

Level and determinants of willingness to donate organs among the general public: A cross-sectional survey in China

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Abstract

Background: This study aims to assess the level and determinants of the general public's willingness to organ donation.

Methods: We conducted a population-based cross-sectional study of 4261 participants in China. The primary outcome was the willingness to donate organs. Logistic regression modelling was used to determine the factors that affect willingness to donate organs.

Results: Overall, the proportion of participants who showed a willingness to donate organs was 47.45% (95%CI: 0.46, 0.49) in this study. Logistic regression modelling showed participants from Western (OR=1.33, 95%CI=1.11-1.59) and Eastern China (OR=1.40, 95%CI=1.19-1.65) were more willing to donate organs compared with those from Central China. The odds of being willing to donate organs was higher in females than males (OR=1.35, 95%CI=1.17-1.55); and was higher in those participants with experience of organ donation (OR=1.58, 95%CI=1.13-2.21), experience of caring for organ transplant patients (OR=1.45, 95%CI=1.01-2.07), and those undertaking related voluntary activities (OR=1.67, 95%CI=1.45-1.94), than those without.

Conclusion: The general public's level of willingness to organ donation was not high in China. Geographical region, gender, experience of organ donation related activities, taking care of organ transplant patients and volunteering in related activities were independently associated with participants' willingness to donate organs.

Background

Since the 1950s, organ transplantation has been considered the most effective life-saving therapeutic option to treat patients who suffer from end-stage organ failure¹⁻². Globally, there is a severe imbalance between supply and demand, the need for organs dramatically exceeds the number of donated organs available for transplantation³. Countries around the world attempt to increase the number of organs donors to meet the demand. Rate of organ donation per million population (pmp) is higher in Western countries. In the United States, registration rates for organ donation range from 20% to 60%⁴, and in 2019, Spain was the world leader in organ donation, with 48.9 pmp deceased organ donors⁵. In Europe, Greece has the fewest organ donations; with 5.5 of donors pmp^{5,6}. Previous studies have shown that organ donation rates in Asia tend to be lower than in Western countries⁷⁻⁹. In 2019, the organ donation rate in Iran was 11.26 pmp, 0.75 pmp in Japan, and 4.43 pmp in China⁵. Thus, increasing the rate of organ donation in Asian populations represents a significant public health challenge.

In China, The Organ Transplantation Program began in the 1960s, and has been successful in saving the lives of thousands of patients with advanced organ diseases. Although 10,000 transplantations are performed in China each year, the supply of organs is inadequate to meet the increasing demand⁹, and the majority of patients with vital or non-vital organ failure are deprived of a new and better quality of life¹⁰. To encourage organ donation, special measures have been taken since the 1960s. For example, a body-donor monument was built to commemorate the contributors in Wuhan 2005¹¹. Furthermore, in 2007, regulation of human organ transplantation was implemented by the authorities and the Human Organ Donation plan was launched post-2013¹².

From the perspective of engaging the general public and improving the rate of organ donation it is essential to understand the characteristics of organ donors. Previous studies have shown that a potential organ donor was characterized as being highly educated, well informed and enthusiastic about donation and would have had a discussion with family members regarding this issue¹³⁻¹⁴.

Some studies have provided insight into the status and determinants of organ donation¹⁴⁻¹⁷. However, these studies have certain limitations: For example, in one study only 1074 effective questionnaires were returned by the participants, indicating a small sample size¹⁵. Further, other studies comprised of specific populations only, such as, medical students and health professionals,^{16,17}. In addition, individuals who had undergone renal transplantation showed a positive attitude towards deceased donation than their caregivers in Hunan¹⁴. Another limitation of these studies was the geographic areas chosen to conduct the studies were specific regions and cities of China, and not representative of the country as a whole.

This study aims to explore the level and determinants of willingness towards organ donation by using a large national sample obtained from Eastern, Central and Western China. The results will provide important information for scientists and policymakers to implement targeted measures to improve the organ donation rate in China.

Methods

Data Source

Due to the cost-effectiveness, a multistage stratified sampling method was applied to sample the research sites. The sampling method was divided into four stages, comprised of different sampling units. For the first stage we selected a province from each of three regions of China: Zhejiang province in the East, Henan province in the Centre and Shaanxi province in the West. Next, we selected the capital city of each province: Hangzhou, Zhengzhou and Xi'an, respectively. Subsequently, the principal investigator in each city selected 6 communities based on convenience sampling method. The procedure can be described as follows. Firstly, investigators conducted an intercept survey on the streets, parks, shops and other public

places in a selected community based on the principle of convenience, facilitated by a local village doctor or public health specialist from the community. Secondly, the local village doctor or public health specialist introduced the survey team, explained the purpose of this survey and the length of time spent on questionnaire to the intercepted people, and invited them to participate the survey. And finally, the survey team conducted a face-to-face interview of the intercepted people who agreed and signed the informed consent form.

According to the results of a previous study, the rate of willingness towards organ donation was 49%¹⁷. Therefore, the sample size was calculated as 1334 for each site with a permissible error of $\delta=3\%$, a type I error of $\alpha=0.05$ and an expected 20% nonresponse rate.

The inclusion criteria of participants were: (1) people who were more than 16 years old and cognitively or physically able to answer questions in a 1-hour interview; (2) people who could clearly communicate orally; (3) people who were without mental illnesses. In this study, 5200 people received a personal invitation to participate, and 17.2% of them rejected to participate. A total of 4305 participants were included and there were 1409, 1408 and 1488 participants from Western, Central and Eastern China respectively from October to December 2019. During the survey, a structured questionnaire that included questions relating to willingness to donate organs was administered individually to each participant (Additional file 1). Forty-four participants failed to answer questions relating to willingness to donate and have been excluded from the analysis. We undertook a statistical analysis of the remaining 4261 participant questionnaires.

Study variables

The primary outcome of this study was the response of willingness to donate organs, recorded as a binary variable of no (0) or yes (1) in the questionnaires. The proportion of those willing to donate organs was calculated by the number of participants who were willing to organ donation over the total number of participants who responded¹⁸. Determinants in this study were selected based on previous studies but constrained by the variables collected in the survey¹⁹⁻²¹. They included residence type (urban or rural), geographical location (region), demographic characteristics (gender, age, marital status, education, employment and monthly income) and personal experiences (experience of organ donation, taking care of organ transplant patients, and voluntary related activities).

Quality control

To ensure the high return rate of valid questionnaires and reduce investigator bias, we invited experts from the Wenzhou Medical University, Liverpool School of Tropical Medicine, Hangzhou Normal University, Xi'an Jiaotong University and Zhengzhou University to train the investigators in terms of interviewing skill and operational procedures. Data such as demographics, experiences and willingness to organ donation were collected using structured questionnaires (Additional file 1). The interview process was standardized prior to formal investigation. The entire investigation was conducted under the supervision of senior researchers.

Statistical analyses

A database was established using EpiData 3.1 software (developed by EpiData Association, Odense, Denmark) and data was double entered to ensure data quality. Categorical variables were summarised using number and percentages. Distributions of basic characteristics by residence, and attitude towards organ donation were compared using Chi-square tests. Logistic regression modelling was applied to identify the determinants of participants' willingness to organ donation, controlling for other confounding factors. Odds ratios (ORs) with 95% confidence intervals (CIs) were derived from logistic regression modelling. The statistical results and figures were processed with STATA statistical software version 12.0 (StataCorp LP, College station 77845, USA) software and Excel 2016, respectively. A two-tailed p value < 0.05 was considered statistically significant.

Results

Basic Characteristics

The descriptive statistics of the participants are shown in Table 1. Of the 4261 respondents, 2008 (47.13%) and 2253 (52.87%) lived in urban and rural areas, respectively. Among these participants, 1382 came from the West, 1393 from the Central and 1486 from the East. The respondents were more female than male and had a median age ≤ 30 years old. The overall results showed significant differences in characteristics between urban and rural participants with the p -value < 0.05 .

Table 1 Basic characteristics of participants (n=4261)

Characteristics	Residence [n (%)]		N	χ^2	P
	Urban (n=2008)	Rural (n=2253)			
Geographical					
Region				103.76	<0.001
Central	753(37.50)	640(28.41)	1393		
West	498(24.80)	884(39.24)	1382		
East	757(37.70)	729(32.36)	1486		
Demographic					
Gender				5.77	0.016
Male	905(45.25)	935(41.59)	1840		
Female	1095(54.75)	1313(58.41)	2408		
Age (years)				60.72	<0.001
≤30	1024(51.98)	1203(54.53)	2227		
31-40	554(28.12)	488(22.12)	1042		
41-50	242(12.28)	218(9.88)	460		
51-60	96(4.87)	224(10.15)	320		
≥61	54(2.75)	73(3.32)	127		
Marital status				7.18	0.007
Others ¹	1001(49.98)	1031(45.86)	2032		
Married	1002(50.02)	1217(54.14)	2219		
Education				162.91	<0.001
≤Primary school	63(3.14)	166(7.38)	229		
Middle-High school	596(29.70)	998(44.38)	1594		
≥University	1348(67.16)	1085(48.24)	2433		
Employment				33.64	<0.001
No	1107(55.21)	1440(63.94)	2547		
Yes	898(44.79)	812(36.06)	1710		
Monthly income (Chinese yuan)				88.00	<0.001
<3300	847(42.72)	1230(55.21)	2077		
3300-5999	570(28.74)	601(26.97)	1171		
6000-9999	370(18.66)	271(12.16)	641		
>10000	196(9.88)	126(5.66)	322		
Personal experience					
Do you or relatives or friends have any experience of organ donation?					
No	1717(94.13)	1860(95.98)	3577	6.81	0.009
Yes	107(5.87)	78(4.02)	185		
Have you taken care of organ transplant patients?					
No	1898(94.95)	2168(96.48)	4066	6.15	0.013
Yes	101(5.05)	79(3.52)	180		
Have you participated in volunteer activities?					
No	1161(58.11)	1460(64.98)	2621	21.12	<0.001

Yes	837(41.89)	787(35.02)	1624
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¹Others include unmarried, divorce, widowed and living with a partner.

Proportion of willingness to donate organs

Overall, 47.45% (95%CI: 0.46, 0.49) of participants were willing to donate organs in this study. A total of (978/2008) 48.71% urban and (1045/2253) 46.38% rural participants indicated a positive attitude towards organ donation ($\chi^2=2.30$, $P=0.130$). The results of the empirical results from the urban and rural areas are presented in Table 2 and 3. There were significant differences in the proportions of willingness to donate organs among demographic characteristics and personal experiences (Table 2). Individuals or relatives and friends of individuals who had experienced organ donation, and individuals taking care of organ transplant patients or undertaking voluntary related activities were more likely to donate an organ (Table 2). Amongst rural respondents, there was no significant difference in the proportion participants' willingness to donate organs, according to their monthly income $P>0.05$ (Table 3).

Table 2 Proportion of participants from urban areas willing to donate organs according to geographic and demographic characteristics (n=2008)

Characteristics	Willing to donate organs [n (%)]		χ^2	P
	No	Yes		
Geographical				
Region			39.06	<0.001
Central	449(59.63)	304(40.37)		
West	251(50.40)	247(49.60)		
East	330(43.59)	427(56.41)		
Demographic				
Gender			23.33	<0.001
Male	518(57.24)	387(42.76)		
Female	508(46.39)	587(53.61)		
Age (years)			36.41	<0.001
≤30	460(44.92)	564(55.08)		
31-40	319(57.58)	235(42.42)		
41-50	135(55.79)	107(44.21)		
51-60	64(66.67)	32(33.33)		
≥61	27(50.00)	27(50.00)		
Marital status			27.12	<0.001
Others	456(45.55)	545(54.45)		
Married	573(57.19)	429(42.81)		
Education			13.07	0.001
≤Primary school	40(63.49)	23(36.51)		
Middle-High school	334(56.04)	262(43.96)		
≥University	655(48.59)	693(51.41)		
Employment			17.93	<0.001
No	521(47.06)	586(52.94)		
Yes	508(56.57)	390(43.43)		
Monthly income (Chinese yuan)			30.40	<0.001
<3300	376(44.39)	471(55.61)		
3300-5999	327(57.37)	243(42.63)		
6000-9999	213(57.57)	157(42.43)		
>10000	100(51.02)	96(48.98)		
Personal experience				
Do you or any relatives or friends have any experience of organ donation?				
No	853(49.68)	864(50.32)	5.20	0.023
Yes	41(38.32)	66(61.68)		
Have you taken care of organ transplant patients?				
No	989(52.11)	909(47.89)	10.40	0.001
Yes	36(35.64)	65(64.36)		
Have you participated in some volunteer activities?				
No	697(60.03)	464(39.97)	85.57	<0.001
Yes	327(39.07)	510(60.93)		

Table 3 Proportion of participants from rural areas willing to donate organs according to geographic and demographic (n=2253)

Characteristics	Attitudes towards organ donation [n (%)]		χ^2	P
	No	Yes		
Geographical				
Region			10.23	0.006
Central	375(58.59)	265(41.41)		
West	468(52.94)	416(47.06)		
East	365(50.07)	364(49.93)		
Demographic				
Gender			9.44	0.002
Male	537(57.43)	398(42.57)		
Female	668(50.88)	645(49.12)		
Age (years)			20.46	<0.001
≤30	611(50.79)	592(49.21)		
31-40	268(54.92)	220(45.08)		
41-50	122(55.96)	96(44.04)		
51-60	147(65.63)	77(34.38)		
≥61	32(43.84)	41(56.16)		
Marital status			26.03	<0.001
Others	493(47.82)	538(52.18)		
Married	713(58.59)	504(41.41)		
Education			21.38	<0.001
≤Primary school	107(64.46)	59(35.54)		
Middle-High school	568(56.91)	430(43.09)		
≥University	532(49.03)	553(50.97)		
Employment			16.70	<0.001
No	726(50.42)	714(49.58)		
Yes	482(59.36)	330(40.64)		
Monthly income (Chinese yuan)			7.60	0.055
<3300	632(51.38)	598(48.62)		
3300-5999	348(57.90)	253(42.10)		
6000-9999	151(55.72)	120(44.28)		
>10000	65(51.59)	61(48.41)		
Personal experience				
Do you or any relatives or friends have any experience of organ donation?				
No	963(51.77)	897(48.23)	8.82	0.003
Yes	27(34.62)	51(65.38)		
Have you taken care of organ transplant patients?				
No	1175(54.20)	993(45.80)	9.37	0.002
Yes	29(36.71)	50(63.29)		
Have you participated in some volunteer activities?				
No	863(59.11)	597(40.89)	50.38	<0.001
Yes	342(43.46)	445(56.54)		

Determinants of willingness to donate organs

Overall, the results of the logistic regression model in Table 4 show there were no significant difference in the odds of willingness to donate organs between urban and rural participants when adjusting geographical, demographic and personal experience characteristics (OR=0.94, 95%CI=0.82-1.06, $P=0.421$). The odds of being willing to donate an organ were 1.33 times higher for participants in Western China (95%CI=1.11-1.59, $P=0.002$) and 1.40 higher in Eastern China (95%CI=1.19-1.65, $P<0.001$) than those in Central China. The odds of willingness to organ donation in female participants was higher than in male participants (OR=1.35, 95%CI=1.17-1.55, $P<0.001$). Participants who had experience of organ donation (OR=1.58, 95%CI=1.13-2.21, $P=0.008$), who took care of organ transplant patients (OR=1.45, 95%CI=1.01-2.07, $P=0.043$) or who were involved in voluntary related activities (OR=1.67, 95%CI=1.45-1.94, $P<0.001$) were more likely to donate an organ ($P<0.05$).

Table 4 Multivariate analysis of the determinants of willingness to organ donation by logistic regression model

Characteristics	All (n=4261)				Urban (n=2008)				Rural (n=2253)			
	OR ¹	95%CI ²		P	OR ¹	95%CI ²		P	OR ¹	95%CI ²		P
		Lower	Upper			Lower	Upper			Lower	Upper	
Residence type												
Urban	1.00				-				-			
Rural	0.94	0.82	1.06	0.421	-	-	-	-	-	-	-	-
Geographical												
Region												
Central	1.00				1.00				1.00			
West	1.33	1.11	1.59	0.002	1.08	0.83	1.41	0.558	1.51	1.17	1.95	0.001
East	1.40	1.19	1.65	<0.001	1.54	1.23	1.94	<0.001	1.27	1.00	1.62	0.048
Demographic												
Gender												
Male	1.00				1.00				1.00			
Female	1.35	1.17	1.55	<0.001	1.46	1.19	1.79	<0.001	1.23	1.01	1.51	0.042
Age (years)												
≤30	1.00				1.00				1.00			
31-40	1.04	0.85	1.27	0.713	0.84	0.62	1.14	0.268	1.27	0.96	1.69	0.094
41-50	1.28	0.98	1.69	0.072	1.00	0.68	1.48	0.985	1.60	1.08	2.38	0.020
51-60	0.84	0.61	1.16	0.292	0.62	0.36	1.07	0.086	1.01	0.67	1.51	0.979
≥61	1.53	0.98	2.39	0.063	1.04	0.54	2.02	0.900	2.04	1.11	3.76	0.022
Marital status												
Others	1.00				1.00				1.00			
Married	0.87	0.71	1.05	0.140	1.03	0.78	1.36	0.847	0.74	0.56	0.97	0.028
Education												
≤Primary school	1.00				1.00				1.00			
Middle-High school	0.96	0.66	1.39	0.829	1.28	0.67	2.45	0.456	0.84	0.53	1.33	0.445
≥University	1.09	0.75	1.59	0.656	1.50	0.79	2.85	0.221	0.98	0.60	1.59	0.925
Employment												
No	1.00				1.00				1.00			
Yes	0.87	0.73	1.04	0.134	1.11	0.85	1.46	0.444	0.71	0.56	0.90	0.005
Monthly income (Chinese yuan)												
<3300	1.00				1.00				1.00			
3300-5999	0.95	0.78	1.15	0.580	0.78	0.59	1.05	0.097	1.10	0.85	1.42	0.458
6000-9999	0.98	0.77	1.25	0.892	0.71	0.50	1.01	0.058	1.27	0.91	1.78	0.165
>10000	1.04	0.78	1.40	0.787	0.78	0.51	1.20	0.260	1.29	0.83	1.99	0.256
Personal experience												
Do you or any relatives or friends have any experience of organ donation?												
No	1.00				1.00				1.00			

Yes	1.58	1.13	2.21	0.008	1.42	0.90	2.22	0.128	1.90	1.13	3.21	0.016
Have you taken care of organ transplant patients?												
No	1.00				1.00				1.00			
Yes	1.45	1.01	2.07	0.043	1.73	1.05	2.83	0.030	1.24	0.73	2.10	0.424
Have you participated in any volunteer activities?												
No	1.00				1.00				1.00			
Yes	1.67	1.45	1.94	<0.001	1.72	1.39	2.11	<0.001	1.61	1.30	1.99	<0.001

¹OR: Odds Ratio; ²CI: Confidence Interval.

The results for subgroup analysis by rural-urban residence are also presented in Table 4. There were no significant interaction effects ($P>0.05$) between residence and any of the characteristics listed in Table 4, suggesting that the determinants of willingness to donate organ are similar for both urban and rural residents.

Discussion

Main findings

Empirical study plays an essential role in providing key information for experts and policymakers to take targeted measures to improve the number of organ donation registrations. In this study, we found that 47.45% (95% CI: 0.46 to 0.49) of the general public from three regions of China are willing to donate organs, which is similar to the percentage of organ donors in Germany (46.8%) >10 years ago²². Unsurprisingly, it is slightly higher than the percentage of organ donation for brain-dead patients (41.8%)²³. Our study shows that the proportion of the general population willing to donate organs in the three regions of China studied was lower than that previously reported in Chinese health professionals (49.3%)¹⁷, Chinese transplantation patients and their caregivers (62.7%)¹⁴, medical students in Spain (79%) and in Germany (63.5%)²⁴⁻²⁵. All things considered, willingness to donate organs in Eastern, Western and Central China is lower than in other countries of the world and suggests targeted measures should be implemented by the decision-makers and scientists to improve the situation.

A better understanding of the determinants of public willingness to donate organs will help to develop strategies to increase the rate of organ donation and meet the need of organ transplantation. The general public perceptions regarding willingness to organ donation are often underpinned by multiple sociodemographic factors, such as ethnicity, culture, religion and education²⁶. Based on the findings of this study and supported by other studies²⁷, urban-rural residence does not influence willingness to donate organs. Nevertheless, geographical region, gender, employment and personal experiences were shown to be the main determinants of willingness in the general public. In comparison to Central and Western China, individuals who lived in the urban area of Eastern China were more willing to donate organs. This could be explained by the social and economic developmental status of Eastern China, which is known to be a well-developed area in terms of economy and education, and the general public in this region would have a positive awareness of organ donation¹⁵.

Gender is directly associated with willingness to donate organs. In this study females had a higher propensity to donate their organs. This is similar to the findings of other studies^{21-22, 27-28}. Furthermore, an individual who, or whose relatives or friends had experienced organ donation, or individuals who had taken care of organ transplant patients or had undertaken voluntary related activities were more likely to donate organs. One potential reason is that they would have a better understanding of the importance of organ donation. Another reason relates to personal values. Participants who have altruistic values would be more willing to donate organs¹⁴.

Limitations

This study had several limitations. Firstly, this was an observational study in which the determinants of willingness to organ donation included were constrained by the pre-specified variables in the survey questionnaires. As a result, some potential unobserved confounding factors such as policy variables that are likely to have an impact on willingness to organ donation were not considered in the analysis. Presumed consent law and allocation priority were found to be effective measures to increase organ donation, for instance²⁹⁻³¹. As a result, the observed differences in willingness to organ donation could be subject to possible unobserved confounding factors. Second, we were unable to collect detailed information on people's perceptions about organ donation. Finally, the study may suffer from potential selection bias. The study was only conducted in three regions (West, East, and Central) of China; there was direct contact between the investigators and the respondents during survey; the education level of the participants was higher than the general population in China according to the sixth census; the participants tended to be younger than the general population. These sampling issues suggest that our study sample may not be representative of the general population in China.

Conclusions

This study has attempted to evaluate the willingness of the general public to donate organs and to assess the influence of social-demographic characteristics and personal experience of determining the willingness of individuals to donate their organs. Overall, approximately half of the respondents were willing to donate organs and was higher in participants in Eastern and West China than in Central China. In addition, gender and personal experiences were independent determinants of an individual's willingness to organ donation. Our results provide valuable information for health experts and policymakers to promote organ donation in China.

List Of Abbreviations

Pmp	Per million population
ORs	Odds ratios
CI	Confidence Intervals

Declarations

Ethics approval and consent to participate

Informed written consent was obtained from all study subjects before participating in the study. The study was conducted in accordance with the Declaration of Helsinki, and the protocol was approved by the Ethics Committee of Wenzhou Medical University (No.2019-054).

Consent for publication

Not applicable.

Availability of data and materials

The datasets generated for the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

Concept and designed the study: EL, DW, XF and ML. Collection of data: E., XF and ML. Analysis and interpretation of data: All authors. Wrote the manuscript: All Authors. Revision of the paper: EL, DW, ZZ and XF. All authors reviewed and approved the final manuscript.

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