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Knowledge, Motivations and Barriers Regarding Blood Donation Among Students in Different Undergraduate Majors

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Abstract: The present work aims to investigate barriers, motivations and perceptions as well as the role of students' future profession with respect to their propensity to donate blood, in students enrolled in different university undergraduate majors: Nursing, Psychology and Economics. Considerable research has underscored that it is crucial to create publicity campaigns differentiated on the basis of target groups' needs and characteristics. University students have been used in many studies to investigate motivations and barriers regarding blood donation, but their specific undergraduate majors have infrequently been studied. A self-report questionnaire was administered to 1,842 students in five different universities (Mean age = 23.27, SD = 5.04, females = 78.3%). The results show differences between the different typologies of the students investigated. Students in the Nursing major demonstrate more knowledge about donation and higher motivations to donate and perceive fewer barriers. They also acknowledge the greater relevance and responsibility existing between their academic major and blood donation. Economics students feel more distant from the world of donation while Psychology students occupy an intermediate position. These differences in knowledge and propensities underscore the necessity of evaluating formative/informative programs in relation to the target group in order to achieve maximum efficacy in interventions and to numerically increase donors of blood and blood products.

Keywords: Blood Donation, Motivation, Barriers, Young Donors, Recruitment

Introduction

The blood available in Italian hospitals, as in many parts of the world, is thus guaranteed solely by an altruistic and voluntary gesture (Ferguson *et al*., 2008). The World Health Organization (WHO) and the Council of Europe recommend that blood and blood products should be collected only from voluntary donors (CoE, 2003): This makes recruitment and retention of donors a complex challenge in that volunteer blood donors are key to maintaining an adequate and safe blood supply. The agencies that deal with recruitment and retention therefore put great effort, on the one hand, into recruiting people who have never donated or who do so only sporadically and then distance themselves from the world of donation and, on the other hand, into sustaining people who are already regular blood donors (Alfieri *et al*., 2016; Guiddi *et al*., 2015; Pozzi *et al*., 2016).

Although they are underrepresented among donors (IG, 2016) young people may be good candidates for becoming regular blood donors: In fact they have the possibility of a long career as blood donor in front of them (Alfieri *et al*., 2017). Many studies have focused on youth and most of them involved university students. Recent research, also carried out in developing countries interested in increasing blood collection, reveal some aspects in the university target group: Basic knowledge about blood donation is low (Batiha and Albashtawy, 2013; Ogunbona *et al*., 2013) and when it exists, it is not correlated with the act of donation (Wiwanitkit, 2002); propensity to donate is influenced by the number or relatives and friends who have awareness about the topic

(Nigatu and Demissie, 2014; Randy and Combie; 1991) and by altruism (Yuan *et al*., 2011), while the greatest deterrents are fear, unsuitability, disinformation and inconvenient donation locations (Ngoma *et al*., 2013; Yuan *et al*., 2011). These studies, however (1) besides a few exceptions, did not look at the students' specific courses of study and (2) do not make comparisons between the various courses of study. We can presume that students in different academic disciplines for which the topic of blood donation is more or less germane would have different attitudes, knowledge and behaviors. For example, students in health majors could be assumed to have greater motivations, knowledge and desire to learn about donation - and even to donate - than other students studying subjects unrelated to healthcare: The former, in fact, should have greater knowledge about the world of donation, feel more confident around blood as well as around the use of medical devices (e.g., needles), have less fear of contracting diseases through blood donation and, in general, have more familiarity with the hospital environment. In sum, students in health-related majors should be less susceptible to experiencing what the literature has clearly delineated as the barriers to donation (Gillespie and Hillyer, 2002; Lemmens *et al*., 2009; Misje *et al*., 2005). Some recent research has focused on students of medicine and scientific-health disciplines have shown that a good knowledge about blood donation does not guarantee that one will actually donate blood (Amatya *et al*., 2013; Papagiannis *et al*., 2005; Zeeshan *et al*., 2014). Students in health-related disciplines donate more frequently than students in other academic areas (Mane & Kolte, 2014; Nwabueze *et al*., 2014), yet the total percentage remains well under the average for other age brackets. This indicates a gap between theoretical knowledge (what donation is from a scientific and practical perspective) and the act of donating, understood as a practical experience and an emotional life event. Suitable programs to recruit new donors are needed to reduce this gap (Alfieri *et al*., 2013; Eser *et al*., 2010; Jovanovic-Srzentic *et al*., 2015; Moog and Fourne, 2007): Only awareness raising programs created *ad hoc* and offered in work or educational contexts, as in the case of university students, actually increase the number of new and loyal donors (Guiddi *et al*., 2015). Clearer understanding of factors that promote (motivators) and deter (barriers) blood donation may help the agencies that deal with recruitment and retention of donors create more effective messages and thus continue to guarantee the availability of blood in hospitals.

The aim of the present work is to investigate and provide evidence of similarities and divergences between students studying different majors. Specifically, the following will be investigated and compared within the groups of participants:

1. Propensity to donate (aim1)
2. Knowledge about donation (aim 2)
3. Factors that can sustain donation (aim 3)
4. Factors that can deter donation (aim 4)
5. The relation between professional sphere and the world of donation (aim 5)

In particular, in the present work three academic majors will be referenced: Nursing, Psychology and Economics. The first was chosen for its professional relevance to donation; the second for its relevance to the helping relationship, in general; finally, the third was chosen because, although it would appear to have a less direct relationship with donation, in recent years the field of economics has witnessed the increasing popularity of trends such as the sharing economy and the economy of solidarity, which focus on the dimension of giving in its different forms.

Moreover, an aim of the present work is to probe the differences between the donor and non-donor in terms of the variables indicated.

Materials and Methods

Participants

A large multifocal cross-sectional study was carried out in five Italian universities between October, 2015 and December, 2015. 1,842 students filled out the questionnaire: 60.3% attend a university in northern Italy and 39.7% in central Italy. 78.3% are females and the mean age is 23.27 years (Range 19-55, SD = 5.04). Recruitment of participants took place in the undergraduate academic programs of Nursing (33.3%), Psychology (42.5%) and Economics (24.2%). 25.8% stated they were in the second year of their major, 24.8% the third, 17.2% the first, 15.0% the fifth (or the second year of a specialist degree), 12.5% the fourth (or the first year of a specialist degree), 4.4% were not enrolled in classes, 0.4% were involved in a post-degree internship. 66.2% of participants had completed a high school diploma, 30.9% the first level Bachelor's degree, 1.9% the first level Master's degree, 0.8% the Bachelor's degree in education and the remaining 0.1% the second level Master's degree. The majority of students stated that they were Italian nationals (97.8%).

The study was approved by the University Ethical Committee of the coordinating center of Università Cattolica del Sacro Cuore.

Materials

The questionnaire is comprised of 22 sets of items that aimed to probe:

Propensity to Donate

The propensity to donate was investigated through three ad hoc items: "*Have you ever donated blood?*" (1 =

Yes; 2 = No), "*If you answered yes, how many times?*" (Response possibilities from 1 = 1 to 5 = five or more), "*If you never donated blood, do you intend to do so in the future?*" (from 1 = Not at all to 5 = Certainly).

Knowledge about Donation

10 *ad hoc* items were created in which students were asked to answer how much they knew about several aspects considered to be important (for ex., "*Selling or marketing blood is illegal*") (1 = I didn't know that; 2 = I've heard that, but I wasn't sure; 3 = I knew that). The participants were also asked to respond to a 5-Likert scale item already used in literature (1 = Not at all; 5 = A lot). "*How much have you heard about blood donation through the following channels?*" followed by a list of the most popular information channels.

Factors that Can Promote Donation

3 items from Zito *et al*. (2012) with a 5-Likert scale response modality (response range from 1 = Not at all to 5 = A lot): "*In your opinion, how effective are these communication media in informing you about blood donation?*"; "*These are the elements that a publicity campaign on blood donation could have. How suitable and useful are they, in your opinion?*"; "*What type of information about donation would be/has been important for you to have?*"

Barriers to Donation

Two items from Zito *et al*. (2012): "*What is the practical barrier you think you would encounter/you have encountered?*"; "*What reasons of an emotional nature would prevent you personally from going to donate blood?*" The first item is formulated both for those who have never donated as well as for those who have; the second is reserved only for those who have never donated. The participants could respond on a scale from 1 = Not at all to 5 = Very much.

Relationship between Professional Sphere and World of Donation

To probe to what extent the students think that a relationship exists between the professional that they will become as a result of their university major and blood donation, 4 *ad hoc* items were created (for ex., "*How much do you think that the professional you will become one day and for which you are studying is obliged more than other people to care about blood donation?*") on a scale from 1 = Not at all to 5 = A lot.

Statistical analysis

For the categorical variables, percentages (%) were calculated while for the continuous variables the Means (M) and Standard Deviations (SD) were calculated.

Moreover, we compared responses between the majors under consideration and between donors and non-donors. For these comparisons, when interval scale items were used, an Analysis of Variance (ANOVA, indicated with the letter F) was performed: This is a statistical procedure that allows one to ascertain whether there are statistically significant differences (indicated with the letter *p*) in the response means between the groups considered. To ascertain between which groups statistically significant differences emerged, *post-hoc* tests were calculated with the Bonferroni method, for which the statistical significance (p) is also reported. In the case that the items had a categorical response modality, the chi-squared test was used (indicated with the symbol χ^2).

Results

Aim 1: Propensity to Donate

As to the first aim, which set out to investigate the propensity to donate in the three majors investigated, only 24.5% of the participants stated that they had donated blood at least once. Of these, the Nursing students report that they donated most frequently compared to the students in the Psychology and Economics majors, χ^2 (2) = 63.28, p<0.001. On the other hand, no statistically significant differences emerge between the majors as regards number of donations, Economics: M = 3.21, SD = 1.69; Nursing: M = 3.17, SD = 1.59; Psychology M = 2.94, SD = 1.60, F (2,365) = 0.90, p = ns (Table 1).

Among those who never donated, the Nursing students (M = 2.32, SD = 1.19) are the ones who, on average, state that they have the most intention of doing so compared to the students in the other two majors (Psychology: M = 1.93, SD = 1.20; Economics: M = 1.84, SD = 1.17), F (2, 1403) = 26.33, p<0.001). In fact, the *post-hoc* tests reveal statistically significant differences between the students in the Nursing major and the other two majors (p<0.001), but not between the Psychology and Economics majors.

Aim 2: Knowledge about Donation

The second aim was to investigate what the students in the different majors knew about donation; as regards the variables having to do with knowledge about donation, statistically significant differences emerge in general between donors and non-donors in that donors, predictably, usually perceive that they know more than non-donors ["Anyone who donates blood is entitled to take time off from work (even if the work is atypical) and will receive his/her regular compensation": χ^2 (2) = 76.134, p<0.001; "People between the ages of 18 and 65 can donate": χ^2 (2) = 58.85, p <0.001; "To donate blood, you must weigh at least 50 kg": χ^2 (2) = 84.47, p <0.001;

"You donate blood in the morning": χ^2 (2) = 39.08, p<0.001; "After the donation, a free meal or breakfast is offered": χ^2 (2) = 106.46, p<0.001; "Suitability to donate is established through a medical exam and parameters established by law": χ^2 (2) = 12.44, p<0.01; "Subjects with one or more of the following cannot become donors: addiction (drugs, alcohol), illnesses transmittable through blood (positive AIDS test, syphilis, Hepatitis B and C), pathologies that require the continuous use of medications": χ^2 (2) = 6.19, p<0.05; "Subjects are temporarily suspended from donation when: they have an ongoing illness, they had surgery or a blood transfusion, they had received a tattoo, they used psychotropic drugs even only occasionally, they had engaged in casual sex, they had traveled in zones where epidemics were ongoing, etc.": χ^2 (2) = 40.83, p<0.001]. Differences between donors and non-donors do not emerge for the variable: "It is illegal to sell or market blood."

As regards the three majors, statistically significant differences emerge for all the items investigated and for each of these, the Nursing students perceive that they have more information about the topic of donation. "It is illegal to sell or market blood": χ^2 (4) = 35.22, p<0.001; "The blood necessary for transfusions can only be donated by donors": χ^2 (4) = 61.86, p<0.001; "Anyone who donates blood is entitled to take time off from work (even if the work is atypical) and will receive his/her regular compensation": χ^2 (4) = 52.13, p<0.001; "People between the ages of 18 and 65 can donate": χ^2 (4) = 83.64, p<0.001; "To donate blood, you must weigh at least 50 kg": χ^2 (4) = 86.63, p<0.001; "You donate blood in the morning": χ^2 (4) = 42.19, p<0.001; "After the donation, a free meal or breakfast is offered": χ^2 (4) = 50.21, p<0.001; "Suitability to donate is established through a medical exam and parameters established by law": χ^2 (4) = 34.16, p<0.001; "Subjects with one or more of the following cannot become donors: addiction (drugs, alcohol), illnesses transmittable through blood (positive AIDS test, syphilis, Hepatitis B and C), pathologies that require the continuous use of medications": χ^2 (4) = 19.26, p<0.001; "Subjects are temporarily suspended from donation when: They have an ongoing illness, they had surgery or a blood transfusion, they had received a tattoo, they used psychotropic drugs even only occasionally, they had engaged in casual sex, they had traveled in zones where epidemics were ongoing, etc.": χ^2 (4) = 13.10, p<0.05. Table 2 show the response percentages for some item divided by the university majors and between participants who stated they donated at least once and those who never donated.

Table 1: Percentages divided by majors for number of donations carried out

	Nursing	Psychology	Economics
Have you ever donated blood? [χ^2 (8) = 4.23, p = <0.001]			
Yes	34.8%	18.6%	15.0%
No	65.2%	81.4%	85.0%
If yes, how many times? [χ^2 (8) = 4.23, p = ns]			
One time	21.1%	27.4%	26.3%
Two times	20.5%	19.4%	14.0%
Three times	13.5%	14.5%	12.3%
Four times	9.7%	8.9%	7.0%
Five times or more	35.1%	29.8%	40.4%

Table 2: Response percentages for each item divided by the university majors and between participants who stated they donated at least once and those who never donated

		Nursing		Psychology		Economics	
		Donors	Non-donors	Donors	Non-donors	Donors	Non-donors
It is illegal to sell or market blood.	I didn't know that	2.2%	2.0%	5.6%	7.1%	1.8%	1.5%
	I heard about that, but I wasn't sure	8.1%	6.4%	9.5%	12.3%	7.0%	12.5%
	I knew that	89.7%	91.6%	84.9%	80.6%	91.2%	86.0%
	Donors Vs Non-donors: χ^2 (2) = 1.95, p = ns						
	Faculty: χ^2 (4) = 35.22, p<0.001						
The blood necessary for transfusions can only be donated by donors.	I didn't know that	3.3%	3.2%	8.7%	9.6%	5.3%	7.7%
	I heard about that, but I wasn't sure	12.5%	10.7%	17.5%	24.4%	21.1%	26.1%
	I knew that	84.2%	86.1%	73.8%	66.0%	73.7%	66.3%
	Donors Vs Non-donors: χ^2 (2) = 7.10, p<0.05						
	Faculty: χ^2 (4) = 61.86, p<0.001						

Table 3: Means and standard deviations divided by the university majors and the associated results of the ANOVA for each item investigated

	How much have you heard about blood donation through the following channels? (Response range: 1-5)			
	Nursing M (SD)	Psychology M (SD)	Economics M (SD)	
Television/radio	2.23 (0.90)	2.38 (0.93)	2.39 (0.94)	F (2,1595) = 4.49, p<0.05
Newspapers/magazines	2.15 (0.84)	2.22 (0.84)	2.18 (0.85)	F (2,1595) = 1.25, p = ns
Billboards/pamphlets/fliers	2.99 (0.91)	3.07 (0.93)	2.89 (0.99)	F (2,1591) = 4.46, p<0.05
University lessons	2.90 (1.12)	1.62 (0.79)	1.37 (0.67)	F (2,1591) = 427.49, p<0.001
Participation in seminars	2.11 (1.03)	1.49 (0.79)	1.36 (0.70)	F (2,1586) = 109.03, p<0.001
Word of mouth (friends/ family members/acquaintances)	3.39 (0.99)	3.69 (0.97)	3.42 (1.04)	F (2,1585) = 16.03, p<0.001

As regards the information channels through which the students had heard about donation, the *post-hoc* tests reveal a statistically significant difference between the Nursing major and the other two majors for the item "television/radio" (p<0.05), "university lessons" (p<0.001) and "seminars" (p<0.001). The greatest discrepancy between one major and another one is found for the item "university lessons" and "seminars," which were indicated more often by the Nursing students compared to the students in the other two majors; these students also state that they had heard about blood donation from "television/radio" more often, with less variance compared to the other two majors. The Psychology students differentiate themselves from both other majors (p<0.05) for the item "word of mouth" (p<0.001), stating that they had heard about donation through this channel more than the students in the two majors; they differentiate themselves from the Economics students only as regards "billboards/pamphlets/fliers (p<0.01), selecting this item more often than the students in the other two majors do (p<0.05). Table 3 shows the means and standard deviations divided by the university majors with the associated results of the analysis of variance for each item investigated.

Aim 3: Factors that Can Promote Donation

As regards the third aim, which set out to investigate factors that can support donation, the *post-hoc* tests reveal statistically significant differences between the Economics major and the other two majors regarding the efficacy of communication media in spreading information about blood donation (p<0.001) for "meetings/lessons with university experts," "TV/radio programs," and "discussing with someone who has donated blood" in that the students in the Economics major are less interested in these aspects. Moreover, a statistically significant difference emerges between students in the Nursing major and the other two majors for "internet" (p<0.001) in that it is the Nursing students' preferred medium. Regarding the elements that a publicity campaign must have to be effective, the *post-hoc* tests reveal specific preferences in the three majors: The Nursing students differentiate themselves from students studying Economics in that they prefer "Bright colors" (p<0.001), "Photos of one or more donors" (p<0.001) and "Character from a comic strip/cartoon" (p<0.001) while the Economics students prefer "Pleasant images (scenic views, parties, etc.)." On the other hand, a difference emerges between the Psychology and Economics majors regarding "Message that makes me reflect" (p<0.01) in that the former students chose it more than the latter ones. The Economics students obtain the lowest values for "Catchy slogan" (p<0.001), differentiating themselves both from the Psychology and the Nursing students. Concerning information that the students perceive to be useful, the *post-hoc* tests reveal that the students in the Nursing major differentiate themselves in a statistically significant way from the other two student typologies as regards "technical information" (p<0.001) where they obtain the highest means. Differences between all the majors investigated emerge for "practical" information (p<0.001), which is chosen most often by the Nursing students, followed by those in Psychology and then by those in Economics. On the other hand, the Economics major differentiates itself from the other two majors in that it obtains the lowest means for information about "experiences" (p<0.001) and for "physical information" (p<0.001). Finally, Psychology differentiates itself from the other two majors in that it obtains the lowest means for "concrete advantages" (p<0.001). Table 1*S* shows the means and standard deviations divided by the university majors with the associated results of the analysis of variance for each item investigated.

Aim 4: Barriers to Donation

Regarding the fourth aim, having to do with the barriers the university students thought they would encounter (if they never donated) or encountered (if they already donated), the *post-hoc* tests reveal a statistically significant difference between the Nursing and Psychology majors compared to Economics for "Donation center far away or difficult to reach" (p<0.05) and "religion" (p<0.05) in that the students studying Economics obtain higher means compared to the other two majors; on the other hand, as regards "no barrier" (p<0.01) the Nursing students obtain the highest means. The Nursing students differentiate

themselves from those in Economics (while those in the Psychology major do not differentiate themselves from either) for the item "Not knowing how it works" (p<0.05) in that the latter obtain higher means than the former. However, the Psychology major differs from the other two for "not having time" (p<0.001) in that the Psychology students obtain lower means than students in the other two majors. Statistically significant differences do not emerge, instead, between the three majors for "Not suitable for life style/characteristics."

Regarding barriers of an emotional nature, on the other hand, the *post-hoc* tests reveal a statistically significant difference between the Nursing major and the other two majors for fear of needles (p<0.001), of blood (p<0.001), of feeling ill (p<0.001) and of the unknown (p<0.001) in that the Nursing students obtain decidedly lower means for these fears compared to the other two majors. However, the Nursing and Psychology majors differentiate themselves from Economics for fear of discovering that something is wrong (health), for which the Economics students obtain higher means than the other two majors (p<0.001). Finally, all the majors differ from one another in that students studying Economics obtain the highest means, Nursing students the lowest and Psychology students are in the middle as concerns the fear of contracting an illness (p<0.001) and mistrust of hospitals (p<0.001). Table 4 shows the means and standard deviations divided by the university majors with the associated results of the analysis of variance for each item investigated.

Table 4: Means and Standard Deviations divided by the university majors and the associated results of the ANOVA for each item investigated

	What is the practical barrier you think you would encounter/you have encountered? (Response range: 1-5)			
	Nursing M (SD)	Psychology M (SD)	Economics M (SD)	
Not knowing how it works (hours, location, what to do)	2.42 (1.15)	2.46 (1.16)	2.62 (1.08)	F (2,1587) = 3.56, p<0.05
Not having time; it's one more thing to schedule	2.51 (1.17)	2.28 (1.06)	2.50 (1.01)	F (2,1583) = 8.14, p<0.001
Blood donation center far away or difficult to reach	2.31 (1.16)	2.27 (1.07)	2.51 (1.07)	F (2,1578) = 6.41, p<0.01
Not suitable for life style/characteristics	2.30 (1.42)	2.24 (1.39)	2.44 (1.37)	F (2,1578) = 2.47, p = ns
My religion forbids it	1.15 (0.51)	1.10 (0.37)	1.23 (0.67)	F (2,1522) = 9.27, p<0.001
No barrier	2.37 (1.45)	2.23 (1.30)	2.05 (1.32)	F (2,1458) = 5.89, p<0.01
Fear of needles	1.63 (1.09)	2.53 (1.51)	2.47 (1.53)	F (2,1302) = 52.90, p<0.001
Fear of blood	1.22 (0.59)	2.13 (1.33)	2.07 (1.28)	F (2,1302) = 79.56, p<0.001
Fear of feeling ill/fainting	1.82 (1.19)	2.53 (1.38)	2.36 (1.38)	F (2,1301) = 33.92, p<0.001
Fear of discovering that something is wrong (health)	1.84 (1.05)	1.96 (1.03)	2.16 (1.23)	F (2,1279) = 7.72, p<0.001
Fear of contracting an illness	1.71 (1.03)	1.88 (0.99)	2.09 (1.18)	F (2,1295) = 11.53, p<0.001
Fear of the unknown	1.63 (0.94)	1.93 (1.03)	2.03 (1.22)	F (2,1295) = 15.53, p<0.001
Mistrust of hospitals	1.54 (0.82)	1.78 (0.93)	2.10 (1.22)	F (2,1297) = 29.73, p<0.001

Table 5: Means and standard deviations divided by the University majors and the associated results of the ANOVA for each item investigated

How much do you think that… (response range: 1-5)	Nursing M (SD)	Psychology M (SD)	Economics M (SD)	
… the professional figure that you will become one day and for which you are studying has an obligation more than others to care about blood donation?	4.24(0.87)	2.92(0.94)	2.08(0.84)	F (2,1592) = 691.05, p<0.001
… the values of blood donation are coherent with the professional figure that you will become and for which you are studying?	4.21(0.83)	3.05(0.97)	2.06(0.83)	F (2,1591) = 661.23, p<0.001
… the professional figure that you will become and for which you are studying will influence your choice to become a blood donor someday?	3.63(1.23)	2.49(0.95)	1.82(0.72)	F (2,1583) = 381.37, p<0.001
… the professional figure that you will become and for which you are studying is important from an educational point of view for blood donation?	4.26(0.83)	3.15(0.96)	2.05(0.83)	F (2,1573) = 689.04, p<0.001

Aim 5: Relationship between one's Major and Propensity to Donate

Finally, as concerns the last aim - to investigate the relationship between major and the propensity to donate - the *post-hoc* tests reveal statistically significant differences between all the majors considered (p<0.001): In general, the Nursing major obtains the highest means, Economics the lowest and Psychology occupies a position between the two. Table 5 shows the means and standard deviations divided by the majors with the associated results of the analyses of variance for each item investigated.

Discussion

Only a small percentage of students (24.5%) stated that they had donated at least once, in line with researches that point out that youth in general donate very little (IG, 2016). The potential of these young people to become blood donors thus remains unexpressed. Unexpectedly, the Nursing students had not carried out more donations than the others: Their numbers do not differ in a statistically significant way from the students studying Economics and Psychology, as has been highlighted by other research concentrated on students in health-related disciplines (Mane and Kolte, 2014; Nwabueze *et al*., 2014). In concordance with previous research, the Nursing students have greater awareness about the topic of blood donation, perceive needles and hospitals as less threatening, thus having had more opportunities to donate. They do not, however, distinguish themselves from the other students as regards number of donations: Therefore, also in our sampling, a good knowledge about blood donation does not guarantee a greater frequency of donation (Amatya *et al*., 2013; Papagiannis *et al*., 2005; Zeeshan *et al*., 2014). The Nursing students state most frequently that they donated only once, probably with the idea of "proving" the experience without, however, continuing it. They are also the students who obtain the highest means on intention to donate.

Moreover, compared to students in the other majors, the Nursing students state on average that they heard about donation at the university and had taken seminars in addition to hearing messages about donation broadcast on television/radio. The Psychology students, in contrast, heard about donation mostly through word of mouth an billboards/pamphlets/fliers. Probably the Psychology students, either due to the representation that they have of themselves or the tools of their discipline acquired over the course of their studies (such as listening), are more in tune with the oral, direct aspect of disseminating information or, more generally, pay greater attention to activities that "help others." As regards ways of conveying messages about donation seen to be effective, it turned out that the opportunity to discuss with someone who had already donated was greatly appreciated while, independently of the student's major, information booths in public do not seem to be effective. Moreover, also independently of major, the students believe that a publicity campaign must have a message that makes people reflect and is simple and clear, although the Nursing and Psychology students believe that these aspects are more important than the Economics students do.

In general, practical information is seen to be most important independently of one's major, although, also in this case, the Nursing students judge this aspect to be more important than the other students do. Technical aspects are also thought to be more important by the Nursing students compared to the other students. Probably the technical aspects are also those that are most interesting to these students given their major. For the Psychology students, instead, after the above mentioned technical aspects, experiential and physical aspects also turn out to be useful. In this case also, since the Psychology major is based on aspects such as acknowledging one's own and others' emotions as well as on empathy, one could surmise that these students are more sensitive to emotions. The Economics students, instead, judge experiential and technical information, as well as physical information, to be of equal importance and in second place after practical information.

Concrete advantages are at the bottom of the priorities for all the students, although they turn out to be more important for those in the Nursing major and less so for those in Psychology.

As regards barriers, the Economics students generally perceive more barriers to donation while those in Nursing perceive fewer. The factor felt most by all the students is not knowing how it works and the Economics students, in particular, underscore the importance of this aspect, probably because they have the least awareness about this topic and receive the least information about donation in their course work. Not having time is also felt to be a barrier, especially by the Nursing and Economics students but less so by those studying Psychology. The Economics students also perceive as barriers a distant or inconveniently located donation center as well as fear that donation is not suitable due to their life style or characteristics. Religion, on the other hand, does not seem to be a barrier, probably because most of the respondents are Roman Catholic (the predominant religion in Italy), which does not place restrictions on blood donation. As regards emotional factors that can hinder donation, the Nursing students say they have on average fewer "fears" in general, in a statistically significant way. The Psychology and Economics students, instead, report higher levels of fears and, in particular, fear of needles, of feeling ill/fainting, of blood, followed by lower means

for fear of the unknown and mistrust of hospitals. The Economics students, moreover, also obtain high means for fear of discovering that something is wrong (coherently with what was expressed in the previous response) and of contracting an illness. Finally, as pertains to the relationship between professional sphere and the world of donation, the Nursing students obtain the highest means independently of the item, thus perceiving more than the other students that they feel obliged to be concerned about the topic of donation and its importance from the educational and values standpoint and affirming that their future profession will influence their desire to donate blood. The Economics students feel that the world of donation is the farthest from their future profession while the Psychology students occupy an intermediate position.

Conclusion

The present work shows the presence of clear differences between students enrolled in different undergraduate majors for most of the aspects investigated: Propensity to donate, knowledge, motivations, barriers and the act of blood donation itself. These differences in knowledge and propensities underscore the necessity of evaluating formative/informative programs in relation to the target group in order to achieve maximum efficacy in interventions and to numerically increase donors of blood and blood products. If, on the one hand, students could be grouped according to their status as university students and can thus be reached and made aware through actions and projects closer to the university world, on the other hand, there are substantial and specific differences connected to their course of study that could lead the designers of projects for new donor recruitment toward modalities that are more effective and suitable to the sub-target groups. For example, advertising campaigns or training sessions in the various faculties could take into consideration the following.

For the Nursing faculty: The first aspect that the present work reveals is that, although the Nursing students should not only have more "awareness" of the topic of donation but should also be less susceptible to fears concerning the use of needles, blood and the hospital context, unexpectedly, they do not donate more than the other students. Clearly, these students do not take the next step toward action and this finding merits more in-depth investigation in future. Perhaps the Nursing students consider the hospital context only as a space for learning and work and not a context where one can voluntarily act to help others; or they are so involved in the hospital context that they prefer to find other spaces for donating their time and resources. In this regard, it would be interesting to investigate whether these students engage in other volunteer activities. The question of whether the hospital environment of medical and nursing professionals is more or less stimulating in terms of blood donation remains open: A structured request from donation centers and from donor associations addressed to hospital personnel, both those in training (students and internists) and employees, could be the solution for bringing their attention back to the act of blood donation as another way that these professionals can foster other people's and their own well-being.

For the faculty of Economics: The Economics students are generally those who have received the least information about donation, have the least interest in it and the least awareness about it and stand out for their concern about the impossibility of donating for reasons connected to health. For these students, we can hypothesize interventions based on information about the possibility of keeping track of one's health through regular donation. In fact, in Italy, as in many other countries, most organizations tasked with collecting blood provide free documentation of tests performed on blood. Awareness raising campaigns aimed at this target group should also focus on aspects connected to optimizing time and making it easy to reach collection sites. Moreover, where possible and following a realistic assessment of intention to donate, mobile blood donation centers could also be positioned near university campuses.

For the faculty of Psychology: The Psychology students position themselves in between the Nursing and Economics students. A targeted intervention could take advantage of their propensity to prefer dialogue and reflection (word of mouth, messages that make one reflect, etc.) by proposing interactive seminars and presentations of donors' experiences and real life situations, for example, whether in person or through video-interviews, with particular emphasis on narratives of life experiences and motivations.

Limitations and Future Developments

The present work shows some limitations that may be kept in consideration for future developments. In the first place, as already mentioned, a limitation could be imputed to the choice of the item that investigates perception of knowledge about blood donation. The Nursing students turn out to perceive themselves as more competent compared to the other students for all the items investigated, but this finding could be invalidated by social desirability – that is, by the desire to respond in a socially acceptable way and/or according to how participants think the researcher wants them to respond – in that they "must" show they

know the topic. It could be useful in the future to offer multiple-choice questions that directly investigate the skills of these students (i.e., *"What is the maximum number of times per year that a woman can donate blood in Italy?"* for which they must choose between the following possible answers: 1. Maximum two times; 2. Three times maximum; 3. Four times maximum; 4. There is no maximum limit) without necessarily asking them if they feel competent.

A second aspect to keep under consideration is the exclusive use of single items in the present research. Despite some evidence of the validity of using single items also for complex constructs (for example see Sandvik *et al*., 1993 for subjective well-being), these results have not been extended to the study of blood. However, it is appropriate to consider that to date there are no known instruments validated in the Italian language that consent investigating the aspects object of interest of the present work. Therefore it is opportune that researchers handling the topic of blood donation develop reliable instruments and in the language in which the research is being conducted.

A third limitation has to do with the choice to consider only three majors: Nursing, Psychology and Economics. It would be useful to be able to gather information about other professions as well, such as lawyer, engineer, doctor, or social worker, in order to have a more multifaceted picture of Italian students.

Finally, another aspect that we believe is a limitation is that we did not probe if and to what extent the students interviewed had participated in awareness raising programs or education about the topic of blood donation: This would have allowed us to detect whether there is a relationship between propensity to donate or number of donations and awareness raising programs. For example, we could hypothesize that the students who have attended such programs not only have more propensity to donate, but were already acquainted with the world of donation. Further research could investigate additional undergraduate majors, both in health and non-health fields, in order to have a more comprehensive and representative picture of the entire range of Italian university students and to translate results into effective and persuasive messages for each target group identified.

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Author's Contributions

Sara Alfieri: She conceived and designed the research project and the paper, performed the questionnaire, collected and analyzed the data, wrote the Introduction, Material and Method, Result sections.

Elena Zito: She conceived and designed the research project and the paper, performed the questionnaire, collected the data, wrote the Introduction and Conclusion sections.

Valentina Simonetti: She collected the data, conceived and wrote the Introduction and Discussion sections.

Elena Marta: She conceived and designed the research project and wrote the Introduction and Discussion sections.

Dania Comparcini: She collected the data, conceived and wrote the Introduction and Discussion sections.

Giancarlo Cicolini: He designed the paper, wrote the Introduction and Discussion sections.

Maura Pozzi: She reviewed the paper.

Ethics

We have declared that no competing interest exists

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Table 1: Supplementary - Means and Standard Deviations divided by the university majors and the associated results of the ANOVA for each item investigated

In your opinion, how effective are these communication media in informing you about blood donation? (response range: 1-5)	Nursing M (SD)	Psychology M (SD)	Economics M (SD)	
Meetings/lessons with university experts	3.39(0.86)	3.35(0.81)	3.13(0.92)	F (2,1595) = 10.88, p<0.001
Information booth in public	2.84(0.94)	2.69(0.98)	2.72(1.08)	F (2,1590) = 1.75, p = ns
TV/radio programs	3.32(0.98)	3.19(0.92)	2.97(0.98)	F (2,1592) = 14.93, p<0.001
Billboards/fliers/radio	3.24(0.89)	3.25(0.94)	3.14(0.99)	F (2,1594) = 1.92, p = ns
Internet	3.64(0.93)	3.35(0.98)	3.26(1.00)	F (2,1572) = 21.23, p<0.001
Discussing with someone who has donated blood	4.16(0.85)	4.16(0.86)	3.88(1.02)	F (2,1588) = 13.96, p<0.001
These are the elements that a publicity campaign on blood donation could have. How suitable and useful are they, in your opinion? (response range: 1-5)				
Famous soccer player/singer	2.51(1.17)	2.56(1.10)	2.67(1.17)	F (2,1590) = 2.13, p = ns
Message that makes me reflect	3.85(0.89)	3.88(0.81)	3.71(0.91)	F (2,1593) = 5.01, p<0.01
Photo of an attractive boy/an attractive girl	1.95(0.96)	1.94(0.88)	1.89(0.96)	F (2,1596) = 0.55, p = ns
Bright colors	2.84(1.07)	2.74(0.96)	2.42(1.04)	F (2,1585) = 19.63, p<0.001
Photo of one or more donors	3.32(1.02)	3.22(0.99)	2.95(1.02)	F (2,1593) = 15.74, p<0.001
Catchy slogan	3.31(1.00)	3.13(0.92)	2.90(0.97)	F (2,1591) = 20.15, p<0.001
Famous person who donated blood	2.77(1.14)	2.84(1.10)	2.82(1.13)	F (2,1587) = 9.67, p = ns
Simple and clear message	3.91(0.87)	3.67(0.90)	3.42(1.00)	F (2,1587) = 31.77, p<0.001
Pleasant images (scenic views, parties, etc.)	2.68(1.04)	2.49(1.06)	2.39(1.05)	F (2,1502) = 8.92, p<0.01
Character from a comic strip/cartoon	2.49(1.05)	2.31(1.04)	2.19(1.00)	F (2,1577) = 10.00, p<0.001
What type of information about donation would be/has been important for you to have? (response range: 1-5)				
Practical: where, how, and when	4.02(0.77)	3.85(0.91)	3.60(0.95)	F (2,1591) = 25.35, p<0.001
Experiences: other people's emotions, testimonials	3.71(0.92)	3.76(0.89)	3.44(0.96)	F (2,1588) = 15.89, p<0.001
Physical: what you feel, how you are	3.60(1.00)	3.58(1.02)	3.41(1.03)	F (2,1579) = 4.52, p<0.05
Concrete advantages: tributes, acknowledgements	2.76(1.15)	2.40(1.06)	2.60(1.12)	F (2,1588) = 15.87, p<0.001
Technical: how much blood is drawn, analyses, conservation	3.81(0.93)	3.49(1.03)	3.44(1.04)	F (2,1588) = 20.81, p<0.001