Knowledge, attitudes and willingness to organ donation among the general public: A cross-sectional survey in China

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Abstract

Background

The purpose of this study is to assess the level of knowledge, attitudes, and willingness to organ donation among the general public in China.

Methods

The study population consisted of 4274 participants from Eastern, Central and Western China. The participants' knowledge, attitudes and willingness to organ donation were collected by a self-designed questionnaire consisting of 30 items. Knowledge is measured by 10 items and presented as a 10 point score, attitudes is measured by 20 items using a 5-step Likert scale and total score ranged between 0 and 80; while the willingness to donate is assessed as binary variable (0 = No; 1 = Yes). A logistic regression model was used to assess the association of knowledge and attitudes with willingness to organ donation, controlling for demographic and socioeconomic confounders.

Results

The questionnaire response rate was 94.98%. The mean score ($\pm$ SD) of the general public's knowledge to organ donation was 6.84 ± 1.76 , and the mean score ($\pm$ SD) of attitudes to organ donation was 47.01 ± 9.07 . The general public's knowledge and attitudes were the highest in Eastern China, followed by West and Central China. The logistic regression model indicated a positive association between knowledge and the willingness to organ donation (OR = 1.12, 95%CI: 1.08, 1.17; $P < 0.001$); attitudes were also positively potential determinant of more willingness to organ donation (OR = 1.08, 95%CI: 1.07, 1.09; $P < 0.001$).

Conclusions

Knowledge and attitudes were found to be positively associated with the Chinese general public's willingness to organ donation. Knowledge about the concept of brain death and the transplant procedure may help raise the rate of willingness to organ donation.

Background

For patients with end-stage organ failure, an organ transplantation is a well-established and often the only life-saving treatment¹. Globally, the number of patients on a waiting list to receive an organ transplantation exceeds the number of organs donors^{2,3}. The WHO Global Observatory on Donation and Transplantation recently estimated that over 130,000 solid organ transplantations were performed across the globe in 2017, which represents less than 10% of the global need⁴. The provision of deceased donor

transplants was shown to be positively associated with per capita gross national income^{5,6}. According to the International Registry in Organ Donation and Transplantation (IRODaT), the countries with the highest number of deceased organ donations in 2019 were Spain, the USA, France, the United Kingdom and Australia, with 48.9 per million population (pmp), 36.88 pmp, 33.25pmp, 24.88 pmp and 22.17 pmp, respectively. The countries with the lowest numbers of organ transplantations in contrast were China (4.43 pmp), Thailand (3.66 pmp), Japan (0.75 pmp), and India (0.65 pmp)⁷.

Knowledge and attitudes towards organ donations are determinants of the willingness to donate an organ. In an online survey of 1945 Intensive Care Unit (ICU) nurses, health science students and non-health science students in Austria, Stadlbauer V et al showed that the study participants knowledge of Austrian organ donation legislation was high⁸. In a cross-sectional study survey of 1275 hospital medical and non-medical staff in 15 Japanese medical facilities, Murakami M et al found high knowledge about organ donation and transplantation was associated with willingness to become an organ donor⁹. Further, in a survey of 724 physicians of different specialties in the USA, Alkhatib AA et al showed physicians who were identified as donors were more aware about issues related to organ shortage¹⁰.

In China, organ transplantations have been conducted since the 1960s and have saved tens of thousands of patients. Today, China is the country with the second highest number of organ transplantations worldwide and completed 6,302 organ donations in 2018^{11,12}. Yet, there is still a shortage of organ donors¹³. A survey among 373 health professionals from 7 hospitals in Dalian and 1 hospital in Chaozhou in China, showed that health professionals lacked knowledge about organ donation on the sector where to donate organ and the procedure of donation¹⁴. Attitudes of visitors at adult intensive care unit to organ donation is low in Hong Kong¹⁵. To date, research is limited to studies with small sample size and lacks geographic diversity.

The aim of this study is to assess the knowledge, attitudes, and willingness to organ donation among the general public in China. An analysis of the knowledge and attitudes towards organ donation in the general Chinese public is required to improve the knowledge about organ donation as well as inform policy and legislation aimed at increasing the number of organ donation.

Methods

Study Population

We conducted a survey among residents in 3 regions of China - Eastern, Central and Western China - between October and December in 2019. We used a multistage stratified sampling method. At the first sampling stage, we used the province as the sampling unit, we selected Zhenjiang (Eastern China), Henan (Central China) and Shaanxi (Western China). At the second stage, we sampled one city by province, namely Hangzhou, Zhengzhou and Xi'an. At the third stage, we selected at least 2 districts per city with a final inclusion of 9 districts. At the final stage, we took a convenience sample of individual residents

within the community or town. Based on a willingness to donate of 49%¹⁴, an error (δ) of 3%, $\alpha = 0.05$, $1 - \beta = 90\%$, and an expected 20% nonresponse rate, we estimated the sample size for each site of this study to be at 1334. We recruited a total of 4305 participants.

Research Instruments

We employed a self-designed questionnaire based on previous researches^{16–21} consisting of 4 parts. (1) The participants' demographic and socioeconomic characteristics, including gender, age, education, marital status, employment, monthly income. (2) Participants' knowledge of organ donation which includes ten statements with a true/false response option. For items 1 to 7 and 10, the true answer scored 0, whereas the false answer would score 1; for items 8 and 9, the opposite applied. Hence, the sum of the responses represents the total score of knowledge of organ donation and ranges between 0 and 10. (3) Further, we collected information on participants' attitudes towards organ donation with 20 items using a 5-step Likert scale ranging from fully agree, mostly agree, neutral, mostly disagree, fully disagree. Items 11 to 14 and 30 were scored in declining order where 'fully agree' was equal to 4 and 'fully disagree' was equal to 0, items 15 to 29 were scored inversely and 'fully agree' was scored as 0. The total score of attitudes towards organ donation ranged between 0 and 80. Moreover, the attitudes were grouped in three categories: life view (item 11 to 18), family value (item 19 to 21), and evaluation (item 22 to 30). (4) Lastly, we collected the participants' willingness to organ donate by asking 'Are you willing to donate your organs?' which generated a binary variable (0 = No; 1 = Yes). The specific questionnaire information was showed in additional file 1. Before analysis, the reliability and validity of questionnaire was tested^{22,23}. Accordingly, the Cronbach α for the questionnaire was 0.7399 and regarded as satisfactory of internal consistency of instruments, structural validity test also supported the validity of the questionnaire ($P < 0.001$).

Quality control

Local investigators were instructed on the study procedures and trained by experts from the Liverpool School of Tropical Medicine, Wenzhou Medical University, Hangzhou Normal University, Xi'an Jiaotong University and Zhengzhou University on how to conduct interviews with study participants. We unified inquiry methods before the formal investigation. Regular assessments and examinations were performed during the entire investigation period.

Statistical analyses

The questionnaire data were entered into the EpiData 3.1 software (developed by EpiData Association, Odense, Denmark), we used a double entry method for all data. All questionnaire data were checked for outliers prior to data analysis, outliers of all variables used in this study and missing value of outcome variable were dropped. Continuous variables were summarized as means with standard deviations, and categorical variables were summarized as counts and percentages. We compared differences in knowledge, attitudes and willingness to organ donation by conducting chi-squared test. We assessed the relationship of knowledge and attitudes with the willingness to organ donate using binary logistic

Loading [MathJax]/jax/output/CommonHTML/jax.js owing confounding factors: participants' gender, age, marital

status, education and monthly income. We present the odds ratios (ORs) with 95% confidence intervals (CIs) and a two-tailed p-value of < 0.05 was considered statistically significant. The statistical analyses were performed in SAS 9.4 (SAS Institute, Cary, NC, USA) and figures were made using the R studio software.

Results

Basic information of participants

At baseline we recruited 4500 participants from 3 sites into the study of which 4274 finished the questionnaires, resulting in response rate of 94.98%. Table 1 shows the demographic and socioeconomic characteristics of the study participants by region. Participants were recruited in similar numbers from each region, namely 32.59% (1393) from Western China, 32.64% (1395) from Central China and 34.77% (1486) from Eastern China. Similarly, the distribution between urban and rural participants was 47.13% and 52.87%, respectively. A small majority was female (56.68%) as compared to males (43.32%) and mean age of participants was 32.07 ± 12.08 years.

Table 1
Demographic characteristics

Variables	Group	West (N = 1393)	Central (N = 1395)	East (N = 1486)	All (N = 4274)
Residence	Urban	498(36.03%)	753(54.06%)	757(50.94%)	2008(47.13%)
	Rural	884(63.97%)	640(45.94%)	729(49.06%)	2253(52.87%)
Gender	Male	545(39.32%)	638(46.16%)	660(44.41%)	1843(43.32%)
	Female	841(60.68%)	744(53.84%)	826(55.59%)	2411(56.68%)
Age (years)	Younger than 31	622(46.77%)	723(52.74%)	884(59.61%)	2229(53.27%)
	31–40	376(28.27%)	364(26.55%)	304(20.50%)	1044(24.95%)
	Older than 40	332(24.96%)	284(20.71%)	295(19.89%)	911(21.77%)
Marital status	Others	407(29.43%)	735(52.80%)	892(60.07%)	2034(47.75%)
	Married	976(70.57%)	657(47.20%)	593(39.93%)	2226(52.25%)
Education	Less than Primary school	88(6.34%)	56(4.02%)	87(5.86%)	231(5.41%)
	Middle-High school	642(46.29%)	485(34.79%)	473(31.85%)	1600(37.51%)
	More than University	657(47.37%)	853(61.19%)	925(62.29%)	2435(57.08%)
Employment	No	909(65.49%)	740(53.12%)	902(60.70%)	2551(59.78%)
	Yes	479(34.51%)	653(46.88%)	584(39.30%)	1716(40.22%)
Monthly income (Ren Min Bi)	Less than 3300	818(60.59%)	613(44.32%)	651(43.81%)	2082(49.35%)
	3300–5999	331(24.52%)	452(32.68%)	390(26.24%)	1173(27.80%)
	6000–9999	137(10.15%)	238(17.21%)	267(17.97%)	642(15.22%)
	More than 9999	64(4.74%)	80(5.78%)	178(11.98%)	322(7.63%)

Knowledge of organ donation

The knowledge about organ donation mean score ($\pm$ SD) was 6.50 ± 1.62 out of 10, participants that were willing to organ donate had a higher score as compared to the ones not willing to donate, 6.71 and 6.32, respectively (Table 2). Most participants were aware of the following items 4 and 3: not any doctor can determine brain death (89.52%) and it is correct that living organs can only be donated to immediate

family members (80.35%). More than 60% of the participants chose the correct definitions related to organ donation (item 1, 60.90%) and brain death (item 2, 64.87%). A minority of the participants did not agree with the statement that 'organ removal must be performed only after brain death is determined' (item 5), indicating a lack of knowledge about the donation procedure. Participants that were willing to donate organs were more likely to know about regulations about the age of an organ donor (item 7) as compared to participants who were not willing to donate (71.49% vs 61.33%, $P < 0.001$). However, for items 1 to 4, 8 and 9 participants that were willing to donate scored lower compared to participants that were not willing to donate in particular for items (from) compared with the participants who were not willing to donate organs ($P < 0.001$).

Table 2
The distribution of knowledge on willingness to organ donation

Items	Answer	Willingness to organ donation			P-Value
		All (N = 4274)	No (N = 1393)	Yes (N = 1395)	
Item 1: Organ donation refers to donation of cadaveric organs, living organs cannot be donated	True	1669(39.10%)	538(38.68%)	643(46.19%)	< 0.001
	False	2600(60.90%)	853(61.32%)	749(53.81%)	
Item 2: Brain death means that the patient cannot breathe, and the heart cannot beat	True	1501(35.13%)	477(34.24%)	596(42.75%)	< 0.001
	False	2772(64.87%)	916(65.76%)	798(57.25%)	
Item 3: Living organs can only be donated to immediate family members	True	839(19.65%)	269(19.35%)	372(26.70%)	< 0.001
	False	3430(80.35%)	1121(80.65%)	1021(73.30%)	
Item 4: Any doctor can determine brain death	True	490(11.47%)	165(11.84%)	189(13.58%)	0.008
	False	3781(88.53%)	1228(88.16%)	1203(86.42%)	
Item 5: Organ removal must be performed only after brain death is determined	True	2460(57.65%)	855(61.51%)	759(54.57%)	0.008
	False	1807(42.35%)	535(38.49%)	632(45.43%)	
Item 6: People with any disease can donate organs	True	599(14.03%)	199(14.30%)	213(15.31%)	0.103
	False	3670(85.97%)	1193(85.70%)	1178(84.69%)	
Item 7: People of any age can donate organs	True	1406(33.00%)	536(38.67%)	396(28.51%)	< 0.001
	False	2855(67.00%)	850(61.33%)	993(71.49%)	

Items	Answer	Willingness to organ donation			P-Value
		All	No	Yes	
		(N = 4274)	(N = 1393)	(N = 1395)	
Item 8: Citizens have not expressed their disapproval of organ donation during their lifetime. After their death, spouses, adult children, and parents can jointly express their consent to organ donation	True	2415(56.56%)	833(59.84%)	752(54.02%)	0.007
	False	1855(43.44%)	559(40.16%)	640(45.98%)	
Item 9: Organ donors cannot claim any monetary compensation	True	2402(56.24%)	868(62.36%)	737(52.91%)	< 0.001
	False	1869(43.76%)	524(37.64%)	656(47.09%)	
Item 10: Donors pay for organ removal surgery	True	801(18.75%)	267(19.18%)	265(19.02%)	0.724
	False	3470(81.25%)	1125(80.82%)	1128(80.98%)	
Total score of knowledge to organ donation	Mean(SD)	6.50(1.62)	6.32(1.66)	6.71(1.53)	< 0.001

Attitudes to organ donation

The overall mean ($\pm$ SD) score of attitudes to organ donation in this study was 47.32 ± 9.55 , among participants who were willing to donate organs the attitude score was higher as compared to participants not willing to donate (Table 3, $P < 0.001$).

Table 3
The distribution of attitude of life view on willingness to organ donation

Variables	Willingness to organ donation [Mean(SD)]			P-Value
	All (N = 4274)	No (N = 1393)	Yes (N = 1395)	
The score of attitude of life view on willingness to organ donation (from item 11 to 18)	23.03(6.07)	21.00(5.75)	25.27(5.62)	< 0.001
The score of attitude of family value on willingness to organ donation (from item 19 to 21)	5.78(2.34)	5.44(2.35)	6.14(2.29)	< 0.001
The score of attitude of self-evaluation on willingness to organ donation (from item 22 to 30)	18.46(4.18)	17.84(3.99)	19.15(4.28)	< 0.001
Total score of attitude to organ donation (from item 11 to 30)	47.32(9.55)	44.34(8.99)	50.60(9.05)	< 0.001

Participants willing to donate organs were more likely to fully agree with the views on organ donation such as ‘organ donation can save lives and benefits mankind’ (item 11; 70.14%) and ‘organ donation is a new form of life’ (item 12; 57.93%). On the other hand, 44.31% of participants that were willing to donate fully disagreed with the statement: ‘I think signing an organ donation card is an auspicious thing and it will bring misfortune’ (item 15), 47.28% disagreed with ‘donating organs is an anti-natural thing’ (item 18) and 38.80% fully disagreed with ‘If I donate my organs after death, I cannot have a traditional funeral’ (item 16). This was 2.5 times higher than the responses by participants who were not willing to donate organs (16.81%). Lastly, 21.43% of participants who were willing to donate organs fully disagreed with ‘If you donate your family's organs, it will be disrespectful or unfilially to your family’ (item 20).

Association of knowledge and attitudes with willingness to organ donation

The association of knowledge about organ donation and the willingness to organ donate is show in Fig. 2. The logistic regression model shows that the sum of knowledge items had the strongest positive association with the willingness to organ donation, among the factors including participants’ residence, gender, age, education, employment, marital and economic status analyzed in this study. The OR of the association of knowledge and willingness was 1.12 (95%CI: 1.08, 1.17; $P < 0.001$), indicating that the knowledge score increases by 1 point, the odds of willingness to organ donation would increase by 12%, meaning more participants will be a potential donor. In addition, the logistic regression model indicated that the attitudes score (OR = 1.08, 95%CI: 1.07, 1.09; $P < 0.001$) was positive determinant of willingness to organ donate (Fig. 3) when controlling for other factors.

The number of organs donated in China has risen rapidly over the past decade but the need is not met which presents a major obstacle to saving lives. This study is the latest survey of the general public's knowledge, attitudes, and willingness to organ donate across geographical settings in Western, Central and Eastern China. We provide an important perspective on organ donation and the barriers to willingness to donate related to knowledge and attitudes.

Main findings

This study shows that higher knowledge about organ donation was associated with the willingness to become an organ donor, which is consistent with previous studies conducted by Figueroa CA et al in Dutch and Wale J et al in the United Kingdom^{24,25}. Other studies conducted in Australia, Korea, Niger and Ghana showed no such association^{26–29}. These discrepancies might be related not only to the measurement of knowledge (the content and number of questions), but also to different cultural and country specific factors such as traditional values, religious beliefs, compensation mechanisms, institutional credibility and ideals³⁰. The relationship between knowledge and willingness to organ donation needs more research to verify. In this study, 10 questions were designed to determine general public's basic knowledge about organ donation. Only 60.90% of the general public identified the right meaning of brain death, and 42.35% of general public were familiar with the right procedure of organ removal. Therefore, increasing knowledge about the concept of brain death and the transplant procedure may help raise the rate of willingness to organ donation in China. Our study also indicated that attitudes were positively associated with the willingness to organ donation, which was confirmed with other studies¹⁸. It is important to note, that most of general public were strongly in favour of organ donation. Chinese traditional values such as donating organs was an auspicious thing (item 15), an anti-natural thing (item 18), cannot have a traditional funeral (item 16), was disrespectful to family (item 20) had not hindered Chinese general public's intentions about organ donation. This finding was consistent with Zhang H, et al's and Aijing L, et al's investigations after 2015, but contrary to several other studies in China before 2014^{30–32}. A possible explanation is that with the development of science and education, Chinese general public's attitudes to death and organ donation have changed. From the dimension of evaluation, 63.4% of general public support 'organ donor families can receive appropriate financial assistance for organ donors' families, which was consistent with Rasiah R, et al and Gordon EJ, et al 's conclusion that financial incentives were significant to help raise rate of willingness to organ donation^{33,34}. Therefore, it is recommended that the relevant departments implement certain financial subsidies to organ donors, so as to improve the willingness to organ donation.

Limitations

This study has some limitations. Firstly, this is an observational study and the confounders of willingness to organ donation included in this study are limited by the pre-specified questions in the surveys. There could be some potential unobserved confounding factors (related policies such as presumed consent law and allocation priority were found to be effective measures to increase organ donation^{35–37}) we did not

Loading [MathJax]/jax/output/CommonHTML/jax.js this study reports the influence of general public's knowledge

and attitudes on willingness to organ donation based on a quantitative study, more evidence based on qualitative studies and randomized controlled trials are needed to support the results comprehensively. Nevertheless, this study forms an important baseline step for future studies.

Conclusions

In summary, knowledge and attitudes were found to be positively associated with Chinese general public’s willingness to organ donation and their attitudes were less hindered by Chinese traditional values. Besides, our study suggested that a donation education program focusing on increasing knowledge about the concept of brain death and the transplant procedure may help raise the rate of willingness to organ donation in China, and ultimately to reduce the imbalance between the supply and need for organ transplantation.

Abbreviations

CMHS	Continuum of care for maternal health services
CI	Confidence Intervals
ICU	Intensive Care Unit
OR	Odds Risk
WHO	World Health Organisation
SD	Standard Deviation

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

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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: JD, XF and ML. Analysis and interpretation of data: All authors. Wrote the manuscript: All Authors. Revision of the paper: EL, DW, HR and XF. All authors reviewed and approved the final manuscript.

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Figures

Figure 1

Proportion of willingness to organ donation among different attitudes

Valirables	Group		Odds Ratio (95%CI)	P value
Total score of knowledge			1.12 (1.08-1.17)	<0.001
Region	Central		1.00	
	East		1.51 (1.29-1.76)	<0.001
	West		1.38 (1.17-1.64)	<0.001
Residence	Urban		1.00	
	Rural		0.90 (0.79-1.03)	0.130
Gender	Male		1.00	
	Female		1.28 (1.12-1.46)	<0.001
Age (years)	Younger than 31		1.00	
	31-40		1.02 (0.84-1.24)	0.835
	Older than 40		1.04 (0.84-1.29)	0.713
Marital status	Others		1.00	
	Married		0.75 (0.63-0.90)	0.002
Education	Less than Primary school		1.00	
	More than University		1.50 (1.10-2.06)	0.012
	Middle-High school		1.40 (1.03-1.89)	0.032
Employment	No		1.00	
	Yes		0.88 (0.75-1.04)	0.132
Monthly income (Ren Min Bi)	Less than 3300		1.00	
	3300-5999		0.87 (0.73-1.03)	0.110
	6000-9999		0.92 (0.74-1.15)	0.468
	More than 9999		1.07 (0.81-1.41)	0.640

Figure 2

Association of knowledge with willingness to organ donation when controlling for other confounders by multivariate analysis

Figure 3

Association of attitudes with willingness to organ donation when controlling for other confounders by multivariate analysis

Supplementary Files

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- [Additionalfile1.docx](#)