World Journal of Gastroenterology

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DOI: 10.3748/wjg.v22.i25.5800

World J Gastroenterol 2016 July 7; 22(25): 5800-5813
ISSN 1007-9327 (print) ISSN 2219-2840 (online)

ORIGINAL ARTICLE

Observational Study

Acceptance of living liver donation among medical students: A multicenter stratified study from Spain

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Author contributions: Ríos A designed the study; Ríos A, López-Navas AI, López-López AI, Ayala MA, Ramírez P and Parrilla P analyzed and interpreted the data; Ríos A and López-Navas AI contributed to statistical expertise, drafted the manuscript, and supervised this program; Ríos A, López-Navas AI, Ayala MA, Ramírez P and Parrilla P critically revised the manuscript for important intellectual content; all authors contributed to acquisition of a substantial portion of data, obtaining funding for this project or study, and final approval of the version to be published.

Institutional review board statement: The study was reviewed and approved by the "Proyecto Colaborativo Internacional Donante" Institutional Review Board.

Informed consent statement: All study participants provided informed verbal consent prior to study enrollment.

Conflict-of-interest statement: All authors declared that there is no conflict of interest to disclose.

Data sharing statement: No additional data are available.

Manuscript source: Invited manuscript

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Received: February 16, 2016
Peer-review started: February 17, 2016
First decision: March 21, 2016
Revised: May 8, 2016
Accepted: June 15, 2016
Article in press: June 15, 2016
Published online: July 7, 2016

Abstract

AIM: To analyze the attitude of Spanish medical students toward living liver donation (LLD) and to establish which factors have an influence on this attitude.

METHODS: Study type: A sociological, interdisciplinary, multicenter and observational study. Study population: Medical students enrolled in Spain (n = 34000) in the university academic year 2010-2011. Sample size: A sample of 9598 students stratified by geographical area and academic year. Instrument used to measure attitude: A validated questionnaire (PCID-DVH RIOS) was self-administered and completed anonymously. Data collection procedure: Randomly selected medical schools. The questionnaire was applied to each academic year at compulsory sessions. Statistical analysis: Student´s t test, χ^2 test and logistic regression analysis.

RESULTS: The completion rate was 95.7% (n = 9275). 89% (n = 8258) were in favor of related LLD, and 32% (n = 2937) supported unrelated LLD. The following variables were associated with having a more favorable attitude: (1) age (P = 0.008); (2) sex (P < 0.001); (3) academic year (P < 0.001); (4) geographical area (P = 0.013); (5) believing in the possibility of needing a transplant oneself in the future (P < 0.001); (6) attitude toward deceased donation (P < 0.001); (7) attitude toward living kidney donation (P < 0.001); (8) acceptance of a donated liver segment from a family member if one were needed (P < 0.001); (9) having discussed the subject with one's family (P < 0.001) and friends (P < 0.001); (10) a partner's opinion about the subject (P < 0.001); (11) carrying out activities of an altruistic nature; and (12) fear of the possible mutilation of the body after donation (P < 0.001).

CONCLUSION: Spanish medical students have a favorable attitude toward LLD.

Key words: Attitude; Living liver donation; Medical students; Transplantation; Organ donation; Psychosocial variables; Spain

Core tip: Students of medicine represent a new generation of physicians, although their attitude towards living liver donation (LLD) has not been studied to any great extent, and most of the studies carried out use measurement tools that have not been validated. The objective of the authors was to analyze the

attitude of Spanish medical students towards LLD. The project is a sociological, interdisciplinary, multicentre and observational study. A sample of 9598 students is stratified by geographical area and academic year. The instrument is a validated questionnaire (PCID-DVH RIOS) it was self-administered and completed anonymously.

Ríos A, López-Navas AI, López-López AI, Gómez FJ, Iriarte J, Herruzo R, Blanco G, Llorca FJ, Asunsolo A, Sánchez-Gallegos P, Gutiérrez PR, Fernández A, de Jesús MT, Martínez-Alarcón L, Lana A, Fuentes L, Hernández JR, Virseda J, Yelamos J, Bondía JA, Hernández AM, Ayala MA, Ramírez P, Parrilla P. Acceptance of living liver donation among medical students: A multicenter stratified study from Spain. *World J Gastroenterol* 2016; 22(25): 5800-5813 Available from: URL: http://www.wjgnet.com/1007-9327/full/v22/i25/5800.htm DOI: http://dx.doi.org/10.3748/wjg.v22.i25.5800

INTRODUCTION

Liver transplantation offers long survival periods and improved quality of life for patients with liver disease whose vital prognosis is short if they do not have a transplant. However, the current transplant organ donation rates are insufficient for covering minimum transplant needs[1], and the shortage of available livers means that mortality on the waiting list is increasing[1]. Even in Spain in the 21st Century, the country with the highest donation rates, mortality on the liver transplant waiting list has been increasing[1]. All of this is making it necessary to encourage alternatives to deceased liver donation. The transplantation of the right liver lobe from a living donor to an adult recipient has been successfully carried out and in countries such as Japan, the United States and some European countries it is becoming more common[2,3]. Even so, in many countries living liver donation (LLD) is at a very low level[1]. One of the possible barriers to its development could be the risk involved for the donor and the fact that the results of the transplant are slightly worse than when the liver is transplanted from a deceased donor[4,5]. However, in experienced centers the results are acceptable[6,7]. Nevertheless, it should be taken into account that professionals in healthcare centers do not always have a favorable attitude toward LLD, and consequently they do not create the right kind of social climate for its implementation[8-10]. Therefore, healthcare professionals have a fundamentally important role to play in its development, given that they have the capacity to generate favorable or unfavorable attitudes in other groups of the population. In fact, in the public it has been seen that attitude toward organ donation which is based on the information provided by healthcare workers, whether positive or negative, is very solid[11].

Students of medicine represent a new generation of physicians, although their attitude toward LLD has not been studied to any great extent[12]. It should be remembered, however, that the adequate training of future physicians in the transplantation and donation process involves specifically finding out those variables that have an effect on certain attitudes toward donation from the stage of being a student. In this sense, a knowledge of the factors that influence attitudes toward donation will allow us to optimize the resources invested in carrying out donation and transplantation promotion campaigns and to act in a more specific way.

The objective of this study was to analyze the attitude of medical students from Spanish universities toward related and unrelated LLD.

MATERIALS AND METHODS

Type of study

A sociological, interdisciplinary, multicenter and observational study carried out in Spain in the university academic year of 2010-2011.

Study population

The study population comprised of students studying a degree in medicine in Spain. The number of students enrolled in the academic year of 2010-2011 was estimated using data published by the Spanish National Institute of Statistics (INE)[13]. The number of students in other medical schools not included in the information of the INE was obtained over the telephone. As a result, the estimated number of medical students enrolled in the academic year of 2010-2011 was 34000. It should be noted that in Spain a degree in medicine lasts for 6 years. Once the degree has been completed and in order to start specialist training, the students have to take the public competitive (MIR) exam which involves a training period lasting between 3 and 5 years.

Sample size

The sample size calculated for a population of 34000 students was 9598 students, considering an estimated proportion (attitude in favor of donation) of 76%, a confidence of 99% and a precision of ± 1%.

Sample stratification

Geographical stratification: In the academic year of 2010-2011 there were 40 medical schools in Spain with active teaching activity. These medical schools were grouped into four geographical regions covering the country: (1) The North: including the Autonomous Communities (AC) of Galicia, the Principality of Asturias, the Basque Country, the Foral Community of Navarra, La Rioja, Cantabria and Castilla León; (2) The Central area: including the ACs of Castilla-La Mancha, Extremadura and the Community of Madrid; (3) The

East: including the ACs of Catalonia, Aragon, Valencia and Murcia; and (4) The South: including the ACs of Andalucía, Ceuta and Melilla, the Canary Islands, and the Balearic Islands.

In order to obtain the sample, an initial sampling stage was planned which was stratified proportionately to the number of students enrolled in each geographical region. In the North, 14% of the students were enrolled, corresponding to a sample of 1343; in the Central area there were 25% corresponding to 2400; in the South there were 23.5% corresponding to 2256; and in the East there were 37.5% corresponding to 3,599 respondents.

Stratification by academic year: In each geographical area stratified sampling was carried out according to each academic year. In order to do this, the proportion of students from each year in each geographical area was calculated and the corresponding sample was obtained. The percentage and number of students in each area in each academic year were as follows: In the North: 28% of the students (corresponding to 376 respondents) were enrolled in the first year; 15.5% (n = 208) were enrolled in the second year; 16% (n = 215) in the third year; 14% (n = 188) in the fourth; 12% (161) in the fifth and 14.5%(n = 195) in the sixth year; In the Central Area: 23% of the student (n = 552) were enrolled in the first year; 25.5% (n = 540) in the second year; 12% (n = 288) in the third year; 13% (n = 312) in the fourth year; 11.5% (n = 276) in the fifth year; and 18% (n = 432) in the sixth year; In the South: 21% of the students (n=474) were enrolled in the first year; 20% (n = 451) in the second year; 13% (n = 293) in the third year; 15% (n = 338) in the fourth year; 15% (n = 338) in the fifth year; and 16% (n = 362) in the sixth year; In the East: 21% of the students (n = 756) were enrolled in the first year; 22% (n = 791) in the second; 18% (n = 648) in the third; 14% (n = 504) in the fourth; 11% (n = 396) in the fifth; and 14% (n = 504) in the sixth.

Data collection procedure

In each geographical area, a number of randomly selected medical schools were formally invited to participate in the study. Contact was made with the Dean of the school at each university to obtain authorization to conduct the research. The questionnaires were administered to medical students by members or collaborators from the "International Donor Collaborative Project" group in the selected medical schools that agreed to participate in the study.

With the aim of preventing selection bias, the questionnaire was applied to each academic year and in each selected school, at one or several compulsory sessions (lectures, seminars, or practical classes). A group was only considered as valid when the response rate (number of completed questionnaires/number of administered questionnaires) was greater than 80% of the students present at the aforementioned compulsory student sessions. After a brief explanation of the study was provided by the study personnel about the structure and content of the questionnaire, and after specifying the confidentiality of the data gathered, a questionnaire was handed out to each student at one of the compulsory sessions. The questionnaire was self-administered, and completed voluntarily and anonymously by each student in a period of 5-10 min.

The final selection of the participating groups was carried out using non-probabilistic convenience sampling until the necessary number of questionnaires for each academic year was reached according to the proportionality factor. Given that the questionnaires were handed out in compulsory student sessions, an academic year was considered to be full when the number of questionnaires administered had a range of ± 5% of the number of questionnaires calculated to be necessary.

Instrument for measuring attitude

The instrument of measurement used was a validated questionnaire of attitude toward Organ Donation and Transplantation[8,9] ["PCID - DVH Rios": A questionnaire of the International Collaborative Donor Project about Living Liver Donation ("Proyecto Colaborativo Internacional Donante sobre Donación de Vivo Hepático" in Spanish) developed by Dr. Ríos]. This questionnaire included items distributed into three subscales or factors, and it was validated in the Spanish population, presenting a total explained variance of 63.995% and a Cronbach's Alpha Confidence coefficient of 0.778. Each factor has an internal consistency, measured by Cronbach's Alpha Confidence coefficient of α = 0.801, 0.696, and 0.559 respectively, and an explained variance of 38.461%, 14.228%, and 11.306% respectively. In Addition an *ad hoc* questionnaire was applied including other variables.

Study variables

As a dependent variable we studied attitude toward related and unrelated LLD. The independent variables studied were classified into the following groups: (1) Socio-personal: age and sex; (2) University: Type of university, academic year of the degree in medicine and geographical location; (3) Knowledge of, and attitude toward, organ donation and transplantation: knowing a transplant patient, knowing a donor, believing that one might need a transplant in the future, attitude toward deceased organ donation, attitude toward living kidney donation and acceptance of a liver segment from a living donor if it was needed; (4) Social interaction: discussion with family and friends about donation and transplantation, the respondent's partner's opinion about the donation of a family member's organs; (5) Pro-social behavior:

Table 1 Sample and completion data for university medical students according to geographical area, university and academic year

	1st		2nd		3rd		4th		5th		6th		TN0	TNR	TR
	N0	NR	N0	NR	N0	NR	N0	NR	N0	NR	N0	NR			
N1	45	0	30	0	30	0	30	0	30	0	35	0	200	0	
N2	96	91											96	91	
N3	133	133	87	87	97	95	100	99	65	65	92	92	574	571	
N4	100	100	89	88	84	84	58	58	73	73	72	71	476	474	
NT	374	324	206	175	211	179	188	157	168	138	199	163	1346	1136	84.39%
C1									32	29			32	29	
C2	107	107	116	116	61	61	73	73	62	52	77	77	496	486	
C3	87	86	139	139	94	94	172	171	58	58	124	124	674	672	
C4	95	93	128	128	53	53	42	42	62	62	123	123	503	501	
C5	53	53	48	48	23	0							124	101	
C6	120	120	29	0	23	22							172	142	
C7	108	107	95	94	43	43	28	28	64	62	103	93	441	427	
NT	570	566	555	525	297	273	315	314	278	263	427	417	2442	2358	96.56%
S1							12	0	25	25	38	38	75	63	
S2	24	0	27	27	24	23	75	75	22	0	28	28	200	153	
S3	193	193	241	238	155	153	99	98	144	143	145	143	977	968	
S4	59	59	68	67	25	25	50	50	26	26	38	38	266	265	
S5	181	179	116	125	86	85	115	114	152	141	119	112	769	756	
NT	457	431	452	457	290	286	351	337	369	335	368	359	2287	2205	96.41%
L1	114	114	148	145	116	114	156	151	101	92	113	112	748	728	
L2	69	69	122	122	98	98	76	76	84	84	110	110	559	559	
L3	261	261	265	265	284	284	123	123	114	114	133	133	1180	1180	
L4	83	82	57	57									140	139	
L5	199	195	195	192	145	141	144	143	87	87	139	137	909	895	
L6	49	48	28	27									77	75	
NT	775	769	815	808	643	637	499	493	386	377	495	492	3613	3576	98.97%
NT	2176	2090	2028	1965	1441	1375	1353	1301	1201	1113	1489	1431	9688	9275	95.73%

N1 to N4: Medical schools in the North; C1 to C7: Medical schools in the Central Area; S1 to S5: Medical schools in the South; L1 to L6: Medical schools in the East; 1st to 6th years: Academic years; N0: Questionnaires administered; NR: Questionnaires obtained; TN0: Total number of questionnaires administered; TNR: Total number of questionnaires obtained; NT: Total questionnaires in the corresponding column; TR (%): Completion rate.

carrying out pro-social type activities; (6) Religious: the respondent's religion and knowing the attitude of his or her religion toward donation and transplantation; and (7) Attitude toward the body: concern about possible mutilation of the body after donation.

Statistical analysis

The data were stored on a database and analyzed using the SPSS 21.0 statistical package (IBM Software Group, Chicago, IL, United States). A descriptive statistical analysis was carried out and in order to compare the different variables Student's *t*-test and the χ^2 test were applied complemented by an analysis of the remainders. For determining and assessing multiple risks, logistic regression analysis was undertaken using the variables that were statistically significant in the bivariate analysis. In all cases, *P* values below 0.05 were considered to be statistically significant. The statistical review of the study was performed by a biomedical statistician.

RESULTS

Medical faculties included and the response rate obtained

The 22 randomly selected medical schools agreed to take part in the study. Of the 9688 selected students (the 9598 selected plus the 0.9% per type of sample) 9275 correctly completed the questionnaire (a response rate of 95.73%). In Table 1, the sampling and completion data is given for each university and academic year.

In the North, the lowest completion rate was found (84.4%) because one of the universities (N1) did not provide any respondents in the end. In the Central area the completion rate was 96.56%. In this area, the third year of medical school C5 and the second of medical school C6 were excluded from the analysis because the 80% response rate was not reached in the compulsory sessions when the questionnaire was handed out. In the South the completion rate was 96.41%, with the resulting exclusion of the fourth year of medical school S1, together with the first and fifth year of medical school S2 due to a response rate of less than 80%. In the East the completion rate was 98.97%.

Attitude toward living liver donation

89% (*n* = 8258) were in favor of related LLD, 1% (*n* = 78) against and 10% (*n* = 939) undecided. If the donation was unrelated, 32% (*n* = 2937) were in favor, 11% (*n* = 1001) were against and 57% (*n* =

Table 2 Socio-personal and university variables related to organ donation and transplantation affecting the attitude of university medical students toward unrelated and related living liver donation *n* (%)

Variable	Unrelated living liver donation			Related living liver donation		
	In favor (*n* = 2937; 32%)	Not in favor (*n* = 6338; 68%)	*P* value	In favor (*n* = 8258; 89%)	Not in favor (*n* = 1017; 11%)	*P* value
Socio-personal variables						
Age (21 ± 3 yr)	22 ± 4 yr	21 ± 3 yr	< 0.001	21 ± 3 yr	22 ± 4 yr	0.008
Sex			0.195			< 0.001
Male (*n* = 2702)	830 (31)	1872 (69)		2310 (86)	392 (14)	
Female (*n* = 6499)	2086 (32)	4413 (68)		5889 (91)	610 (9)	
DS/DK (*n* = 74)	21	53		59	15	
University variables						
Type of university			0.68			0.103
Public university (*n* = 8192)	2600 (32)	5592 (68)		7278 (89)	914 (11)	
Private university (*n* = 1083)	337 (31)	746 (69)		980 (91)	103 (9)	
Year of medicine			< 0.001			< 0.001
First (*n* = 2090)	521 (25)	1569 (75)		1811 (87)	279 (13)	
Second (*n* = 1965)	544 (28)	1421 (72)		1736 (88)	229 (12)	
Third (*n* = 1375)	422 (31)	953 (69)		1212 (88)	163 (12)	
Fourth (*n* = 1301)	480 (37)	821 (63)		1166 (90)	135 (10)	
Fifth (*n* = 1113)	443 (40)	670 (60)		1020 (92)	93 (8)	
Sixth (*n* = 1431)	527 (37)	904 (63)		1313 (92)	118 (8)	
Geographical location			0.109			0.013
North (*n* = 1136)	365 (32)	771 (68)		1002 (88)	134 (12)	
Central area (*n* = 2358)	718 (30)	1640 (70)		2118 (90)	240 (10)	
South (*n* = 2205)	741 (34)	1464 (66)		1993 (90)	212 (10)	
East (*n* = 3576)	1113 (31)	2463 (69)		3145 (88)	431 (12)	

DS/DK: Does not say/does not know.

5337) were undecided.

Of the students who were in favor of this type of donation, 42% (*n* = 3506) believed that LLD involved a considerable amount of risk, 30% (*n* = 2484) quite a lot of risk, 10% (*n* = 817) hardly any, 9% (*n* = 799) had not considered this matter and 8% (*n* = 652) believed it to be a highly risky kind of donation.

Factors affecting attitude toward LLD

Socio-personal variables: Regarding age, significant differences have been found in favorable attitudes toward LLD. In the related type of donation, the younger respondents had a more favorable attitude (*P* = 0.008), while in unrelated donation it was the older students who were more in favor (*P* < 0.001) (Table 2). With regard to sex, this factor has only been found to be associated with attitude toward related LLD, with females having a more favorable attitude toward related LLD than males (91% *vs* 86%, *P* < 0.001) (Table 2).

University variables: The respondent's academic year was an influential factor on attitude toward LLD, with the latter years being the ones when a more favorable attitude has been observed. When considering related donation, for instance, attitude was more favorable among students in the fifth and sixth year compared to those in the first year (92% *vs* 87%, *P* < 0.001). The same was also true for unrelated donation; the fifth and sixth years had the students with the most favorable attitude compared to those in the first year (40% and 37% *vs* 25%, *P* < 0.001) (Table 2). Finally, with regard to geographical location, significant differences have only been found in attitudes toward related LLD with the students from the Central area and the South having a better attitude compared to those from the North and East (90% *vs* 88%, *P* = 0.013) (Table 2).

Variables of knowledge about, and attitude toward, organ donation and transplantation: Among the factors associated with a favorable attitude toward related LLD, we have found that a respondent's belief that he or she might need a transplant in the future tended to encourage a favorable attitude as opposed to when he or she had not considered this possibility (90% *vs* 81%, *P* < 0.001) (Table 3). In addition, the acceptance of other types of donation, such as deceased (92% *vs* 79%, *P* < 0.001) or living kidney donation (96% *vs* 75%) (*P* < 0.001), was also associated with a more favorable attitude compared to when these other types of donation were rejected. Finally, it should be noted that the willingness to accept a liver segment from a family member also tended to be associated with a favorable attitude toward LLD compared to when there were doubts about this option or there was an unwillingness to accept it (96% *vs* 80%, *P* < 0.001) (Table 3).

With regard to attitudes toward unrelated LLD, significant relationships have been found with all the variables analyzed in this section. We can see that those who had had previous links with donation and

Table 3 Variables of the university medical students' knowledge about, and attitude toward, related and unrelated living liver donation *n* (%)

Variable	Unrelated living liver donation			Related living liver donation		
	In favor (*n* = 2937, 32%)	Not in favor (*n* = 6338, 68%)	*P* value	In favor (*n* = 8258, 89%)	Not in favor (*n* = 1017, 11%)	*P* value
Knowing a transplant patient						
Yes (*n* = 2261)	813 (36)	1448 (64)	< 0.001	2026 (90)	235 (10)	0.296
No (*n* = 6992)	2121 (30)	4871 (70)		6210 (89)	782 (11)	
DS/DK (*n* =22)	3	19		22	--	
Knowing a donor						
Yes (*n* = 1305)	482 (37)	823 (63)	< 0.001	1180 (90)	125 (10)	0.086
No (*n* = 7943)	2451 (31)	5492 (69)		7055 (89)	888 (11)	
DS/DK (*n* = 27)	4	23		23	4	
Possibility of needing a transplant						
Yes (*n* = 7712)	2544 (33)	5168 (67)	< 0.001	6951 (90)	761 (10)	< 0.001
No (*n* = 118)	35 (30)	83 (70)		96 (81)	22 (19)	
Doubts (*n* = 1372)	341 (25)	1031 (75)		1159 (85)	213 (16)	
DS/DK (*n* = 73)	17	56		52	21	
Attitude toward deceased donation						
In favor (*n* = 7376)	2603 (35)	4773 (65)	< 0.001	6761 (92)	615 (8)	< 0.001
Against - undecided (*n* = 1899)	334 (18)	1565 (82)		1497 (79)	402 (21)	
Donating a living kidney						
Yes, I would donate one (*n* = 2784)	1965 (71)	819 (29)	< 0.001	2684 (96)	100 (4)	< 0.001
No, I would not donate one (*n* = 872)	111 (13)	761 (87)		656 (75)	216 (25)	
I do not know (*n* = 5619)	861 (15)	4758 (85)		4918 (88)	701 (12)	
Willingness to accept a living liver segment from a family member						
Yes, I would accept it (*n* = 5342)	2187 (41)	3155 (59)	< 0.001	5146 (96)	196 (4)	< 0.001
No, I would wait on the waiting list (*n* = 907)	224 (25)	683 (75)		751 (83)	156 (17)	
I do not know (*n* = 2932)	519 (18)	2413 (82)		2341 (80)	591 (20)	
DS/DK (*n* = 94)	7	87		20	74	

DS/DK: Does not say/does not know.

transplantation, that is, people who knew a transplant patient (36% *vs* 30%, *P* < 0.001), or donor (37% *vs* 31%, *P* < 0.001) (Table 3), had a more favorable attitude compared to those respondents who did not have this personal experience.

Variables of social interaction: As shown in Table 4, all of these variables were associated with attitude toward LLD. Accordingly, the students who had discussed the subject of donation and transplantation, both with their families and friends, had a more favorable attitude toward related and unrelated LLD. It has also been found that the favorable attitude of a respondent's partner toward donation and transplantation had a favorable influence (Table 4).

Variables of pro-social behavior: Among the students surveyed, a more favorable attitude has been observed toward both related and unrelated LLD among those who carry out altruistic type activities or who would be prepared to take part in them (Table 4).

Religious variables: In the present study no significant relationships were found between attitude toward LLD and the religious variables analyzed (Table 5). However, it is notable that believers who considered that their doctrine was in favor of donation and transplantation were more in favor of unrelated donation than those who believed their religion was against (35% *vs* 27%) (*P* < 0.001).

Variable of attitude toward the body: Finally, it has been seen that not being concerned about the possible mutilation of the organism after donation tended to be associated with a favorable attitude toward LLD unlike in the case of those who were concerned about this aspect (*P* < 0.001) (Table 5).

A multivariate analysis of the factors affecting attitude toward related LLD

The multivariate analysis has shown that the following independent factors affected attitude toward related LLD (Table 6): (1) Being a female (OR = 1.356; *P* < 0.001); (2) Studying in the last academic years of the degree in medicine (fifth and sixth year) (OR = 1.485; *P* = 0.005); (3) Being in favor of deceased organ donation (OR = 2.169; *P* < 0.001); (4) Being in favor of living kidney donation (OR = 3.278; *P* < 0.001); (5) Being willing to be a recipient of a liver segment from a living donor (OR = 6.493; *P* < 0.001); (6) Not having a partner, and therefore, not being influenced by this person's opinion (OR = 1.569; *P* = 0.040); and (7) Being involved in regular pro-social activities (OR = 1.620; *P* = 0.012).

Table 4 Variables of social interaction and pro-social behavior affecting the attitude of university medical students toward unrelated and related living liver donation *n* (%)

Variable	Unrelated living liver donation			Related living liver donation		
	In favor (*n* = 2937, 32%)	Not in favor (*n* = 6338, 68%)	*P* value	In favor (*n* = 8258, 89%)	Not in favor (*n* = 1017, 11%)	*P* value
Variables of social interaction						
Family discussion						
Yes (*n* = 6565)	2255 (34)	4310 (66)	< 0.001	5946 (91)	619 (9)	< 0.001
No (*n* = 2689)	675 (25)	2014 (75)		2297 (85)	392 (15)	
DS/DK (*n* = 21)	7	14		15	6	
Discussion with friends						
Yes (*n* = 6841)	2307 (34)	4534 (66)	< 0.001	6172 (90)	669 (10)	< 0.001
No (*n* = 2418)	627 (26)	1791 (74)		2074 (86)	344 (14)	
DS/DK (*n* = 16)	3	13		12	4	
A partner's opinion about donation and transplantation						
Yes, it is favorable (*n* = 2740)	1045 (38)	1695 (62)	< 0.001	2511 (92)	229 (8)	< 0.001
I do not know (*n* = 2451)	603 (25)	1848 (75)		2101 (86)	350 (14)	
Yes, he or she is against (*n* = 247)	71 (29)	176 (71)		204 (83)	43 (17)	
I do not have a boyfriend/girlfriend (*n* = 3654)	1162 (32)	2492 (68)		3281 (90)	373 (10)	
DS/DK (*n* = 183)	56	127		161	22	
Donation of a family member's organs						
Yes (*n* = 8424)	2776 (33)	5648 (67)	< 0.001	7592 (90)	832 (10)	< 0.001
No (*n* = 667)	128 (19)	539 (81)		536 (80)	131 (20)	
DS/DK (*n* = 184)	33	151		130	54	
Variable of pro-social behaviour						
Participation in pro-social activities						
Yes, regularly (*n* = 882)	348 (40)	534 (60)	< 0.001	778 (88)	104 (12)	< 0.001
Yes, occasionally (*n* = 1968)	710 (36)	1258 (64)		1756 (89)	212 (11)	
No, nor am I going to (*n* = 598)	92 (15)	506 (85)		499 (84)	99 (16)	
No, but I would be willing to (*n* = 5766)	1774 (31)	3992 (69)		5201 (90)	565 (10)	
DS/DK (*n* = 61)	13	48		24	37	

DS/DK: Does not say/does not know.

Table 5 Religious variables and attitude toward the body which affect the attitude of university medical students toward unrelated and related living liver donation *n* (%)

Variable	Unrelated living liver donation			Related living liver donation		
	In favor (*n* = 2937, 32%)	Not in favor (*n* = 6338, 68%)	*P* value	In favor (*n* = 8258, 89%)	Not in favor (*n* = 1017, 11%)	*P* value
Religious variables						
Respondent's religion						
Catholic (*n* = 5102)	1629 (32)	3473 (68)	0.607	4603 (90)	499 (10)	0.138
Other religions (*n* = 266)	92 (35)	174 (65)		233 (88)	33 (12)	
Atheist/agnostic (*n* = 3726)	1179 (32)	2547 (68)		3322 (89)	404 (11)	
DS/DK (*n* = 181)	37	144		100	81	
Knowing the attitude of one's religion toward donation and transplantation						
Yes, in favor (*n* = 3049)	1074 (35)	1975 (65)	< 0.001	2755 (90)	1975 (65)	0.624
Yes, against (*n* = 723)	193 (27)	530 (73)		645 (89)	530 (73)	
I do not know (*n* = 1152)	325 (28)	827 (72)		1035 (90)	827 (72)	
DS/DK (*n* = 444)	129	315		401	43	
Variable of attitude toward the body						
Fear of mutilation or scars						
Yes, I am concerned about it a lot (*n* = 1004)	262 (26)	742 (74)	< 0.001	860 (86)	144 (14)	< 0.001
I do not mind (*n* = 6318)	2230 (35)	4088 (65)		5746 (91)	572 (9)	
I do not know (*n* = 1860)	427 (23)	1433 (77)		1582 (85)	278 (15)	
DS/DK (*n* = 93)	18	75		70	23	

DS/DK: Does not say/does not know.

Table 6 Variables affecting the attitude of university medical students toward related living liver donation, a multivariate study

Variable	Regression coefficient (β)	Standard error	OR (CI)	*P* value
Sex				
Male (*n* = 2702)			1	
Female (*n* = 6499)	0.304		1.356 (1.602-1.146)	< 0.001
Academic year of degree in medicine:				
First (*n* = 2090)			1	
Second (*n* = 1965)	0.090	0.111	1.095 (1.360-0.880)	0.416
Third (*n* = 1375)	0.096	0.127	1.101 (1.412-0.858)	0.449
Fourth (*n* = 1301)	0.078	0.135	1.081 (1.408-0.830)	0.561
Fifth (*n* = 1113)	0.396	0.157	1.485 (2.024-1.091)	0.012
Sixth (*n* = 1431)	0.396	0.143	1.485 (1.964-1.123)	0.005
Attitude toward deceased donation				
Against – Undecided (*n* = 1899)			1	
In favor (*n* = 7376)	0.774	0.088	2.169 (2.577-1.824)	< 0.001
Donating a living kidney				
I do not know (*n* = 5619)			1	
Yes, I would donate one (*n* = 2784)	1.189	0.127	3.278 (4.219-2.557)	< 0.001
No, I would not donate one (*n* = 872)	0.914	0.109	2.494 (2.016-3.086)	< 0.001
Willingness to accept a liver segment from a family member				
I do not know (*n* = 2932)			1	
Yes, I would accept it (*n* = 5342)	1.872	0.096	6.493 (7.874-5.376)	< 0.001
No, I would wait on the list (*n* = 907)	0.347	0.115	1.414 (1.769-1.129)	0.003
The respondent's partner's opinion about donation and transplantation				
Yes, he or she is against (*n* = 247)			1	
Yes, it is favorable (*n* = 2740)	0.383	0.225	1.466 (2.277-0.943)	0.089
I do not know it (*n* = 2451)	0.157	0.220	1.169 (1.801-0.759)	0.477
I have not got a boyfriend or girlfriend (*n* = 3654)	0.450	0.219	1.569 (2.409-1.021)	0.040
Participation in pro-social activities				
No, I have no intention to participate (*n* = 598)			1	
Yes, regularly (*n* = 882)	0.482	0.193	1.620 (1.110-2.364)	0.012
Yes, occasionally (*n* = 1968)	0.332	0.171	1.394 (0.997-1.948)	0.052
No, but I would be prepared to (*n* = 5766)	0.168	0.154	1.183 (0.875-1.599)	0.276

A multivariate analysis of the factors affecting attitude toward unrelated LLD

The multivariate analysis has shown the following independent factors to affect attitude toward unrelated LLD (Table 7): (1) Age (OR = 1.026; *P* < 0.001); (2) Studying in the final years of medicine (fourth, fifth and sixth years) (OR = 1.436 and *P* = 0.006; OR = 1.594 and *P* = 0.001; OR = 1.745 and *P* < 0.001); (3) Being in favor of deceased organ donation (OR = 1.724; *P* < 0.001); (4) Being in favor of living kidney donation (OR = 12.820; *P* < 0.001); (5) Being willing to be a recipient of a liver segment from a living donor (OR = 3.115; *P* < 0.001); (6) Having a partner who is in favor of organ donation (OR = 1.443; *P* < 0.001) or not having a partner, and therefore, not being influenced by that person (OR = 1.410; *P* < 0.001); (7) Regular participation in altruistic activities (OR = 1.992; *P* = 0.002); and (8) A respondent's belief that his or her religion is in favor of donation and transplantation (OR = 1.398; *P* = 0.002).

DISCUSSION

Knowing about people's attitude toward organ donation allows us to determine which factors affect this attitude and to be able to create adequately designed and cost-effective campaigns. The application of questionnaires is one of the most widely-used data collection techniques in social research, given that (1) it has a low cost; (2) it makes it possible to reach a larger number of participants; and (3) it facilitates the analysis of the results obtained[14]. However, questionnaires also have their limitations, such as the loss of verbal communication. Furthermore, it is fundamentally important for the questionnaire to be designed so that it can quantify and universalize this information, and thus standardize the interview process. Therefore, a questionnaire should be subjected to a creation and validation process to confirm to what degree it reflects the situation that we are trying to measure. This basic premise has not been fulfilled in research into attitude toward donation, given that most of the studies carried out and published use measurement tools that have not been designed for such a purpose and have not been validated. Finally, we should remember that the interpretation of the results should involve the recognition of certain limitations that arise in opinion questionnaires. The first of these is the result of the tendency of all the participants to respond according to what is considered to be "socially desirable" in the surroundings where they live. The second is caused by the distance

Table 7 Variables affecting the attitude of university medical students toward unrelated living liver donation, a multivariate study

Variable	Regression coefficient (β)	Standard error	OR (CI)	*P* value
			1	
Age (21 ± 3 yr)	0.026	0.012	1.026 (1.051-1.002)	0.037
Year of medicine				
First (*n* = 2090)			1	
Second (*n* = 1965)	0.082	0.120	1.085 (1.373-0.857)	0.496
Third (*n* = 1375)	0.205	0.131	1.226 (1.587-0.949)	0.118
Fourth (*n* = 1301)	0.362	0.131	1.436 (1.855-1.111)	0.006
Fifth (*n* = 1113)	0.467	0.141	1.594 (2.100-1.210)	0.001
Sixth (*n* = 1431)	0.556	0.138	1.745 (2.288-1.331)	< 0.001
Attitude toward deceased donation				
Against - Undecided (*n* = 1899)			1	
In favor (*n* = 7376)	0.546	0.106	1.724 (2.123-1.402)	< 0.001
Donating a living kidney				
I do not know (*n* = 5619)				
Yes, I would donate one (*n* = 2784)	2.552	0.078	12.820 (14.925-10.989)	< 0.001
No, I would not donate one (*n* = 872)	0.099	0.146	1.104 (0.830-1.469)	0.495
Willingness to accept a liver segment from a family member				
I do not know (*n* = 2932)			1	
Yes, I would accept it (*n* = 5342)	1.137	0.089	3.115 (3.717-2.617)	< 0.001
No, I would wait on the waiting list (*n* = 907)	0.257	0.144	1.293 (1.715-0.974)	0.074
A partner's opinion about donation and transplantation				
I do not know it (*n* = 2451)			1	
Yes, it is favorable (*n* = 2740)	0.367	0.099	1.443 (1.751-1.187)	< 0.001
Yes, he or she is against (*n* = 247)	0.336	0.227	1.398 (2.183-0.896)	0.139
I do not have a boyfriend/girlfriend (*n* = 3654)	0.344	0.094	1.410 (1.694-1.173)	< 0.001
Donating a family member's organs				
No (*n* = 667)			1	
Yes (*n* = 8424)	0.395	0.162	1.483 (2.040-1.078)	0.015
Participation in pro-social activities				
No, I do not intend to particpate in them (*n* = 598)			1	
Yes, regularly (*n* = 882)	0.690	0.219	1.992 (3.067-1.297)	0.002
Yes, occasionally (*n* = 1968)	0.611	0.200	1.841 (2.724-1.243)	0.002
No, but I would be willing to (*n* = 5766)	0.518	0.190	1.677 (2.439-1.157)	0.006
Knowing the attitude of one's religion toward donation and transplantation				
Yes, against (*n* = 723)			1	
Yes, in favor (*n* = 3049)	0.336	0.110	1.398 (1.736-1.127)	0.002
I do not know it (*n* = 1152)	0.249	0.123	1.282 (1.633-1.008)	0.043

between the responses and the responent's actual behavior if the situation under consideration were to occur in real life[15].

One of the main efforts of this sociological study was to achieve a representative sample of medical students in the whole of Spain. In addition, the response rate in any attitude study is an indicator of the quality of the data and it is desirable for it to be above 75% in order to prevent a positive bias given that those who tend to respond are those who are more interested in the topic[16].

LLD has been very controversial, although after a steep learning curve, there have been improved outcomes for both donors and recipients in specialist centers making this an acceptable therapeutic option[6,17,18]. This type of living donation has therefore become especially necessary because of the shortage of livers available for transplantation and the mortality on the transplant waiting list[1]. Until now LLD has not been developed to a great extent in Spain, where LLD rates are lower than 0.1 per million population[1].

With the objective of boosting LLD, it has become necessary to improve the social image of this donation[19]. In order to achieve this, it has become essential to find out the attitude of the population about the issue, because it is not free of fear and mistrust[19,20]. Furthermore, healthcare professionals should get involved in the matter, given that although they might not be directly involved in the donation and transplantation process, they are groups that generate opinions and therefore they influence the decisions of potential donors[8,9]. This study has shown that medical students, who will be physicians in a few years, have a clearly favorable attitude toward related LLD. This fact is very important, because it should be taken into account that for its development it is essential for healthcare professionals to encourage living donation. However, other factors should be analyzed given that donation rates are not increasing in spite of this positive attitude[1].

Attitude was favorable in 89% of the respondents, a percentage that is higher than the rate reported in

the Spanish general public[19] and in other European countries[21], where about 75% are in favor. In all of these cases it is related donation that is under consideration, that is, when there is some kind of connection between the donor and recipient. This is the reason why it has such a high acceptance level in every stratum, both in the population[12] and healthcare workers[8]. A lot of sensitivity toward unrelated living donation has also been found, with rates of more than 30% in favor. This differs from the data found in English speaking societies where there is a lower acceptance rate[21].

Attitudes toward LLD have not been studied very extensively and there have only been a few isolated studies on medical students. Among these the most notable is the one by Dahlke *et al*[12] which analyzed the attitude of students in the United States, Germany and Japan, and although the sample was small, it suggests that acceptance is mainly influenced by cultural factors. For example, they state that acceptance is greater in the United States compared to Germany and Japan, with a greater willingness for infant donation than adult donation, and therefore they suggest that socio-demographic differences should be taken into account to establish protocols of clinical practice in living donation. Although this is very important, this aspect is well-known in attitude studies, given that there are many cultural differences between the different continents. We should point out that there have not been any studies about this issue covering a whole country, or a specific geographical area, or even the whole degree in medicine. Instead of this, researchers have focused on a specific group of a specific university. Therefore, until today the only generalizable conclusions about the attitude of medical students toward LLD, in this case in Spain, are the ones presented in this study.

The student's academic year has an effect on attitude toward LLD. As the student advances through the years there is a gradual progress in technical knowledge of the issue which allows students, mainly in the second half of their degree, to establish contact with the healthcare system and certain clinical services related to transplantation making it possible for students to develop a personal view of the subject[22,23]. In this way, it has been seen that students in the fifth and sixth years have a more favorable attitude than those in the earlier years.

Regardless of academic training and university progression, a close relationship has been observed between attitude toward LLD, and attitude toward the other kinds of human organ donation, both deceased and living kidney donation. This coincides with findings in the Spanish speaking population, where there is a clear association between attitude toward deceased and living donation[24]. Organ donation is an altruistic aspect of life, and if one is able to accept one type of donation then other kinds are also generally acceptable. Furthermore, as reported in deceased organ donation, feelings of reciprocity also have an influence[14], that is, doing to others what we would like to be done to ourselves. Thus, the principal related factors that have been found have this component of reciprocity, such as the belief that one might need a transplant in the future and if this were the case, a respondent's willingness to receive an organ from a living donor.

The variables of social interaction have a very clear association with attitude toward the donation of one's own organs[25-28]. The way each respondent perceives opinions in his or her surroundings has a great influence on his or her ultimate decision on whether to donate or not. For instance, being in a family and social context in which there is a favorable attitude multiplies the chances of the student having a favorable attitude. In current times, when it is uncommon to live independently of the family during the university period, and when students tend to continue to depend on the family for financial support, this fact is becoming more evident.

Family factors should also be noted[29], in the sense that the respondent's partner's attitude toward donation has an important influence on the respondent's attitude. This is a factor that has been typically reported in attitude toward deceased donation[14,30], and it has been seen that when one's partner is against donation there is a significant increase in the percentage of respondents with doubts or who are against this kind of donation and vice versa. This aspect continues to reinforce the theory that we should keep talking about donation and transplantation, and underlines the importance of expressing favorable attitudes toward donation, because this simple act will have a promotional effect on donation which is generally greater than any organized campaign.

Finally, there is the fear of possible mutilation as a consequence of living donation. Healthcare professionals are just as sensitive as the general public with regard to feelings that arise due to the manipulation of the body, and it has been seen that they have greater difficulty in allowing action to be carried out on it even when there are well-accepted objectives such as in transplantation[19].

We have the basic pillars in place such as future professionals with a relatively high favorable attitude (when deceased donation was first encouraged in Spain, attitude toward this kind of donation was less favorable than current attitude toward LLD), and we also have a receptive population. If institutional and political support can be achieved, as occurred in deceased donation, it is hoped that in the coming years we could relaunch this kind of donation, so we could reach a point where we are able to prevent mortality on the waiting list.

However, we should be cautious about its development and restrict it to experienced centers to

prevent unnecessary morbidity among donors[1]. Therefore, given that current mortality on the liver transplant waiting list in Spain ranges between 8%-10%, our objective should be to arrive at this percentage, and no more. If this is not achieved, we are going to create a healthy young population subjected to liver surgery with frequent morbidity and occasional mortality[31]. Moreover, we should remember that among all the potential liver donors for each recipient a series of invasive procedures need to be performed such as biopsy, arteriography, etc. that produce morbidity in people who do not even become donors[6]. On the other hand, it is well-known that there is an improvement in the bond between the donor and recipient and their self-esteem as a result of this kind of transplant, especially when it is donation from a parent to a child[32], while parents who have refused to donate to their children report consequent stress, anxiety, psychosomatic syndromes and feelings of guilt[32].

To conclude, the attitude of medical student toward related and unrelated LLD is very favorable, and is associated with factors directly and indirectly related to donation and transplantation, family and religious factors, and factors related to attitude toward the body.

COMMENTS

Background

Liver transplantation offers long survival periods and improved quality of life. However, the current transplant organ donation rates are insufficient for covering minimum transplant needs. Even though living liver donation (LLD) has been successfully carried out in many countries it is at a very low level. One of the possible barriers to its development could be the risk involved for the donor. However, in experienced centers the results are acceptable. Nevertheless, it should be taken into account that professionals in healthcare centers do not always have a favorable attitude toward LLD. Students of medicine represent a new generation of physicians, although their attitude toward LLD has not been studied to any great extent. It should be remembered, however, that the adequate training of future physicians in the transplantation and donation process involves specifically finding out those variables that have an effect on certain attitudes toward donation from the stage of being a student. In this sense, a knowledge of the factors that influence attitudes toward donation will allow us to optimize the resources invested in carrying out donation and transplantation promotion campaigns and to act in a more specific way.

Research frontiers

Attitudes toward LLD have not been studied very extensively and there have only been a few isolated studies on medical students. Among these the most notable is the one by Dahlke *et al* analyzing the attitude of students in the United States, Germany and Japan, and although the sample is small, it suggests that acceptance is mainly influenced by cultural factors. For example, they state that acceptance is greater in the United States compared to Germany and Japan, with a greater willingness for infant donation than adult donation, and therefore they suggest that socio-demographic differences should be taken into account to establish protocols of clinical practice in living donation. Although this is very important, this aspect is well-known in attitude studies, given that there are many cultural differences between the different continents. We should point out that there have not been any studies about this issue covering a whole country, or a specific geographical area, or even the whole degree in medicine. Instead of this, researchers have focused on a specific group of a specific university. Therefore, until today the only generalizable conclusions about the attitude of medical students toward LLD, in this case in Spain, are the ones presented in this study.

Innovations and breakthroughs

In studies of attitude toward organ donation, there are few stratified studies that have stratified the study population so that generalizations can be made from the results obtained. The study presented in this article represents the first stratified and validated study carried out on medical students covering a whole country, in this case Spain. Attitude was favorable in 89% of the respondents, a percentage that is higher than the rate reported in the Spanish general public and in other European countries, where about 75% are in favor. In all of these cases it is related donation that is under consideration, that is, when there is some kind of connection between the donor and recipient. Attitudes toward LLD have not been studied very extensively in medical students. Dahlke *et al* analyzed the attitude of students in the United States, Germany and Japan, and although the sample was small, it suggests that acceptance is mainly influenced by cultural factors.

Applications

The authors have the basic pillars in place such as future professionals with a relatively high favorable attitude (when deceased donation was first encouraged in Spain, attitude toward this kind of donation was less favorable than current attitude toward LLD), and the authors also have a receptive population. If institutional and political support can be achieved, as occurred in deceased donation, it is hoped that in the coming years this kind of donation could be relaunched, so that they could reach a point where they are able to prevent mortality on the waiting list. However, they should be cautious about its development and restrict it to experienced centers to prevent unnecessary morbidity among donors. Therefore, given that current mortality on the liver transplant waiting list in Spain ranges between 8%-10%, our objective should be to arrive at this percentage, and no more. If this is not achieved, the authors are going to create a healthy young population subjected to liver surgery with frequent morbidity and occasional mortality. Moreover, the authors should remember that among all the potential liver donors for each recipient a series of invasive procedures need to be performed such as biopsy, arteriography, *etc*. that produce morbidity in people who do not even become donors. On the other hand, it is well-known that there is an improvement in the bond between the donor and recipient and their self-esteem as a result of this kind of transplant, especially when it is donation from a parent to a child, while parents who have refused to donate to their children report consequent stress, anxiety, psychosomatic syndromes and feelings of guilt.

Terminology

Liver transplantation offers long survival periods and improved quality of life for patients with liver disease whose vital prognosis is short if they do not have a transplant. However, the current transplant organ donation rates are insufficient for covering minimum transplant needs, and the shortage in available livers means that mortality on the waiting list is increasing. Even in Spain in the 21st century, the country with the highest donation rates, mortality on the liver transplant waiting list has been increasing. All of this is making it necessary to encourage alternatives to deceased liver donation. The living liver transplantation has been successfully carried out and in some countries it is becoming more common.

Peer-review

This is a very interesting manuscript that explores the views of the next generation of Spanish doctors about living related liver donation. The study includes a large number of medical students with an excellent response rate.

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P- Reviewer: Bramhall S, Gruttadauria S, Qin JM
S- Editor: Gong ZM **L- Editor**: A **E- Editor**: Wang CH

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ISSN 1007-9327