

Biospecimen Donation in Biobank Construction: Aspects Affecting Donation and Publics' Concern

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Abstract

Background A biobank is a storage facility which stores sample mainly for biological or medical researches. Biospecimen collection is the kind of work essential in the building of biobank. However, we found the collection works had the difficulties in the proceeding because of the low anticipation rate.

Methods We here conducted a questionnaire including several questions covered several aspects in order to find out people's attitude towards biospecimen donation. The questionnaire had 20 questions mainly focused on overall publics' participation rates, matters that influence their participation and major publics' concerns in biospecimen donation.

Results In our survey, 1477 from 2200 distributed questionnaires were responded, and electronic questionnaires showed the highest response rate of 49.9%. In all respondents, 936 showed willingness in participation, providing a percentage of 63.4%. We found that most respondents lack the knowledge of biospecimen donation and biobanking but still have a positive attitude towards biospecimen donation. Several factors, including family disease history($p < 0.05$), previous donation history ($p < 0.01$), the knowledge of biospecimen donation ($p < 0.01$), the knowledge of biospecimen donation conception ($p < 0.01$) were closely linked to donation willingness. Among those factors, family disease history, brief knowledge about biospecimen donation were independent factors affecting donation willingness. The reverse health effects and privacy leakage were major concerns among the majority of respondents. Primary reasons affected willingness, or unwillingness donation were their benefic to public interests and privacy concerns. In summary, this survey we mainly discussed factors affecting publics' willingness and issues people concerned most in biospecimen donation of a biobank.

Conclusions Most respondents hold positive attitudes towards biospecimen donation but lack relevant knowledges. Several factors influenced donation willingness probably caused by those deficiency knowledge. Even though faced this challenge, responders' merits of altruistic behavior may contribute to the act of donation. In addition, information leakage and health impairment remained the domain factors prevented their participation. Further works are required to eliminate those undesirable elements restrained biospecimen donation by the well biobank knowledge popularization and detailed pre-donation information exchange .

Background

As we know, biobanks are the storage facilities that store samples for further researches, involve in big-data researches and evolve in new and upcoming researches [1]. It can provide many samples in a short time and usually established by hospitals, scientific research facilities. Researchers desire for real and effective samples to carry out epidemiological research, clinical research and pharmaceutical research[2–4], which biobank can meet their needs. Conclusively collection of human biospecimen, including biofluid, stool, tissues, organs or processed biospecimens, show indispensable value in biobank construction[5]. However, in the previous studies, human biospecimen collection met a variety of social

factors and donors' concerns in the non-target collection. Due to those reasons, people showed lower degree cooperation[6].

In recent years, the Chinese government has promoted the construction platform of Medical Big Data, which called for biobank construction [7]. Due to the rapid development phase of standard biobanks construction, most people are unfamiliar to the biospecimen collection. Even people who can clearly understand the concept of biospecimen collection also reluctant to donate biospecimens in our pervious biospecimen collection. The main reason we found is that publics' willingness of donation and the factors influencing donation willingness were unclear. Moreover, lacking a uniform standard for informed consent, which affected people's willingness appeared in the work of biospecimen collection. Besides, the main concerns of informed consent affecting the donors' willingness to donate have not been reported. All of those problems above had an unknown impact on the biospecimen collection process.

Therefore, according to the previous questionnaire[8–11], we designed a questionnaire for people who had highly educated and can understand the survey. The purpose of this study was to assess the impacting factors of participation tendency in healthy youth when facing biospecimen collection projects. We gathered the answers in order to find publics' major concerns in biospecimen collection and factors that influenced the willingness for donation.

Materials And Methods

Sample size estimation

We first distributed a test questionnaire to 35 young people and conducted a test survey to ensure that participants understood the survey project and provide clear answers. With a 63% approval rate (22/35), we estimate that 60–70% of respondents will support the biospecimen donation[12]. To obtain a 95% confidence interval(CI) of $\pm 2.5\%$ around 65%, we need to get 1300 people participation. We expected that the participation of 60%, leading to the number of 2200 people.

Study design, setting and participants

Questionnaire designation was based on previous studies on healthy people [13]. This survey focused on accessing the intention of healthy young people to participate in biospecimen donation. The questionnaire was evaluated and reached consensus by three independent reviewers. The final anonymous questionnaire covered age, gender, nationality, career, residence(urban/provinces or rural/provinces), education background(high school, ungraduated or graduated), marital status, previous donation, family disease, the willingness to attend the questionnaire, Chinese is the primary language of the questionnaire. In this questionnaire, biospecimens refer to specimens obtained from relatively non-invasive routes such as blood, urine, feces and saliva, as well as discarded test biospecimens and postoperative biospecimens.

We distributed anonymous electronic questionnaires through internet among students and faculty from 2019.3- 2019.4, and we also distributed paper questionnaires to random youth passers-by in the field investigation. Based on the feedback of the pre-sent questionnaire, we conducted electronic questionnaires and paper questionnaires for 2200 people. Of which, 1400 questionnaires were randomly sent by QQ and Wechat, and 400 randomly sent by e-mail, another 400 were randomly sent by paper questionnaires. This research used a cross-sectional method.

Inclusion and exclusion criteria

In order to investigate the health youth, we limited respondents aged from 16 to 35, without a history of trauma and operation and completely finish questionnaires will include in our study.

For respondents who were willing to donate biospecimen, questionnaires also covered their primary motivation for donation and their interest in biospecimen usage. To investigate the key factors related to the respondents' main concerns, causes for concern and willingness to donate, the respondents were asked to select one or more options provided by the topic.

Ethical approval

The study protocol was reviewed and approved by the Ethics Committee of Third Xiangya Hospital of Central South University.

Group classifies

In the article, 'I would certainly agree' and 'I would agree' group together, and group 'I would disagree' and 'I would certainly disagree', and Age groups were divided into 16–18,19–25 and 26–35 years. Educational backgrounds were grouped to 'High school graduation' vs 'Undergraduates' vs 'Postgraduates' as the reference. self-rated health condition was categorized as 'excellent/ good' vs 'fair/poor'. Respondents attitude on biospecimen donation were ordered from 'very negative' to 'very positive' and grouped in 'Very concerned', 'concerned', 'not sure', 'not concerned' and 'Completely not concerned'. Then the original 5-point Likert scale was used to assess the primary outcomes.

Statistical analysis

All data were calculated by quantities and percentages. The associations of socio-demographic characteristics, public's knowledge, concerns and willingness to donate were used the chi-squared test to analysis. If the results statistical significance level were 0.05 or less, it would be included in the logistic regression model. Moreover, multiple logistic regression was used to analysis demographic characteristics and other impact factors associated with the donation willingness, and RRs with 95% confidence intervals (CIs) to estimate the willingness to participate biospecimen donation. All statistical analyses were conducted in SPSS software system(SPSS for Mac, version 22).

Results

1. Responders' characteristics

The anonymous electronic questionnaires were spread through QQ, Wechat, E-mail and issue paper anonymous questionnaires face to face. A total number of 2200 people were invited to this research. After excluding those did not accord with the inclusive criteria, 67.1%(1477) of respondents mainly aging from 16 to 35 years, were included in this survey. The electronic questionnaires sent by QQ and WeChat had the highest response rate of 49.9% (1097), the other two methods: E-mail 10.9% (239) and paper questionnaire 6.4% (141). (Supplement Table 1)

In all the gathered questioners, slightly above half were female (824, 55.8%). A majority (1422, 96.3%) of the respondents were in good health, whereas very few with fair/poor health (55, 3.7%). More than half (783, 53.0%) of respondents were unmarried, and 1321 (89.4%) respondents were Han nationality, and 156 (10.6%) were minorities. 1250 (84.6%) had undergraduates or higher education background and 1274 (86.3%) live in the urban area. About one in five respondents (306, 20.7%) had a family disease history, 8.4% (124) had a chronic disease history, and about one in ten (187, 12.7%) had a previous donation history. All respondents' characteristics were listed in Supplement Table 2.

2. Respondents' knowledge of donation and biobank construction

Among the respondents, about one in five of them (305,20.6%) said they have a brief knowledge of biospecimen donation, while 1172(79.4%) indicated that they do not know about that. Among them, 194(63.6%) respondents knew the type of biospecimen, 162(53.1%) knew the usage of biospecimen and 89(29.2%) of them knew the process of biospecimen donation. 106(34.8%) have an overview but knew no details of biospecimen donation, most of the respondents who had contacted the biospecimen donation have some knowledge of biospecimen type and usage. Results listed in Supplement Table 3.

3. Donation willingness in different situations

In 1477 responders, 936 were willing to participating, providing a percentage of 63.4%. Among them, 638 (68.2%) respondents indicated that they are willing to donate biospecimens and participate in biospecimen collection of discarded biospecimens after examinations. There were 421(45.0%) respondents willing to donate biospecimens without any test, training or treatment, and there were 256(27.4%) respondents willing to donate biospecimens after hospital discharge. In other conditions, such as before admission(252, 26.9%), after the treatment(245, 26.2%) and before treatment(219, 23.4%), the willingness of biospecimen donations was almost identical percentage. (Table 1)

4. Characteristics affecting the donation willingness

Several characteristics, including genders, age, place of residence, educational background, nationality and health condition, were being analyzed in order to find the aspects influencing donation willingness. Chi-square test of all respondents characteristics and biospecimen donation willingness demonstrated statistically significant between donation willingness and family disease history($p<0.05$), previous

donation history ($p < 0.01$), the brief knowledge of biospecimen donation ($p < 0.01$) and the knowledge of biospecimen donation details ($p < 0.01$). (Table 2)

Univariate analysis and multivariate analysis were used to investigate factors relation with donation willingness. In the univariate analysis model, we observe that people with family disease history ($p = 0.016$), a previous donation ($p < 0.01$), brief knowledge of biospecimen donation ($p < 0.01$) and knowledge of biospecimen donation details ($p < 0.01$) were more likely to participate in the biospecimen donation. (Table 3). In the multiple logistic regression model, donation willingness and related factors were included in the following assay. Respondents with family disease history ($p = 0.014$) and respondents have a brief knowledge of biospecimen donation ($p < 0.01$) were more willing to participate in biospecimen donation. (Table 3)

In summary, the respondents more likely to donate biospecimen were had the family disease and had a brief knowledge of biospecimen donation, held a positive attitude to biospecimen donation.

5. Major concerns and motivation in donation willingness

Respondents who participate in the questionnaire and willing to donate biospecimen were invited to answer additional questions about their major motivations and major concerns (Table 1). Most of them driven by altruistic motives choosing the social benefits. There were 598 (63.9%) respondents motivation is to benefit the public, 526 (56.2%) respondents choose to help other patients, while there were 479 (51.2%) choose to help family members, relatives or future generations, 424 (45.3%) choose to benefit to their health. Moreover, there were 486 (51.9%) refer to benefit advance researches. However, when talking to the concerns, among the adverse effects of the questionnaire, half of the respondents (518, 55.3%) who were willing to donation chose to focus on the adverse effects on their health, and 513 (54.8%) respondents concerns on the leakage of personal information or biospecimens. Another 370 (39.5%) respondents concerned about the impairment of medical rights. (Table 1)

When respondents were asked what problems they were most worried about in the process of biospecimen donation and the factors prevented them from participating in the biospecimen donation, more than half (322, 59.5%) of the respondents who were unwilling to donation expressed concern that individual's private information could not be entirely protected. In contrast, only 137 of the respondents were concerned that their health would be affected. Another 54 respondents said they were not interested. 43 respondents concerned that biospecimen and information may be used for unclear purposes. There were 9 of the respondents said they have other reasons for their unwillingness to participate in biospecimen donation, such as fear of being cheated without knowing the corresponding knowledge, time-consuming to donation specimens, and they fear to be taken by others to get their personal data. When it comes to the concerns, 257 (47.5%) respondents concerned about the negative impact on their health, and 236 (43.6%) respondents concerned about the leakage of personal information or biospecimens. 158 (29.2%) respondents concerned about the impairment of medical rights. Besides, 131 (24.2%) concerned about the influence of examination results. Equally, 125 (23.1%) respondents

express the distrust toward biobank staff. Furthermore, 81(15.0%) respondents concerned about the unknown impact in the future. (Table 1)

Discussion

As we know, the usage of healthy and pathological data and tissues are necessary and ordinary in scientific research. High-quality biospecimens and its related data are essential for scientific researches. In the previous process of collecting biospecimens, we have contacted a large number of college students and post-graduates, but most of them show low participation. In that case, we speculated that it was not easy in obtaining biospecimens and data from healthy people, especially for young people. Therefore, in order to find the youths' truth attitude towards specimen collection, we designed an anonymous questionnaire to investigate domestic healthy young volunteers' participation intentions in biospecimen donation. We sought to see the intention degree of healthy young volunteers to participate in biospecimen donation and related factors affecting participation intention.

The questionnaire in this study was mainly conducted by Wechat and QQ, which were the unique means of Chinese network communication and had the characteristics of low cost, large-scale, high promotion and high public acceptance[14, 15]. Paper questionnaires have the advantages of face-to-face communication and clear explanation, but its probability of being rejected is higher than that of online questionnaires [16]. Internet questionnaires may lead to an unclear understanding of the concept of the investigation, doubts about the credibility of the questionnaire results, and distortion of filling information [16]. Having ignored those deficiencies, we thought that the internet was more convenient and acceptable to the public, and can enable information collection working in a relatively low-cost and large-scale manner[17]. Some researchers have found higher response rates in the survey using an online questionnaire when compared to paper questionnaire [18, 19]. The result of our study also showed the same trend (60.7% in the online distributed questionnaire). After excluding those who do not meet our inclusion criteria, the response rate is in line with our expectations. In general, even though our survey met the difficulty in conducting a targeted investigation due to the limitation of the electronic questionnaire which accounts for a majority of our distributed questionnaires, but it still has a certain guiding significance in describing donation willingness in the general healthy people.

In our study, people showed the different attitude of donation in different situations and prone unwillingness in situations such as before admission, before and after treatment, hospital discharge. We thought the willingness in the different situation was affected by the biospecimen collection methods. Lacking relevant knowledge of biospecimen made them uneasy to understand appropriate and convenient circumstances of biospecimens donation. Most publics know the sample collection from blood, urinal, stool or saliva test. However, they have no idea of other biospecimens, such as molecular, pathological examination, et al. Also, we thought that they were afraid of incorrection in the sample examination due to the donation.

In our study, only 63.4% of the respondents expressed their willingness to participate. While, in some previous studies, respondents showed a more positive attitude towards donating biospecimens (64%–90%)[20, 21]. The reason was we thought may due to their in-invasive collecting methods described in their article in a biobank. In addition, even though foreign studies have shown that donation willingness has nothing to do with medical distrust[22], we thought the low public trust in biospecimen donation might come due to the tense doctor-patient relationship in China[23]. Some previous studies have identified several sociological characteristics and personal factors associated with the willingness to participate in the specimen donation and biobank researches. In general, different gender, age, nationality, marriage, education background, donation history, family disease and the knowledge of biospecimen donation have been proved can influence public's willingness in specimen donation[6, 24–26]. Also, researches have reported that people with higher education background may hold more positive attitudes toward donation[27]. We included these characteristics in our questionnaire to investigate the connection between different characteristics and donation willingness.

In our research, we found the donation history and knowledge of biospecimen donation were factors that affected donation willingness. The same results were also found in a study of Arabia clinics which showed that the donation history could elevate the donating participation[28]. Their donation experience and biobank knowledge have made them hold a more positive towards biospecimen donation to a certain extent. People with donation history have a better understanding of biospecimen collection methods and usage, which made them were more willing in participate. Most respondents in our search provide limited insight toward biobank, which leads a low willingness toward donation. Different gender affected donation willingness in the Scotland research[29], but the result in our study have no significant. Another research found that people with minority nationality show lower cooperation to biobank research[30], but in our study, we did not found have a significant difference. We also found that family disease history can affect the willingness in biospecimen donation, this phenomenon may drive by the attention of self-health, the respondents seem to be more careful about the family disease especially when the family member or close friends were in the unhealthy situation. The respondent's experience of some genetic disease may raise their attention to the importance of this new field of the biobank. The previous study explained the donors' positive attitude toward advantage researches, the donors' willingness to donate blood samples had a relationship with their personal experience of family/genetic disease[27, 31].

In our study, the largest share of motivation affecting donation willingness was "*biospecimen donation benefits society*" and "*help other patients*". The same result was also found in previous studies[32, 33]. Among the respondents, an equal percentage choose to "*help family members, relatives or future generations*" and "*benefit advance researches*". The health youth, which accounted for the majority of our research, seems more positive toward altruistic and gain a sense of responsibility to the society. Also, according to our questionnaire, we find younger seemed to have a sense of duty and desire to contribute to the future.

Our research also covered negative impacts affecting their participation. In previous scientific research, some people worried about privacy when they did scientific researches, and it was tough to obtain

biospecimens from healthy people in China[34]. We found that the leakage and loss of personal information was the main reason that prevented people from participating both in the two groups. We think this result may be due to the severe information leakage, which has been a common phenomenon in the internet age[35]. Apart from this, impairment of medical right and bias of exam results were also their concerns in our research. We believe that these concerns are still due to the low penetration rate of knowledge in the biobank. Information unequal and trust crises between biobank staff and donors were major obstacles in the work of biospecimen collection. Moreover, that kind of obstacle we believe can be eliminated by the good biobank knowledge popularization and detailed pre-donation information exchange. As biospecimen collectors and propagandists, It is necessary to correctly introduce the security of informed consent, privacy protection, information protection and biospecimen use.

Conclusion

This study assessed the biospecimen donating willingness of ordinary young people in the construction of the biobank. Even restricted by insufficient knowledge of the relevant content, we found that most of the respondents maintained a positive attitude towards biospecimen donation. The main factors influenced donor's willing we found was the concern of privacy leakage and impairment of physical health and medical rights. We believe that the reason behind this misunderstanding is the lack the knowledge of biobank and specimen collection, which can be solved by public popularity. In addition, a more standardized process in the subsequent use of donated biospecimens and a detail corresponding interpretation of the participants before collecting biospecimens were required. More importantly, trust needs to be built up, in the entire process of biospecimen use, including collection, storage, use and data sharing, so that donors can correctly and comprehensively understand the importance of biospecimen donation and show a more participated rates.

Declarations

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Availability of data and materials

In order to protect the privacy of responders, the data and/or analysis of this study cannot publicly availability. However, the data can be obtained from the corresponding author as reasonably requests.

Ethics approval and consent to participate

This study was reviewed and approved by the Ethics Committee of Third Xiangya Hospital of Central South University. Respondents were informed that their agreement to participate in the study were voluntary and completed their informed consent.

Authors' contributions

HY, ZZ and JH designed the questionnaire, YZ and BQ participated in the questionnaire granting. Besides, JH and ZZ participated in the analyzed and interpreted the data. ZZ drafted the manuscript. All authors read and approved the manuscript.

Competing interests

The authors declare that they have no competing interests.

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Tables

Table 1 the motivation and concerns of donation willingness

Variables	Respondents	%
For those willing to donation(N=936)		
What are the most motivations affect you to donate?		
For the benefit of other patients	526	56.2
For the benefit of family members, relatives or future generations	479	51.2
For the benefit of my health	424	45.3
benefit advance researches	486	51.9
Biospecimen donation benefits society	598	63.9
No specific motive	103	11.0
Do you concerned about the negative impact on yourself when you decided to donate biospecimens?		
Very concerned	553	37.4
Concerned	790	53.5
Not sure	87	5.9
Not concerned	44	3.0
Completely not concerned	3	0.2
Which possible negative impacts do you most worried about?		
Reverse health effects	518	55.3
Impairment of medical rights	370	39.5
Influence examination results	351	37.5
Non-financial reward	69	7.4
Leakage of personal information or biospecimens	513	54.8
The distrust toward biobank staff	279	29.8
Unknown impact in the future	135	14.4
For those unwillingness to donation(N=541)		
What are the possible reasons do you concern disagree to the biospecimens donation?		
Personal privacy information lack of protection	322	59.5
have an impact on health	137	25.3
Concerned about the usage for unclear purposes	43	7.9
Have no interest	54	10.0
Other reasons	9	1.7
Which is the impact you most worried about?		
Reverse health effects	257	47.5
Impairment of medical rights	158	29.2
Influence examination results	131	24.2
Non-financial reward	32	6.0
Leakage of personal information or biospecimens	236	43.6
The distrust toward biobank staff	125	23.1
Unknown impact in the future	81	15.0
In which condition would you agree to donate biospecimen (Suppose you need hospitalization, samples including blood, cerebrospinal fluid, saliva, urinal, spool, tissues, etc.)? (N=936)		
Health people without any test, training or treatment	421	45.0
After examinations	638	68.2
Before admission	252	26.9
Before treatment	219	23.4
After treatment	245	26.2
Hospital discharge	256	27.4

Table 2 respondents characteristic and related with donation willingness

Variables	Respondents N=1477	Willingness to donate				χ^2	P-value
		Yes		No			
		N	%	N	%		
Total (2200 invited), n(%)	1477(67.1)						
Male	653(44.2)	406	43.4	247	45.7	0.723	0.395
Female Gender, n(%)	824(55.8)	530	56.6	294	54.3		
Categories of age(years), n(%)							
16-18	422(28.6)	261	27.9	161	29.8	4.200	0.122
19-25	780(52.8)	486	51.9	294	54.3		
26-35	275(18.6)	189	20.2	86	15.9		
Mean age±SD, median	23.83±(±5.48,25)						
Level of education							
High school graduation	227(15.4)	148	15.8	79	14.6	0.550	0.760
Undergraduates	958(64.9)	601	64.2	357	66.0		
Postgraduates or above	292(19.8)	187	20.0	105	19.4		
Health condition, n(%)							
Excellent	1196 (81.0)	753	80.4	443	81.9	1.233	0.540
Good	226(15.3)	150	16.0	76	14.0		
Fair& Poor	55(3.7)	33	3.5	22	4.1		
Nationality, n(%)							
Chinese Han	1321(89.4)	833	89.0	488	90.2	0.529	0.467
Other nationalities	156(10.6)	103	11.0	53	9.8		
Location							
First-tier cities	313(21.2)	199	21.3	114	21.1	0.255	0.968
Second-tier cities	182(12.3)	113	12.1	69	12.8		
Third-tier cities	779(52.7)	493	52.7	286	52.9		
Rural areas	203(13.7)	131	14.0	72	13.3		
Marital status							
Married	694(47.0)	448	47.9	246	45.5	0.787	0.375
Unmarried	783(53.0)	488	52.1	295	54.5		
Income level(yuan/year)							
Less than 50000	666(45.1)	432	46.2	234	43.3	1.588	0.662
50,000 -100,000	386(26.1)	239	25.5	147	27.2		
100,000 -150,000	250(16.9)	159	17.0	91	16.8		
More than 150,000	175(11.8)	106	11.3	68	12.8		
Family disease history							
Yes	306(20.7)	212	22.6	94	17.4	5.806	0.016
No	1171(79.3)	724	77.4	447	82.6		
Chronic disease history							

Yes	124(8.4)	77	8.2	47	8.7	0.095	0.758
No	1353(91.6)	859	91.8	494	91.3		
previous donation							
Yes	187(12.7)	140	15.0	47	8.7	12.187	0.01
No	1290(87.3)	796	85.0	494	91.3		
brief knowledge of biospecimen donation							
Know	305(20.6)	246	26.3	59	10.9	49.469	0.01
Unknown	1172(79.4)	690	73.7	482	89.1		
knowledge of biospecimen donation details							
Know	234(15.8)	187	20.0	47	8.7	32.782	0.01
Unknown	1243(84.2)	749	80.0	494	91.3		

Table 3 Binary Logistic Regression analysis

Variables	Univariate analysis			Multivariate analysis		
	HR	95CI	P	HR	95%CI	P
Categories of age(years)						
16-18	1			1		
19-25	1.020	0.799-1.302	0.875	1.075	0.781-1.480	0.655
26-35	1.356	0.983-1.870	0.064	1.453	0.991-2.131	0.056
Gender	0.912	0.737-1.128	0.395	0.911	0.730-1.136	0.408
Nationality	0.878	0.619-1.246	0.467	1.145	0.798-1.642	0.463
Marital status	1.101	0.890-1.361	0.375	1.078	0.855-1.359	0.525
Income level						
Less than 50,000 yuan/year	1			1		
50,000 -100,000yuan/year	0.881	0.679-1.142	0.338	0.753	0.551-1.029	0.075
100,000 -150,000yuan/year	0.946	0.699-1.281	0.722	0.769	0.537-1.100	0.150
More than 150,000 yuan/year	0.832	0.591-1.172	0.293	0.733	0.495-1.087	0.122
Education background						
High school graduation	1			1		
Undergraduates	0.899	0.664-1.216	0.489	0.883	0.626-1.246	0.479
Postgraduates	0.951	0.661-1.367	0.785	0.934	0.609-1.434	0.756
Location						
First-tier cities	1			1		
Second-tier cities	0.938	0.643-1.369	0.741	0.934	0.632-1.382	0.734
Third-tier cities	0.987	0.752-1.297	0.928	1.002	0.755-1.329	0.989
Rural areas	1.042	0.721-1.506	0.826	1.117	0.764-1.633	0.568
Health condition						
Excellent	1			1		
Good	1.161	0.860-1.567	0.329	1.236	0.893-1.711	0.202
Fair &Poor	0.882	0.508-1.533	0.657	0.873	0.487-1.566	0.649
Family disease history	1.392	1.063-1.824	0.016	1.418	1.073-1.873	0.014
Chronic disease history	0.942	0.645-1.377	0.758	0.973	0.657-1.441	0.890
Previous donation	1.849	1.304-2.621	<0.01	1.395	0.953-2.043	0.087
Brief knowledge of biospecimen donation						
Know	1			1		
Unknow	2.913	2.143-3.959	<0.01	2.377	1.644-3.436	<0.01
Knowledge of biospecimen donation details						
Know	1			1		
Unknown	2.624	1.869-3.685	<0.01	1.401	0.918-2.137	0.118
Concerned about the negative impact						
Concerned	1			1		
Not concerned	0.962	0.665-1.393	0.839	0.896	0.611-1.312	0.571
Concerned about the biospecimen application						
Concerned	1			1		
Not concerned	1.281	0.918-1.789	0.145	1.203	0.854-1.695	0.290

Supplementary Files

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