxiety were associated with blood donation intention. In general, our findings are consistent with prior studies on blood donation that have utilized the TPB model as a theoretical framework [2–8]. Blood donation intention was found to be positively associated with attitude, social norm, and self-efficacy among young adults in China. This indicates that those who held a more positive attitude towards blood donation, perceived greater control over donating, and felt greater social pressure from important others to donate blood had a stronger intention to donate blood in the future. Additionally, our study identified positive interrelationships among attitude, social norm, and self-efficacy towards blood donation in the university student population. The perception that significant others endorse blood donation behavior engenders a more positive attitude and enhanced self-efficacy towards blood donation. Moreover, a more favorable attitude is associated with heightened self-efficacy towards blood donation. The identification of favorable correlations between attitude, social norm, and self-efficacy towards blood donation among college students highlights the urgency to foster a positive perception of blood donation, including enhanced attitude and subjective norm, in order to promote self-efficacy and ultimately promote voluntary blood donation. Health professionals are suggested to promote blood donation by increasing awareness and education (through organize campaigns, workshops, and informational sessions specifically targeting university students) about its importance and benefits. Health professionals can also collaborate with student organizations, universities, and blood donation centers to set up on-campus blood donation drives and make the process convenient and accessible for students. Meawhile, as social norm is a significant predictor for predicting blood donation intention among university students in China. Encouraging positive testimonials and personal stories from fellow students who have donated blood, while leveraging social media platforms and university communication channels, may also help create a sense of social norm, peer influence, spread awareness, and promote a culture of blood donation among university students in China.

Donation anxiety also plays a crucial role in shaping blood donation intention. In this study, we found that the impact of anxiety was completed mediated by attitude and self-efficacy. However, our data revealed that anxiety failed to influence blood donation intention directly. This finding is consistent with previous research that has documented the negative and indirect influence of anxiety on blood donation intention via attitude [9,31]. These results suggest that donation anxiety alone may not be sufficient to influence blood donation intention, and that attitude and self-efficacy are important factors that follow the presence of anxiety. Therefore, it is essential for health professionals and message designers to provide information on blood donation recruitment in a manner that can help reduce anxiety levels, thus promoting a more positive attitude and greater self-efficacy among potential donors. Current research has identified that potential donors may experience donation anxiety due to exposure to needles and blood, which can reduce the effectiveness of recruitment messages promoting blood donation [28]. Consequently, presenting needles and blood in recruitment messages may cause individuals to stop processing the messages, rendering the messages ineffective. Therefore, health professionals are suggested to create educational initiatives and resources that specifically focus on addressing concerns related to blood donation anxiety, such as offering accurate information about the donation process, dispelling common fears or misconceptions, and providing guidance and support.

In accordance with previous study, we also found that the impact of altruism on blood donation intention was mediated by attitude and self-efficacy. In other words, our data showed that altruism was positively associated with attitude and self-efficacy, which, in turn affected blood donation intention. These results are consistent with previous research on this topic [13]. Improving the level of altruism was found to increase attitude and self-efficacy towards blood donation, resulting in a positive indirect effect on blood donation intention. In light of these findings, health professionals and word-of-mouth (WoM; e.g., Facebook, Instagram, Reddit) platforms can consider utilizing messages that emphasize altruistic reasons for donating blood, such as highlighting the impact of blood donation on saving lives and benefiting the community. These messages have the potential to create a positive attitude and enhance individuals' sense of self-efficacy, ultimately leading to an increase in blood donors.

In this study, we addressed two gaps in existing knowledge. First, although Chinese university students have been recognized as one of the most proactive groups in blood donation, there is limited targeted research examining the specific factors that drive blood donation behavior among this population and how these factors can be effectively utilized for blood donation health education. The findings of our study contribute valuable insights into these aforementioned research questions. Second, previous research has yielded inconsistent findings regarding the impact of donation anxiety and altruistic tendencies on individuals' intention to donate blood. Through a cross-sectional study conducted among university students in China, our data reveal the indirect effects of donation anxiety and altruism on blood donation intention mediated by attitude and self-efficacy.

Limitations of this study should also be noted. First, this study is limited by its design. Our data are descriptive rather than pre-dictive and survey-based findings do not denote causal relationships between variables. Future studies are needed to examine the causal relationships among attitude, subjective norm, self-efficacy, altruism, anxiety, and blood donation intention. The second limitation of our study pertains to the use of a sample consisting solely of college students, which may limit the generalizability of our findings to other populations. Further investigation is required to determine if and how populations such as military personnel and healthcare professionals may differ in their attitudes, norms, and self-efficacy toward blood donation, and how these factors may relate to blood donation intention. Finally, this study primarily focused on identifying the motivators and barriers to blood donation among Chinese college students. Future research could explore potential differences in factors influencing the intention to donate blood voluntarily among first-time donors, infrequent donors, and frequent donors. This knowledge could help improve attitudes and knowledge about blood donation, ultimately increasing the rate of blood donation.

6. Conclusion

Taken together, this study applied the theory of planned behavior model to investigate the associations between attitude, social norm, self-efficacy, altruism, anxiety, and blood donation intention. In general, we found that people with more favorable attitude and

higher levels of perceived social norm and self-efficacy were more likely to have greater blood donation intention. Additionally, donation anxiety and altruism affect blood donation intention through attitude and self-efficacy. Therefore, it is important to develop communication strategies that can reduce donation anxiety and promote altruism and social support environment to improve attitudes and intentions towards blood donation, ultimately leading to an increase in blood donation rate. Moreover, this study contributes to the existing literature by highlighting the importance of including donation anxiety and altruism as key factors in the theory of planned behavior model when predicting intentions to donate blood.

Our findings also have practical implications for blood donation recruitment and retention practice and education. First, health communication scholars and practitioners working to improve blood donation intention are suggested to develop behavioral change interventions designed to promote positive perceptions toward blood donation and motivate behavior change. This may involve designing messages that are tailored and personalized to the specific needs of individuals, with the goal of changing their attitudes, perceived social norms, and self-efficacy towards voluntary blood donation. Further, when designing donor recruitment messages, it is important to consider both donation anxiety and altruism. Health professionals and message designers, including word of mouth practitioners, should strategically disseminate donor recruitment information in a way that can help reduce anxiety and promote altruistic behavior. By synergistically combining the efforts of health professionals and harnessing the influential power of word of mouth, positive attitudes and self-efficacy regarding blood donation can be cultivated among university students, ultimately alleviating the existing blood shortage and advancing the overall welfare of the community.

Author contribution statement

Jiawei Liu: Conceived and designed the survey; Analyzed and interpreted the data; Wrote the paper.

Huazhi Han: Conceived and designed the survey; Performed the survey study; Analyzed the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

Data availability statement

Data will be made available on request.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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