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ORIGINAL RESEARCH

Voluntary Blood Donation Among Bahir Dar University Students: Application of Integrated Behavioral Model, Bahir Dar, Northwest Ethiopia, 2020

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Introduction: The World Health Organization recommends that 1% to 3% of a country's population should donate blood to meet its demand and should focus on young people to achieve 100% voluntary blood donation. The aim of this study was to assess voluntary blood donation among Bahir Dar University students by using an integrated behavioral model.

Methods: An institution-based cross-sectional study was conducted on Bahir Dar University students from March 1–21, 2020. A multi-stage sampling technique was applied to select 625 study participants. Data were entered in Epi data version 3.1 and then exported to SPSS version 23.0 for analysis. Path analysis was done using Stata 15 to check the causal effect of the integrated behavioral model constructs on voluntary blood donation. Internal consistency and validity of constructs were checked using Cronbach's alpha and exploratory factor analysis, respectively. Multivariable linear and logistics regression were used to predict independent predictors on intention and voluntary blood donation, respectively. The significant independent predictor was declared at 95% confidence interval and P-value < 0.05.

Results: One hundred and four (16.8%) university students donated blood voluntarily. Being female (AOR = 1.92 (1.15–3.22)), being third year (AOR = 2.88 (1.55–5.35)), knowledge (AOR = 1.53 (1.32–1.77)), descriptive norm (AOR = 1.10 (1.01–1.12)) and intention (AOR = 1.42 (1.28–1.57)) were positively associated with blood donation. Injunctive norm (B = 0.06) and self-efficacy (B = 0.36) have significant association with intention. Intention, descriptive norm and knowledge have significant effect on blood donation with path coefficient 0.0, 0.09 and 0.48, respectively.

Conclusion: The magnitude of voluntary blood donation was low as compared to other similar studies. Descriptive norm, intention, knowledge, sex, year of study were significant predictors associated with voluntary blood donation. Therefore, behavioral change health communication strategies should develop to address these factors among the students. Researchers should conduct prospective analytical study design to examine the causal relationship of constructs of the model to develop better interventional strategy.

Keywords: integrated behavioral model, voluntary blood donation, path analysis

Introduction

Blood donation is the process of giving blood for transfusion into another person for a therapeutic purpose. The donated blood plays an essential role in the management of bleeding during major surgeries, accidents, deliveries, peptic ulcer and other blood diseases.[1] The world health organization (WHO) recommends that 1%

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to 3% of a country's population should donate to meet its demand and should focus on young people to achieve 100% voluntary blood donation by 2020. There are three types of blood donors: voluntary unpaid, family/replacement and paid. Adequate and reliable supply of safe blood can be assured by a stable regular, voluntary, unpaid blood donor to decrease transmission of serious infections, including HIV and hepatitis, since in every unit of blood there is a 1% chance of a transfusion transmitted infection.[2]

Globally 117.4 million units of blood are collected annually, from this 42% is in high-income countries. In total, 78 countries collected over 90% of their blood supply from voluntary unpaid blood donors; however, 58 countries collect more than 50% of their blood supply from family/replacement or paid donors and 66 countries less than 10% per 1000 people.[1,2] In middle- and low-income countries pregnancy complications and childhood anemia, a high prevalence of malaria and road traffic accidents need blood transfusions to save millions of lives but there is a considerable shortage of blood with the supply being less than 50% of the requirement. Young people are the hope for a safe blood supply in the world. In Sub Saharan Africa, including Ethiopia, 26% of maternal mortality can be prevented by safe blood transfusion during post-partum hemorrhaging.[1,3,4]

In Africa, studies showed that the total number of blood donations was 4,899,913 units with the donation rate 4.9 per 1000 population, with a shortage of 5,040,434 units. In Ethiopia less than 1% of the population are active blood donors. The Ethiopian national blood bank aims to collect 3000 units of blood per day to ensure a safe and sufficient blood supply in the health care system.[5–7] University students are young and educated so that they are considered safer blood donors to satisfy the need for blood by national and regional blood banks of the country since the residual risk of transfusion-transmissible infections is assumed to be lower in this population.[8–10]

Integrated Behavioral Model (IBM) is the behavioral model which is an extension of the Theory of Planned Behavior (TPB). According to IBM a particular behavior is most likely to occur if a person has knowledge about it, there is no environmental constraint preventing performance and the person has performed the behavior previously. Direct determinants of individuals' behavioral intention (BI) are their Instrumental and experiential attitudes, injunctive and descriptive norms, self-efficacy, and perceived control.[11] Despite research done on voluntary blood donation and associated factors in different universities in Ethiopia, to the best of our knowledge, there is no research done on voluntary blood donation and associated factors, specifically on the study area by application of an integrated behavioral model. The application of IBM to this study adds a descriptive norm and self-efficacy which are best predictors of behavior. Therefore, this study will fill the information gap by assessing voluntary blood donation and associated factors among Bahir Dar University students by application of an integrated behavioral model.

Methods and Materials

Study Design and Area

An institutional based cross-sectional study was conducted from March 1–21, 2020. Bahir Dar University is found in Bahir Dar city which is located to the northwest and 565 kilometers away from Addis Ababa; the capital of Ethiopia. It is now among the largest universities in Ethiopia, accepting more than 52,830 students, divided into 69 undergraduate disciplines, 118 masters, and 32 PhD programs. Currently it has 8 campuses with 5 colleges, four institutes, three faculties, two academies and one school.

Sampling Technique and Study Population

This study includes all regular undergraduate students who were present during the data collection period from selected departments. The sample size was determined using a single population proportion formula using p = 24.5% of the proportion of students who donate blood in Samara University,[12] assumption of using 95% confidence level and 5% marginal error, design effect 2 with 10% non-response rate, then the final sample size was 625. Multistage sampling technique was applied to select study participants. Five academic units from the fifteen were selected randomly, using a lottery method, as the primary sampling unit. Then the sample was proportionally allocated by year of study, department and college to include freshman students taking 8 classes from natural and 6 class from social science randomly using the lottery method and 3 out of 9 departments in the colleges of business and economics were selected, 2 from 4 departments in the faculty of social science, 3 from 9 departments in the college of medicine and health science, and 2 from 8 departments in the college of natural science as a secondary sampling unit. Then by proportionally

allocating to each department and year of study a simple table of random method was used to select participants.

Data Collection Tool and Procedures

Data were collected using a structured questionnaire developed from elicitation study. The elicitation study was conducted on 20 individuals from the target population before one weeks of the actual data collection period, which was a critical step in applying the IBM constructs. Open-ended elicitation interviews were conducted to identify relevant behavioral beliefs, outcomes, referents, facilitators, and barriers for each particular behavior and target population under investigation. The interview contents were analyzed by coding related items in to similar construct and frequency table was done. Finally, based on frequency of items, IBM constructs were developed. The data was collected by five trained data collectors and two supervisors using a self-administered questionnaire.

In this study the practice of voluntary blood donation was measured by history of blood donation by whoever had donated in the past. Responses of knowledge related 11 items was summated to get a score for each respondent and a higher score indicates better knowledge. Experiential attitude directly measured with semantic differential scale three items and indirectly measured by four behavioral belief items summated across to get the score and a higher score indicates a favorable attitude for each respondent. The direct measure of instrumental attitude towards performing the behavior is obtained using a semantic differential scale of four items. And indirectly measured by five behavioral belief items, multiplied by the corresponding item evaluating the outcome evaluation. All of the multiplicative scores were summated across items to get the score and a higher score indicates a favorable attitude. The injunctive norm directly measured with a 5-point Likert scale, agree to disagree, five items summated to get the score and indirectly measured by four normative beliefs and multiplied by the corresponding four items of motivation to comply. All of the multiplicative scores were summated across to get the score and a higher score indicates high injunctive norm.

Descriptive norm directly measured by belief about whether most people perform the behavior by a 5-point Likert scale, agree to disagree, five items summated to get the score and indirectly measured by using four normative belief items summated to get the score and a higher score indicates a higher descriptive norm. Perceived control is directly measured by the overall measure of perceived control over the behavior by semantic differential scale three items summated to get the score and indirectly measured by four control belief items multiplied by four perceived power items. All of the multiplicative scores are summated across items to get the score and a higher score indicates a higher perceived control. Self-efficacy was directly measured by a 5-point Likert scale, four items and indirectly by perceived ability to overcome each facilitating and constraining condition by self-efficacy belief, four items were summated to get the score and a higher score indicates higher self-efficacy. Intention was measured by three items containing a 5-points Likert scale. All items were summated to get the score and a higher score indicates high intention to donate.

Data Quality Assurance

Quality of data was assured through pretesting of the questionnaires on five percent of the study subjects as a target population a week before the actual data collection period at Enjebara University and any necessary amendment was made on the questionnaire and the questionnaire was translated from English to Amharic. Data collectors and supervisors were trained on data collection procedures and instruments, close supervision of the data collectors and proper handling of the data. The reliability of constructs was measured using Cronbach alpha to see internal consistency of items to each construct. The validity of the constructs was checked using exploratory factor analysis.

Validity and Reliability of IBM Constructs

For each construct, the reliability of the items was cheeked using reliability analysis (Table 1). Exploratory factor analysis was conducted to check the validity of items using principal component analysis (PCA) as the extraction method and promax rotation since there was a correlation between items. Based on the observation of scree plot and initial eigenvalues determined the number of components. Twelve components with eigen values greater than one and total variance explained 65.8%, KMO value 0.825, Bartlett's test of sphericity chi-square 10,685.87, df = 867, sig value 0.00 showing a significant relationship and factor loading ≥ 0.4 were included. From experiential attitude four items loaded from five, seven out of eight items for instrumental attitude, all items of injunctive norm, descriptive norm,

Table 1 Internal Consistency of Constructs of the Integrated Behavioral Model

Constructs	Cronbach Alpha
Experiential attitude	0.76
Instrumental attitude	0.79
Injunctive norm	0.80
Descriptive norm	0.80
Perceived control	0.70
Self-efficacy	0.80
Intention	0.87

intention, self-efficacy and perceived control were loaded to their respective constructs.

Data Management and Analysis Procedures

Data was edited, cleaned and entered into EPI data version 3.1 and exported to SPSS version 23 for analysis. Path analysis was done using Stata 15 to check the causal effect of the IBM constructs on intention and voluntary blood donation. Descriptive statics was done to summarize frequency, percentage, mean and standard deviation of the variables. The correlation between direct and indirect IBM constructs was assessed using Pearson's correlation coefficient (r). Linear and logistics regression were performed. Linearity and normality of the data were checked with scatter plot and histogram respectively. Variables significant in simple linear regressions were entered into multiple linear regression analysis to identify the association of IBM constructs with behavioral intention at p value <0.05. Variables at p-value of less than 0.25 in the bivariable analysis were entered into multivariable logistics regressions to identify the independent predictors of voluntary blood donation. An odds ratio with 95% confidence interval was used to interpret the strength of association of independent variable with voluntary blood donation, while beta value was used to interpret the strength of association between IBM constructs and intention. Model fitness was checked using the Hosmer-lemeshow test which revealed the model was fitted.

Result

Sociodemographic Characteristics of Participants

A total of six hundred nineteen Bahir Dar University students from different disciplines participated with 99.4% response rate.

Most of the participants were male 373 (60.3%). From the participants (82.2%) were Orthodox Christians; regarding students' year of study 317 (51.2%) were first year, from which 79.5% were natural science students and 64.1% of the students were from urban areas (Table 2).

Knowledge and Magnitude of Voluntary Blood Donation

All the study participants heard about blood donation. The mean score of knowledge on voluntary blood donation was 7.5 with SD ± 1.908. From this study one hundred four students (16.8%) had ever donated blood voluntarily and 1.5% of them donated to replace for their relatives. Eighteen (2.9%) of the students did not donate due to medical problems.

Table 2 Sociodemographic Characteristics of Bahir Dar University Students, Northwest Ethiopia, 2020 (n = 619)

Variables	Category	Frequency	Percent
Sex	Male	373	60.3
	Female	246	39.7
Age	16–20	274	44.3
	21–25	271	43.8
	26 and above	74	12.0
Religion	Orthodox	509	82.2
	Muslim	54	8.7
	Protestant	50	8.1
	Catholic	4	0.6
	Other	2	0.3
Residence	Urban	397	64.1
	Rural	222	35.9
Department	Nurse	52	8.4
	Midwife	47	7.6
	Laboratory	43	6.9
	Maths	12	1.9
	Biology	36	5.8
	Economics	29	4.7
	Accounting	30	4.8
	Management	24	3.9
	Civics	14	2.3
	Anthropology	15	2.4
	Natural fresh	190	30.7
	Social fresh	127	20.5
Year of study	First year	317	51.2
	Second year	135	21.8
	Third year	119	19.2
	Fourth year	48	7.8

Environmental Constraints of Blood Donation

Ninety-nine (85.3%) students who donated blood were comfortable with the screening procedure and 40.7% of the participants know where a blood bank is located. From the students only 15.7% of them had participated in a blood donation campaign (Table 3).

Association Between Intention and Constructs of IBM

Multiple linear regression was done to predict the association between intention to blood donation and constructs of the model. This model has explained 51.4% of the variance (R square = 0.514). Experiential attitude (B = −0.052, p<0.043) was negatively associated with behavioral intention. Injunctive norm (B = 0.06, p<0.000) and self-efficacy (B = 0.36, p<0.00) have positive significant association with behavioral intention. The result indicates that for a unit positive change in injunctive norm and self-efficacy the behavioral intention to donate blood increased by 0.06 and 0.36 respectively (Table 4).

Table 3 Environmental Factors of Blood Donation Among Bahir Dar University Students, Northwest Ethiopia, 2020

Variables	Category	Frequency	Percent
Comfortable at screening procedure	Yes No	99 17	85.3 14.7
Satisfied with care Providers counseling	Yes No	91 25	78.4 21.6
Know where blood bank is located	Yes No	252 367	40.7 59.3
Have time to give blood	Yes No	158 461	25.5 74.5
Participated in blood donation campaign	Yes No	84 535	15.7 84.3

Factors Associated with Voluntary Blood Donation Among Bahir Dar University Students

Multiple logistic regressions were done to identify predictors of voluntary blood donation among Bahir Dar University students. In this model sex, year of study, descriptive norm, knowledge and intention were significantly associated with voluntarily blood donation. The model was fitted with a Hosmer–Lemeshow test of 0.73 and 37.4% (Nagelkerke R Squared = 0.374) of the variance is explained collectively by the model.

A unit increase in students' knowledge on voluntary blood donation meant the odds of voluntary blood donation increased by 53% (AOR = 1.53 (1.32–1.77)). Those respondents in the third year of study were 2.88 times more likely to donate blood voluntarily than first year students (AOR = 2.88 (1.55–5.35)). As descriptive norm increases by one unit voluntary blood donation increase by 10% (AOR = 1.10 (1.01–1.12)). A unit increase in intention to donate blood will increase voluntary blood donation practice among students by 42% (AOR = 1.42 (1.28–1.57)). Being female was 1.92 times more likely to donate blood as compared to males (AOR = 1.92 (1.15–3.22)) (Table 5).

Path Analysis of the Integrated Behavioral Model

Experiential attitude, injunctive norm and self-efficacy were statistically significant with intention, with path coefficients of −0.05, 0.006 and 0.36 respectively. The model accounted for 31% of the variance in the intention to donate blood voluntarily. Intention, descriptive norm and knowledge were significantly associated with VBD with

Table 4 Association Between Behavioral Intention and Constructs of IBM Among Bahir Dar University Students, March, 2020

IBM Constructs				P value	95.0% Confidence Interval	
	B	Mean	SD		Lower Bound	Upper Bound
Experiential attitude	−0.052	15.2746	4.12297	**0.043**	−0.102	−0.002
Instrumental attitude	0.002	350.0307	128.26921	0.067	0.000	0.003
Injunctive norm	0.006	147.5945	66.96617	**0.000**	0.003	0.010
Descriptive norm	0.043	11.6737	3.14022	0.237	−0.028	0.115
Perceived control	0.000	144.3199	60.80930	0.882	−0.003	0.004
Self-efficacy	0.364	12.4120	3.61898	**0.000**	0.302	0.425

Notes: Adjusted R2 = 0.514; bold shows significant variable p<0.05.

Table 5 Factors Associated with Voluntary Blood Donation Among Bahir Dar University Students

Variables	Category	Voluntary Blood Donation		COR (CI)	AOR (CI)
		Yes	No		
Sex	Male	56	317	1	
	Female	48	198	1.37 (0.898–2.098)	1.92 (1.15_3.22)**
Year of study	First	43	274	1	
	Second	16	119	0.857 (0.464–1.581)	0.787 (0.390–1.590)
	Third	33	86	2.45 (1.46–4.09)	2.88 (1.55–5.35)**
	Fourth	12	36	2.124 (1.025–4.399)	2.274 (0.927–5.581)
Residence	Urban	75	322	1	
	Rural	29	193	0.645 (0.40–1.026)	0.650 (0.367–1.150)
Knowledge				1.68 (1.46–1.93)	1.53 (1.32–1.77)**
Experiential attitude				0.924 (0.876–0.975)	1.005 (0.936–1.080)
Instrumental attitude				1.003 (1.001–1.005)	1.001 (0.998–1.003)
Injunctive norm				1.007 (1.004, 1.010)	0.999 (0.995–1.004)
Descriptive norm				1.17 (1.09–1.25)	1.10 (1.01–1.12)**
Perceived control				1.002 (0.999–1.006)	0.999 (0.995–1.004)
Self-efficacy				1.225 (1.147–1.308)	0.964 (0.880–1.056)
Intention				1.48 (1.35–1.63)	1.42 (1.28–1.57)**

Notes: **Shows significant variable at p value <0.05; R square=37.4%.

path coefficient 0.04, 0.09 and 0.48 respectively. The model accounted for 24% of the variance in voluntary blood donation. The Bentlers comparative fit (CFI) index (1), Tucker-Lewis (TLI) index (1.041), standardized root mean squared residual (SRMR) 0.000 and the root mean-square error of approximation (RMSEA) of 0.000 with its 90% confidence interval of 0.000–0.019 revealed the model used to predict the behavioral intention and voluntary blood donation based on IBM constructs showed an acceptable model fit index (Figure 1).

Discussion

This study revealed that 16.8% (95% CI = 13.8%-–19.7%) of Bahir Dar University students voluntarily donated blood in their lifetime which was higher than the studies done in Gondar University, Hawassa city, Mekelle town, Ethiopia, Nigeria and Iraq universities (12.5%, 12.5%, 12.4%, 13.3%, 13%) respectively. The possible reason might be a difference in methodology, study population difference and sociodemographic characteristics of the students. The studies in Gondar and the Iraqi university were only on health science students and the study in Hawassa and Mekelle was using the theory of planned behavior which is a community based study.[8,13–16]

However, it was lower than the studies done in Addis Ababa University (23.4%), Ambo University (23.6%), Samara University, Ethiopia (24.5%), China (35.1%), Kampala (43%), India (31.5%) and Namibia (28%).[3,12,17–21] This difference might be due to methodology and study population difference; on previous study participants were selected from health science students while the current study includes all faculties of natural and social studies. And also, it might be there is not much awareness regarding blood donation, socio-cultural factors, differences in attitude and awareness or poor periodic sensitization for blood donation. This study was also consistent with studies done in Madawalabu University 18.4%, Ghana 14.6% and Pakistan 17.5%.[22–24]

In this study being a third year of study was a positive significant predictor which was comparable with studies done in Ambo University and Addis Ababa University, Ethiopia, Kenya and India in which the university students' increased year of study has a significant association with blood donation practice.[17,19,25,26] This study also showed that blood donation is different by sex. Female students were more likely to donate blood than males, which is consistent with studies done among Namibia University,[21] Nigeria, Hong Kong and Spain University which showed that females have more potential of being voluntary donors than males.[27–29] The possible reason might be females are more pro-social than males, they tend to score higher on pro-social traits around trusting,

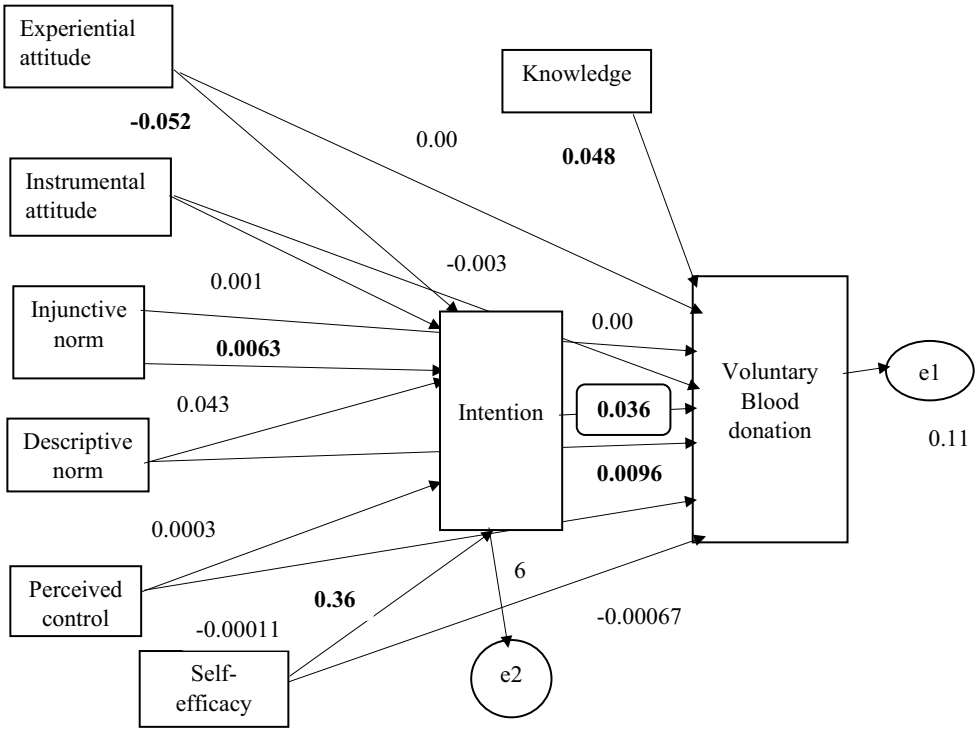

Figure 1 Path analysis model for voluntary blood donation among Bahir Dar University students. Bold shows significant variable at p value <0.05.

altruism, agreeableness, compassion, and males are more individualistic so that females have stronger moral norms and a positive attitude towards blood donation.[14,17,20,30] In this study knowledge has a positive significant association with voluntary blood donation which is comparable with studies conducted in India, Iraq, Nigeria, and Ambo University, Ethiopia and indicated that most of the respondents were aware of blood donation.[13,14,19,20] The studies in a Kenyan private university and a North Indian university showed that there is a significant relationship between knowledge and blood donation practice among the students.[26,31]

In this study descriptive norm has a positive association with blood donation, which is in line with a study in Iran which showed that family and friends with a history of blood donation encourages students to donate blood in the future.[32] The Mekelle city study showed that, if one's friends and family engage in blood donation, the likelihood of donating blood for the first time increases in such individuals.[15] The study in India showed that people are generally influenced by social behavior, family opinion, along with friends and people they are connected with as a factor to donate blood.[33]

In this study behavioral intention was a positive significant predictor with voluntary blood donation, which is consistent with studies done in Iran,[17] Mekelle[15] and Ghana University students[23] which showed intention as the determinant factor for blood donation. In this study the injunctive norm and self-efficacy have positive significant associations with behavioral intention. This is consistent with studies done in China and India using the theory of planned behavior, as injunctive norm and self-efficacy were positive significant predictors of behavioral intention.[18,33] It is also comparable with a study done in the United States of America using an integrated behavioral model on high risk drinking among college students and intention to do regular exercise among college students.[34,35]

The integrated behavioral model explained (51.4%) and (37.4%) of the variance for behavioral intention and the magnitude of voluntary blood donation in the regression analysis, respectively. This is consistent with a study done in USA among college students on high risk drinking intention (44%) and behavior (26%) variance explained respectively.[34] The study conducted on healthy sleep behavior among college students showed that intention (25%) and behavior (19%) variance was explained respectively.[36] This study was also consistent with a study done in Africa through systematic review using models for predicting and understanding alcohol related behaviors showed that the TPB and IBM model predicted between 45% to 75%

variance for intentions and 26% to 90% of the alcohol related behaviors respectively.[37] The limitation of this study was the cross-sectional nature of the study design may provide a poor prediction and understanding of behavior, since time order of having attitude, beliefs, perceived norm, perceived behavioral control, self-efficacy, intention and the behavior cannot be discerned at one time.

Conclusion

The proportion of Bahir Dar University students who had voluntary blood donation was low as compared to other similar studies. Descriptive norm, intention, knowledge, sex and year of study were significant predictors associated with voluntary blood donation. Injunctive norm and self-efficacy have significant association with behavioral intention. Therefore, behavioral change health communication strategies should be developed to address these factors among the students. Researchers should conduct prospective analytical study design to examine the causal relationship of constructs of IBM to develop better interventional strategy.

Abbreviations

WHO, World Health Organization; IBM, integrated behavioral model; BI, behavioral intention; DN, descriptive norm; EA, experiential attitude; IA, instrumental attitude; IN, injunctive norm; PC, perceived control; SE, self efficacy; TPB, theory of planned behavior; VBD, voluntary blood donation.

Data Sharing Statement

The datasets used and analyzed during the current study are available from the corresponding author on reasonable request.

Ethical Approval and Consent

Ethical clearance was obtained from Bahirdar University College of Medicine and Health Science's Institutional Review Board. After the purpose and objective of the study had been informed, verbal and written consent was obtained from each study participant. Participants were informed that participation was on a voluntary basis and they can leave the study at any time if they are not comfortable about the questionnaire. In order to keep confidentiality of any information provided by study subjects, the data collection procedure was anonymous. Participants under the age of 18 years were approved by the ethics committee to be able to provide informed consent on their own behalf and the study was conducted in accordance with the Declaration of Helsinki.

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Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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Disclosure

The authors declare that they have no competing interests.

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