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Barriers and willingness to express consent to organ donation among the Kazakhstani population

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Abstract

Background Organ donation is a critical component of healthcare, yet donation rates in Kazakhstan remain low. Understanding the socio-demographic factors, knowledge levels, and perceived barriers influencing individuals' willingness to consent to organ donation is essential for developing effective interventions.

Methods This cross-sectional study surveyed 1,294 participants across Kazakhstan. The sample was predominantly female (78.3%), urban (79.4%), and well-educated, with a significant proportion having medical backgrounds. Data were collected on socio-demographic characteristics, knowledge about organ donation, and perceived barriers. Comparison methods and binomial logistic regression analysis was used to identify significant predictors of willingness to express consent for organ donation.

Results Age, ethnicity, family status, and knowledge about organ donation were significant predictors of willingness to donate. Older participants and Russian ethnic group members were less likely to consent, while widowed individuals and those with higher knowledge levels were more likely to express consent. Although several factors did not have significant prediction with willingness to donate in the regression analysis, chi-square and U-tests revealed significant associations for residence, occupation, educational level, and religious affiliation. Key barriers to donation included distrust in the medical system, fears of organ trafficking, and insufficient awareness, particularly among non-medical participants. These barriers were significant deterrents and correlated with lower willingness to donate. However, due to the overrepresentation of urban, educated, and medical-affiliated participants in the sample, findings may not fully reflect the general population of Kazakhstan.

Conclusion The findings highlight the need for targeted educational campaigns to increase public awareness and address misconceptions about organ donation. Building trust in the medical system and dispelling fears of unethical practices are essential for improving donation rates. The study underscores the complex interplay of socio-

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demographic factors, knowledge, and perceived barriers in shaping organ donation decisions in Kazakhstan, while also emphasizing the need for future research with a more representative sample.

Keywords Organ donation, Barriers, Willingness, Knowledge, Kazakhstan

Introduction

Organ donation is a critical component of modern healthcare, offering a viable option for patients with end-stage organ failure [1]. Despite its significance, organ donation rates remain low in many parts of the world, including Kazakhstan. Since the first heart transplant in Kazakhstan in 2012, progress has been made, with a total of 92 heart transplants and 474 liver transplants performed by 2023, though only 13.3% of liver transplants involved deceased donors [2, 3]. Similarly, out of 1,278 kidney transplants performed between 2012 and 2019, only 12.6% were from deceased donors [4].

As of August 2024, more than 4,000 individuals in Kazakhstan are on the waiting list for deceased-donor organ transplantation, with the majority (91.4%) requiring kidney transplants [5]. However, every year, 200–300 patients either leave the waiting list voluntarily or pass away before receiving a transplant, underscoring the urgent need to increase awareness and willingness to donate organs in the country. The persistent gap between organ supply and demand underscores the importance of understanding the factors influencing individuals' decisions regarding organ donation.

Kazakhstan follows an opt-in system for organ donation, meaning individuals must actively express their consent or refusal regarding posthumous organ donation. According to paragraph 8, Article 209 of the Code of the Republic of Kazakhstan "On the Health of the People and the Healthcare System" (dated July 7, 2020, No. 360-VI ZRK), citizens can register their decision to consent or refuse posthumous organ (or tissue) donation either by visiting a primary healthcare facility or through the electronic government portal. If a person has not documented their decision and brain death is confirmed, the deceased's closest relatives are authorized to either consent to or refuse organ donation on their behalf. However, if the deceased had formally expressed consent for organ donation during their lifetime, transplant coordinators will inform the relatives, who may either agree with or override the deceased's wishes regarding donation. This distinction between legal provisions and actual clinical practices underscores the complexities surrounding organ procurement decisions in Kazakhstan.

Previous research has demonstrated that organ donation willingness is influenced by a range of socio-demographic, cultural, and psychological factors [6–10]. Studies from other countries have shown that religious beliefs, cultural norms, medical trust, and knowledge about organ donation play a crucial role in shaping individuals' decisions to donate [11–15]. Kazakhstan is home to over 100 ethnic groups, with Kazakhs and Russians being the largest, alongside significant communities of Uzbeks, Ukrainians, Uyghurs, Germans, Tatars, etc. Religiously, Islam and Russian Orthodoxy are predominant, with smaller groups practicing Christianity, Judaism, and other faiths. These cultural and religious diversities can shape attitudes toward medical interventions, including organ donation, creating both challenges and opportunities for increasing donor participation. Given the evolving nature of Kazakhstan's transplantation system and the historical lack of research on public perceptions of organ donation in this region, a detailed analysis of these factors is necessary.

Despite the critical need for organ donation, limited research has been conducted in Central Asian region on public attitudes, making this study one of the first comprehensive assessments. Studies from Turkey, Uzbekistan, and the broader Middle East and Central Asia highlight common barriers, including low awareness, cultural and religious concerns, and distrust in the healthcare system. In Turkey, only 33.9% felt informed about organ donation, and 85.2% refused to donate a deceased family member's organ, largely due to misconceptions about brain death and body integrity [16]. Similarly, in Uzbekistan, limited access to transplantation forces patients to seek treatment abroad, while efforts to implement deceased-donor programs face public trust challenges [17]. Across the region, living-donor transplants dominate due to inadequate procurement infrastructure and ethical debates on brain death [18]. However, no large-scale studies have examined these determinants in Kazakhstan.

This study aims to examine the socio-demographic, cultural, and knowledge-related determinants of willingness to express consent for organ donation in Kazakhstan. Given the country's diverse ethnic and religious composition and the evolving nature of its transplantation system, understanding public perceptions, religious beliefs, and trust in the medical system is crucial. By identifying key barriers and facilitators, this research seeks to provide evidence-based insights to inform culturally sensitive educational campaigns and targeted public health interventions aimed at increasing donor rates. The findings of this study will contribute to national efforts to improve organ donation awareness, reduce misconceptions, and expand the donor pool in Kazakhstan.

Methods

Study design and participants

This study utilized a cross-sectional survey-based design to explore the willingness to express consent to organ donation and identify barriers among the population in Kazakhstan. A total of 1,294 participants were recruited using convenience sampling. The inclusion criteria were being a resident of Kazakhstan, aged 18 years or older, and capable of providing informed consent. The survey was created on Google Forms platform and conducted between July 3– August 20, 2024, and participants were approached through various online platforms and social media (e.g., Instagram, WhatsApp, Facebook).

Survey instrument

The survey instrument consisted of a structured questionnaire designed to capture socio-demographic characteristics, knowledge about organ donation, willingness to express consent to organ donation, and perceived barriers to organ donation.

Participants provided information on their gender, age, ethnicity, predominant residence (urban or rural), educational level, occupation (medical or non-medical), family status, whether they have children or not, religious identity and extent of their religiousness, and economic well-being. Participants were categorized into medical and non-medical groups based on their response to the question: "Are your work or studies related to medicine or healthcare?". The question offered Yes/No response options, allowing participants to self-report their involvement in the medical or healthcare field. The extent of religiousness was assessed on a 5-point scale, where 1 is not religious and 5 is very religious. The question "How comfortable do you feel in your current financial situation?" was used to assess financial well-being and was rated on a 5-point scale, where 1 is very uncomfortable and 5 is very comfortable.

In this study, we developed a tailored questionnaire specifically designed to assess knowledge about and perceived barriers to organ donation. These scales were created by the authors to capture relevant insights unique to this study's objectives and population. The questionnaire was developed based on existing literature [7, 9, 10, 13, 15]. To ensure clarity, relevance, and cultural appropriateness, the questionnaire was refined through a pilot study conducted with 19 expert participants, including transplant coordinators, psychologists, and public health experts. These experts were selected based on their professional experience in organ donation, medical ethics, behavioral psychology, and public health communication. Based on expert feedback, the questionnaire underwent several refinements before finalization. Medical terminology was simplified for broader understanding, and items addressing religious and ethical concerns were culturally adapted to reflect Kazakhstan's diverse beliefs while maintaining neutrality. Likert-scale questions were adjusted for clarity, and overlapping barriers were merged to reduce redundancy while preserving conceptual precision. The questionnaire was available in both Kazakh and Russian languages. Kazakh, Russian and English language versions of the questionnaire has been included as a supplementary file (Appendix 1 and 2).

Willingness to express consent

The primary outcome of the study was the participants' willingness to express consent to organ donation. This was assessed using the survey question: "Are you willing to express consent to organ donation?". Participants responded on a 5-point Likert-type agreement scale. For analysis, responses were dichotomized into two categories: "Agree" (those who expressed willingness) and "Disagree" (those who did not). It is important to note that the survey did not specify whether the willingness referred to living or post-mortem organ donation. Participants were asked a general question about their willingness to donate organs, without distinguishing between these two forms of donation.

Barriers to organ donation

Participants' perceptions of barriers to organ donation were assessed using a series of nine statements, each rated on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The barriers included concerns about medical complications, family members' opposition to the idea of organ donation, impact on cultural or religious beliefs, trust in the medical system, potential for organ trafficking, fear of reduced medical care, discomfort with posthumous body use, insufficient awareness and education, and financial implications (Table 1 and Appendix 2).

Knowledge about organ donation

Knowledge levels were measured using a seven-item scale, with each correct answer contributing to a total knowledge score ranging from 0 to 7. The knowledge items covered basic information about organ donation procedures, eligibility, and benefits (Suppl. Tables 1 and Appendix 1).

Statistical analysis

Descriptive statistics were used to summarize the socio-demographic characteristics of the participants and their responses to the willingness, barriers, and knowledge questions. Chi-square tests were employed to examine associations between categorical variables, and Mann-Whitney U tests were used for comparisons between groups with non-normally distributed data.

The reliability and validity of the Barriers to organ donation scale and Knowledge about organ donation scale used in this study were assessed through several statistical methods. Internal consistency was evaluated using Cronbach's alpha to determine the extent to which the items within each scale measured a cohesive construct. To evaluate the validity of the scales, Confirmatory Factor Analysis was performed. Model fit indices, such as the Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), and Root Mean Square Error of Approximation (RMSEA), were used to evaluate the adequacy of the model.

Binomial logistic regression analysis was conducted to identify significant predictors of willingness to express consent to organ donation. The independent variables included socio-demographic factors, knowledge levels, and perceived barriers. Odds ratios (OR) and 95% confidence intervals (CI) were calculated, and a p-value of < 0.05 was considered statistically significant. All statistical analyses were performed using Jamovi software (Version 2.2.5).

Ethical considerations

The study was approved by the Local Bioethics Commission of the "University Medical Center" Corporate Fund (Protocol No. 3 dated July 14, 2023), and all methods were performed in accordance with the relevant guidelines and regulations, including those outlined by the Declaration of Helsinki and local ethical standards. Informed consent was obtained from all participants prior to their inclusion in the study. Participants were informed about the purpose of the research, and their right to withdraw from the study at any time without any consequences was clearly communicated.

Results

The study included a total of 1,294 participants, with a higher representation of females (78.3%) compared to males (21.7%). The average age of the participants was 36.8 ± 11.5 (18–70) years. The majority of participants were aged 25–34 years (37.8%), followed by 35–44 years (24.0%), 45–54 years (14.6%), under 25 years (12.5%), and over 55 years (11.1%). Ethnic distribution among participants was predominantly Kazakh (82.1%), followed by Russian (8.8%) and other ethnic groups (9.1%). The majority of participants resided in urban areas (79.4%). Regarding occupation, most participants were employed (77.1%), with students constituting 12.4%, self-employed individuals 5.9%, unemployed 2.7%, and pensioners 1.9%. Educational levels varied, with the majority having an undergraduate degree (65.4%), followed by those with special-professional education, post-graduate degree, high-school and middle-school diploma. In terms of specialization, a significant portion of participants had a medical background (70.3%). Among participants identified as having a medical background, the majority had an undergraduate degree (59.2%), while 22.6% had special professional education (nurses). A majority of participants identified as Muslim (72.6%), followed by Orthodox Christians, Agnostics, Atheists, and other religions. Table 1 presents the socio-demographic characteristics of the study participants.

Willingness to express consent to organ donation

The study revealed insights into the willingness to express consent to organ donation across various socio-demographic groups in Kazakhstan (Table 1). While the difference between male (40.9%) and female (42.9%) participants in expressing willingness was not statistically significant ($\chi^2=0.366$, $p = 0.545$).

Willingness to express consent to organ donation varied significantly across age groups ($\chi^2=55.8$, $p < 0.001$). Younger participants showed higher willingness, with 51.2% among those under 25 years and 49.3% among those aged 25–34 years. Willingness declined in older age groups, with 45.7% in the 35–44 age group, 25.9% in the 45–54 age group, and 24.5% among participants over 55 years.

Ethnicity showed no statistically significant association with willingness to express consent ($\chi^2 = 3.89$, $p = 0.143$). However, Kazakh participants demonstrated a higher willingness (43.6%) compared to Russians (34.2%) and other ethnic groups (40.7%).

A significant disparity was observed between urban and rural residents, with urban participants showing a much higher willingness to donate organs (46.1%) compared to their rural counterparts (28.8%) ($\chi^2=25.7$, $p < 0.001$).

Occupational status also significantly influenced willingness. Students were the most willing to express consent to organ donation (62.7%). On the other hand, employed participants exhibited the lowest willingness (37.6%) ($\chi^2=46.2$, $p < 0.001$).

Educational attainment was strongly associated with willingness, with those holding post-graduate degrees showing the highest readiness (58.7%), while those with only middle-school education had the lowest (25.0%) ($\chi^2=49.7$, $p < 0.001$). This pattern suggests that higher education levels may correlate with greater awareness and acceptance of organ donation.

Interestingly, participants with non-medical specializations were more willing to express consent (49.7%) compared to those with medical backgrounds (39.5%) ($\chi^2=11.7$, $p < 0.001$). This finding could reflect differing perspectives on organ donation between those within and outside the medical community, potentially due to professional experiences and ethical considerations. It is worth noting that medical students (71.3%) more often

Table 1 Study population and willingness to express consent to organ donation ($N = 1,294$)

Variable	*n* (%)	Willingness to express consent to organ donation (%)	χ^2, *p*
Gender			
Male	281 (21.7%)	40.9%	0.366,
Female	1013 (78.3%)	42.9%	$p = 0.545$
Age groups			
18–24 years	162 (12.5%)	51.2%	55.8,
25–34 years	489 (37.8%)	49.3%	$p < 0.001$
35–44 years	311 (24.0%)	45.7%	
45–54 years	189 (14.6%)	25.9%	
> 55 years	143 (11.1%)	24.5%	
Ethnic group			
Kazakh	1062 (82.1%)	43.6%	3.89,
Russian	114 (8.8%)	34.2%	$p = 0.143$
Other	118 (9.1%)	40.7%	
Residence			
Rural	267 (20.6%)	28.8%	25.7,
Urban	1027 (79.4%)	46.1%	$p < 0.001$
Occupation			
Student	161 (12.4%)	62.7%	46.2,
Employed	998 (77.1%)	37.6%	$p < 0.001$
Self-employed	76 (5.9%)	56.6%	
Unemployed	35 (2.7%)	57.1%	
Pensioner	24 (1.9%)	45.8%	
Education			
Middle-school (9 classes)	12 (0.9%)	25.0%	49.7,
High-school (11 classes)	94 (7.3%)	31.9%	$p < 0.001$
Special-professional	233 (18.0%)	25.8%	
education	846 (65.4%)	46.5%	
Undergraduate	109 (8.4%)	58.7%	
Post-graduate			
Specialization			
Non-medical	384 (29.7%)	49.7%	11.7%,
Medical	910 (70.3%)	39.5%	$p < 0.001$
Family status			
Single	373 (28.8%)	54.4%	33.4,
Married	766 (59.2%)	36.4%	$p < 0.001$
Divorced	119 (9.2%)	43.7%	
Widowhood	36 (2.8%)	44.4%	
Children			
No	434 (33.5%)	58.1%	64.7,
Yes	860 (66.5%)	34.7%	$p < 0.001$
Religion affiliation			
Muslim	940 (72.6%)	37.1%	76.8%,
Christian (orthodox)	97 (7.5%)	33.0%	$p < 0.001$
Agnosticism	116 (9.0%)	73.3%	
Atheism	124 (9.6%)	60.5%	
Other	17 (1.3%)	52.9%	

indicated their willingness to consent to organ donation in comparison with non-medical students (41.3%), $p < 0.001$. At the same time, medical workers (34.3%) were less likely than non-medical employed participants (47.9%) to indicate their willingness to consent to organ donation ($p < 0.001$). Moreover, employed medical workers are less likely to express their willingness to agree to be donors compared to medical students ($p < 0.001$; Suppl. Table 2).

Family status also played a critical role, with single participants showing the highest willingness (54.4%) to donate organs, compared to married (36.4%), divorced (43.7%), and widowed participants (44.4%) ($\chi^2 = 33.4$, $p < 0.001$). Participants without children demonstrated a higher willingness (58.1%) to donate organs compared to those with children (34.7%) ($\chi^2 = 64.7$, $p < 0.001$). This difference may be influenced by parental responsibilities or concerns about legacy and family welfare.

Finally, religious identity significantly affected willingness to express consent. Atheists (60.5%) and Agnostics (73.3%) were the most willing, whereas Muslims (37.1%) and Orthodox Christians (33.0%) showed lower readiness ($\chi^2 = 76.8$, $p < 0.001$). At the same time, the extent of religiousness was significantly higher among those respondents who were willing to consent to organ donation (2.78 ± 1.38) compared to those who were not (2.46 ± 1.23), U-test = 175,501, $p < 0.001$. However, the extent of religiousness, regardless of religious affiliation, did not have significant differences between participants who were willing to consent to donation compared to those who were not. While the level of religiosity did not have a significant difference regardless of willingness to express consent in the group with non-medical specialization ($p = 0.061$), in the group with medical specialization, the level of religiosity was significantly higher among those who were not willing to consent to donation compared to those who were ($p < 0.001$, Suppl. Table 3). This finding underscores the profound impact of religious beliefs and doctrines on decisions regarding organ donation.

Overall, these results highlight the complex interplay of socio-demographic factors in shaping individuals' willingness to express consent to organ donation in Kazakhstan, offering critical insights for targeted interventions and policy development.

Barriers to organ donation and knowledge levels

The study assessed various barriers to organ donation among participants with both medical and non-medical specializations. Cronbach's alpha for the Barriers to organ donation scale demonstrated good internal consistency, with values of 0.824 (Kazakh version) and 0.774 (Russian version). For the Knowledge on organ donation scale, Cronbach's alpha was 0.717 for the Kazakh version and 0.795 for the Russian version. The validity of the scales was confirmed using CFA. For both scales, the model fit indices showed satisfactory results, with CFI values > 0.911, TLI > 0.875, and RMSEA < 0.089 (Suppl. Table 4). These findings indicate that the scales are both reliable and valid for assessing barriers and knowledge

in the context of organ donation. The barriers were measured on a scale from 1 to 5, with higher scores indicating greater concern (Table 2).

Overall, participants expressed moderate concern about potential medical complications arising from organ donation, with no significant difference between those with medical and non-medical specializations (p = 0.425). The average concern level that arises from the family member' opposition to organ donation was relatively low, and there was no significant difference between participants with medical and non-medical specializations ($p = 0.455$).

Concerns about the impact of organ donation on cultural or religious beliefs were less prominent overall but were significantly higher among participants with medical specializations compared to those with non-medical specializations ($p < 0.001$). While this barrier did not have significant differences by the ethnic groups of the study participants, Muslims and Orthodox had higher levels of perceived religion and cultural barriers (Suppl. Table 5). Participants expressed notable concern regarding the lack of trust in the medical system's handling of organ donation, with significantly higher levels among non-medical participants compared to those with medical backgrounds ($p < 0.001$).

Concerns about the potential for organ trafficking or unethical practices were one of the higher concerns overall, with non-medical participants showing significantly more concern than those with medical specializations ($p < 0.001$). Fear that expressing a willingness to become an organ donor may lead to reduced efforts by medical professionals to save the donor's life was also moderate, with this concern being significantly higher among non-medical participants ($p < 0.001$).

Discomfort with the idea of the body being used for organ transplantation posthumously was moderate, with non-medical participants expressing slightly lower discomfort compared to those with medical specializations ($p = 0.012$). Insufficient awareness and education about organ donation in Kazakhstan was one of the most prominent barriers, with significantly higher concern among non-medical participants compared to medical participants ($p < 0.001$). Concerns about financial implications associated with organ donation were moderate, with no significant difference between non-medical and medical participants ($p = 0.133$).

The total score for all barriers ranged from 9 to 45, with non-medical participants reporting significantly higher overall barriers (M = 32.52 ± 5.51) compared to medical participants (M = 31.55 ± 6.13), $p = 0.019$. This suggests that non-medical participants perceive more barriers to organ donation, which could be a reflection of their lesser exposure to medical education and information.

The study also assessed participants' knowledge about organ donation, with scores ranging from 0 to 7. The average knowledge score among all participants was moderate (M = 4.70, SD = 1.83). There was no significant difference in knowledge between non-medical and medical participants, $p = 0.449$. This indicates that both groups have similar levels of knowledge about organ donation, though there remains room for improvement, particularly through targeted educational initiatives. These findings highlight the various barriers perceived by participants regarding organ donation and suggest that enhancing awareness and trust, particularly among non-medical populations, could be a crucial step toward improving organ donation rates in Kazakhstan.

Factors of willingness to express consent to organ donation

The results of the binomial regression analysis, as presented in Table 3, provide insights into the socio-demographic, knowledge-based, and barrier-related factors

Table 2 Barriers to and knowledge on organ donation ($N = 1,294$)

	Barrier (1–5)	M ± SD	Specialization		
			Non-medical	Medical	U-test, *p*
1	Concerns about potential medical complications arising from organ donation	3.50 ± 0.99	3.55 ± 0.91	3.47 ± 1.02	170,099, $p = 0.425$
2	Opposition to organ donation from family members	3.01 ± 0.99	3.00 ± 0.96	3.01 ± 1.00	170,382, $p = 0.455$
3	Concerns about the impact of organ donation on cultural or religious beliefs	2.51 ± 1.12	2.32 ± 1.08	2.59 ± 1.13	150,170, $p < 0.001$
4	Lack of trust in the medical system's handling of organ donation	3.47 ± 1.10	3.71 ± 1.03	3.36 ± 1.12	145,572, $p < 0.001$
5	Concerns about the potential for organ trafficking or unethical practices	3.57 ± 1.19	3.81 ± 1.15	3.47 ± 1.18	143,892, $p < 0.001$
6	Fear that expressing a willingness to become an organ donor may lead to a reduced effort by medical professionals to save the donor's life	3.01 ± 1.28	3.30 ± 1.32	2.89 ± 1.24	142,714, $p < 0.001$
7	Discomfort with the idea of the body being used for organ transplantation posthumously	2.62 ± 1.26	2.50 ± 1.30	2.67 ± 1.24	159,646, $p = 0.012$
8	Insufficient awareness and education about organ donation in Kazakhstan	3.80 ± 1.05	4.05 ± 0.97	3.70 ± 1.07	140,474, $p < 0.001$
9	Concerns about the financial implications associated with organ donation	3.03 ± 1.05	3.11 ± 1.00	3.00 ± 1.06	165,932, $p = 0.133$
Barriers total (9–45)		28.5 ± 6.22	32.52 ± 5.51	31.55 ± 6.13	160,347, $p = 0.019$
Knowledge (0–7)		4.70 ± 1.83	4.75 ± 1.59	4.68 ± 1.92	170,155, $p = 0.449$

Table 3 Factors of willingness to express consent to organ donation ($R^2_{McF} = 0.349$, $p < 0.001$)

Variable	OR	OR 95% CI	*p*
I. Socio-demographics			
Gender			
Female– Male	1.215	0.841–1.755	0.299
Age group			
25–34–18–24 years	1.387	0.761–2.528	0.286
35–44–18–24 years	1.877	0.937–3.759	0.075
45–54–18–24 years	0.916	0.426–1.971	0.823
> 55–18–24 years	0.769	0.328–1.803	0.546
Ethnic group			
Russian– Kazakh	0.464	0.224–0.961	0.039
Other– Kazakh	0.765	0.430–1.358	0.359
Residence			
Urban - Rural	1.134	0.768–1.675	0.527
Occupation			
Employed– Student	0.579	0.324–1.034	0.065
Self-employed– Student	0.742	0.321–1.715	0.486
Unemployed– Student	1.322	0.458–3.813	0.606
Pensioner– Student	2.258	0.691–7.380	0.178
Educational level	1.026	0.820–1.285	0.822
Specialization			
Medical– Non-medical	0.935	0.646–1.354	0.724
Family status			
Single– Widowhood	0.191	0.061–0.594	0.004
Married– Widowhood	0.310	0.113–0.844	0.022
Divorced– Widowhood	0.355	0.119–1.060	0.063
Children			
Yes– No	0.490	0.276–0.869	0.015
Religion affiliation			
Christian (orthodox)– Muslim	1.185	0.535–2.624	0.675
Agnosticism– Muslim	1.563	0.869–2.811	0.136
Atheism– Muslim	1.050	0.565–1.952	0.878
Other– Muslim	0.864	0.232–3.211	0.827
Religiosity	1.049	0.914–1.203	0.499
Economic well-being	1.095	0.943–1.272	0.234
II. Knowledge on organ donation			
Knowledge level	1.483	1.331–1.652	< 0.001
III. Barriers to organ donation			
Concerns about potential medical complications arising from organ donation	1.505	1.264–1.791	< 0.001
Opposition to organ donation from family members	0.790	0.665–0.938	0.007
Concerns about the impact of organ donation on cultural or religious beliefs	0.773	0.655–0.912	0.002
Lack of trust in the medical system's handling of organ donation	1.074	0.907–1.273	0.405
Concerns about the potential for organ trafficking or unethical practices	1.009	0.853–1.194	0.917
Fear that expressing a willingness to become an organ donor may lead to a reduced effort by medical professionals to save the donor's life	0.733	0.625–0.860	< 0.001
Discomfort with the idea of the body being used for organ transplantation posthumously	0.482	0.415–0.561	< 0.001
Insufficient awareness and education about organ donation in Kazakhstan	1.440	1.229–1.687	< 0.001
Concerns about the financial implications associated with organ donation	1.194	1.002–1.422	0.050

that influence the willingness to express consent to organ donation among the participants.

The analysis revealed that gender and age did not significantly affect the willingness to express consent, with females being slightly more willing than males. The lack of a significant effect for age in the regression model comparing with χ^2 association test (Table 1) suggests that other factors may mediate or confound the relationship between age and willingness to express consent. This indicates that age alone may not be a strong predictor of willingness when other variables are considered. Thus, the mediation analysis (Suppl. Table 6) showed that age influenced willingness to express consent for organ donation indirectly through knowledge (β=-0.055,

$p < 0.001$), having children (β=-0.040, $p = 0.009$), and discomfort with the idea of posthumous body use (β=-0.074, $p < 0.001$). The direct effect of age was not significant (β=-0.021, $p = 0.445$), indicating that these mediators fully explained the relationship, while the total effect of age on willingness remained significant (β=-0.191, $p < 0.001$). Similarly, a significant disparity was observed between urban and rural residents in the chi-square test, with urban participants showing a higher willingness to donate ($p < 0.001$; Table 1). However, in the multivariate logistic regression analysis, residence did not remain a significant predictor of willingness ($p = 0.422$) when other factors were included in the model. The mediation analysis (Suppl. Table 7) showed that residence influenced willingness to express consent for organ donation both directly (32.6%) and indirectly (67.4%) through multiple mediators. Indirect effects were observed via knowledge (β = 0.032, $p < 0.001$), concerns about the impact of organ donation on cultural or religious beliefs (β = 0.011, $p = 0.007$), discomfort with the idea of the body being used posthumously (β = 0.029, $p = 0.004$), and insufficient awareness and education about organ donation in Kazakhstan (β = 0.015, $p = 0.004$). These mediators collectively explained a significant portion of the effect of residence on willingness. The direct effect of residence on willingness to donate was significant (β = 0.046, $p = 0.045$), while the total effect, including both direct and indirect pathways, was also significant (β = 0.141, $p < 0.001$). This indicates that while residence had a direct influence on willingness, much of the effect was mediated through factors such as knowledge and specific barriers.

Ethnicity emerged as a significant factor, with Russian participants being less willing to express consent compared to Kazakh participants (OR = 0.464, $p = 0.039$), while other ethnic groups showed no significant difference.

Regarding occupation, none of the employment categories showed a significant difference compared to students. Educational level and specialization (medical vs. non-medical) also did not significantly influence willingness. Bivariate analysis indicated that medical workers were significantly less likely than non-medical employed participants to express willingness to consent to organ donation ($p < 0.001$). However, in the regression model, professional specialization was not a significant predictor of willingness, suggesting that other factors might explain this observed difference. To further investigate potential underlying mechanisms, a mediation analysis was conducted among employed participants. The results revealed that the effect of specialization on willingness was indirectly mediated by concerns about cultural and religious beliefs (β = 0.039, $p < 0.001$) and insufficient awareness and education about organ donation (β = 0.034, $p < 0.001$). Non-medical workers had fewer religious/cultural concerns (β=-0.338, $p < 0.001$) but also demonstrated higher levels of awareness (β = 0.478, $p < 0.001$) compared to medical participants. The total effect of specialization on willingness remained significant (β = 0.1210, $p < 0.001$), but the direct effect was not significant (β = 0.047, $p = 0.119$), indicating that the observed difference in willingness was fully explained by these mediators (Suppl. Table 8).

Family status had a notable impact, particularly among widowed participants, who were significantly more likely to express willingness compared to married participants. Having children showed a trend towards lower willingness (OR = 0.490, $p = 0.015$). Religious affiliation also did not significantly affect willingness, with none of the comparisons between religious groups and Muslims reaching statistical significance. Similarly, religiousness and economic well-being were not significant predictors.

Knowledge about organ donation was a strong and significant predictor of willingness to express consent. Higher knowledge levels were associated with a greater likelihood of expressing willingness (OR = 1.483, $p < 0.001$). This suggests that educational efforts to increase knowledge about organ donation could have a positive impact on willingness rates.

Several barriers to organ donation were identified as significant factors influencing willingness. Concerns about potential medical complications significantly increased the likelihood of willingness (OR = 1.505, $p < 0.001$), indicating that those who are concerned about medical risks may be more inclined to ensure they have control over their decision to donate.

Conversely, family members being against organ donation was associated with lower willingness (OR = 0.790, $p = 0.007$), as were concerns about the impact of donation on one's cultural or religious beliefs (OR = 0.773, $p = 0.002$).

Interestingly, fear of a possibility that expressing willingness to donate organs might lead to reduced medical care was a strong deterrent, as was discomfort with the idea of one's body being used for transplantation posthumously ($p < 0.001$).

Finally, insufficient awareness and education about organ donation in Kazakhstan was a significant barrier, with higher levels of concern leading to greater willingness (OR = 1.440, $p < 0.001$). This highlights the importance of addressing these gaps in information to improve donation rates.

Overall, the binomial regression analysis underscores the complex interplay of socio-demographic factors, knowledge, and perceived barriers in shaping individuals' willingness to express consent to organ donation in Kazakhstan. The model explained a significant portion of the variance in willingness (R^2_{McF}=0.349, $p < 0.001$), suggesting that targeted interventions addressing these

factors could potentially enhance organ donation consent rates.

Discussion

This study provides novel insights into the complex interplay of socio-demographic, cultural, and awareness-related factors influencing organ donation willingness in Kazakhstan. This research is one of the first to comprehensively assess attitudes toward organ donation in a multi-ethnic and multi-religious population within Central Asia. Thus, current study fills a significant research gap by addressing organ donation attitudes in Kazakhstan, a country with distinct historical, cultural, and post-Soviet healthcare system characteristics. Furthermore, our study provides a foundation for future public health interventions by identifying key modifiable factors influencing organ donation decisions. The findings underscore the necessity of culturally sensitive educational campaigns, increased transparency in organ allocation processes, and engagement with faith leaders to address religious concerns. By distinguishing between direct and mediated effects, our research offers actionable insights for policymakers seeking to improve organ donation rates in Kazakhstan and similar settings.

The study population consisted of 1,294 participants, predominantly female (78.3%), with an average age of 36.8 years. The sample was largely composed of ethnic Kazakhs (82.1%) and urban residents (79.4%), with a significant portion having a medical background (70.3%). The participants were generally well-educated, with 65.4% holding an undergraduate degree, which may influence their knowledge and attitudes toward organ donation.

Willingness to express consent to organ donation

In this study, the overall willingness to express consent for organ donation was 42.5%. This figure is lower than the willingness rates reported in several other regions, reflecting differences in cultural, social, and healthcare contexts. For instance, a meta-analysis from the Middle Eastern region, which pooled data from 14 original studies, found an overall willingness rate of 49.8% [19]. Similarly, studies from Saudi Arabia and Syria reported willingness rates of 56.4% and 62.8%, respectively, highlighting higher levels of willingness in these populations [20; 7].

The analysis of the participants' willingness to express consent for organ donation revealed that several socio-demographic factors played significant roles, while others did not show statistically significant associations. Thus, gender did not significantly influence willingness to express consent, with similar levels of readiness observed among males (40.9%) and females (42.9%). Although females showed a slightly higher trend, the difference was not statistically significant. For instance, women were generally more willing to donate their organs to both family members and strangers, as demonstrated in a U.S. survey, which highlights the importance of addressing gender-specific motivations and barriers to improve donation rates [21]. Moreover, in reality the proportion of women among living kidney donors is predominantly higher, which is associated with societal and cultural perceptions of gender roles and attitudes toward donation [22]. However, in the current study participants without children showed higher willingness (58.1%) compared to those with children (34.7%) regardless of gender, possibly due to fewer familial obligations.

Ethnicity was another factor where no statistically significant difference was found, despite Kazakh participants showing higher willingness (43.6%) compared to other ethnic groups (40.7%) and Russians (34.2%). Similar findings have been observed in studies conducted in other multi-ethnic contexts, such as the work by Kernodle (2021), which suggested that differences in deceased organ donation between different populations have attenuated over time [23].

In contrast, several factors showed statistically significant associations with willingness to express consent for organ donation. A major disparity was observed between urban and rural residents, with urban participants exhibiting a much higher willingness to donate organs (46.1%) compared to their rural counterparts (28.8%). This finding is consistent with research conducted in China [24], and it is possible that urban residents are often more exposed to access to information and health services, which contributes to a higher willingness to donate. Similarly, studies from Thailand and Saudi Arabia have highlighted that urbanization and higher socioeconomic status are key drivers of organ donation willingness. Urban residents benefit from resourceful environments, whereas rural populations, while generally less willing to donate, may exhibit greater readiness for living donations due to stronger community bonds and cultural factors [25, 26].

Occupational status also significantly influenced willingness, with students showing the highest willingness to express consent (62.7%), possibly due to greater exposure to educational campaigns, altruistic motivations or more prosocial behaviors associated with younger age groups [27, 28]. Thus, a meta-analysis conducted across 25 countries found that 69.2% (95% CI: 64.7–73.4%) of medical students expressed willingness to donate their organs after death [29]. In contrast, employed participants showed the lowest willingness (37.6%), which may reflect concerns about the impact of donation on work and health.

Educational attainment was strongly associated with willingness, where participants with post-graduate

degrees showed the highest readiness (58.7%), while those with only middle-school education showed the lowest (25.0%). Higher education levels often correlate with greater awareness and acceptance of organ donation, a pattern supported by studies like that of Alghalyini et al. (2024), which found similar associations between educational levels and consent to organ donation [20].

Interestingly, specialization in a medical field was associated with significantly lower willingness to express consent (39.5%) compared to non-medical participants (49.7%). While non-medical participants reported greater distrust in the medical system's handling of organ donation and expressed more concerns about the potential for organ trafficking or unethical practices, they also exhibited higher willingness to consent to organ donation compared to medical participants. At the same time, medical participants reported higher levels of concern about the impact of organ donation on cultural or religious beliefs and discomfort with the idea of the body being used for transplantation posthumously. This suggests that medical participants, despite perceiving fewer systemic barriers overall, may be more sensitive to cultural, religious, and ethical considerations associated with organ donation. Non-medical participants, on the other hand, may be more influenced by altruistic or emotional factors, which could outweigh their higher levels of distrust and perceived systemic barriers (Table 2). The initial chi-square analysis suggested that medical workers were less willing to consent to organ donation compared to non-medical participants (Table 1). However, the non-significant effect in the regression model, combined with mediation analysis findings, indicates that this difference was not directly due to professional specialization but rather explained by differences in religious/cultural concerns and awareness levels. Contrary to what might be expected, non-medical participants exhibited lower religious and cultural concerns and higher awareness of organ donation, which in turn contributed to their greater willingness to donate (Suppl. Table 8). This finding challenges the assumption that higher medical knowledge always translates to greater donation willingness [15].

Religious affiliation and the extent of religiousness had a profound impact on willingness to express consent. Atheists (60.5%) and Agnostics (73.3%) were the most willing, whereas Muslims (37.1%) and Orthodox Christians (33.0%) showed lower readiness. Similar trends were observed in Israel, where members of Christianity, Islam, and Judaism expressed low willingness due to limited knowledge and misconceptions about organ donation [30]. Religious concerns about the legitimacy of cadaveric organ donation, despite official support within certain restrictions by all three monotheistic religions, further hinder consent. Collaborating with faith leaders to provide accurate, faith-aligned information can effectively address these barriers and help align organ donation advocacy with cultural and religious beliefs [31]. Additionally, while higher religiousness was associated with greater willingness to donate (U-test = 175501, $p < 0.001$), the relationship was complex, particularly among those with medical specializations, where higher religiousness was linked with lower willingness (Suppl. Table 3). Therefore, features related to medical specialization, religion and religiousness need to be further explored.

Barriers to organ donation

The study identified various barriers to organ donation, with significant differences observed between participants with medical and non-medical specializations. The most prominent barriers reported were the insufficient awareness and education about organ donation in Kazakhstan, concerns about the potential for organ trafficking or unethical practices, concerns about potential medical complications arising from organ donation, and lack of trust in the medical system's handling of organ donation. It is worth noting that all these barriers are directly related to the effectiveness of health policies. And such barriers can potentially be eliminated by the right campaigns in the area of public education and increasing trust in the healthcare system. Thus, non-medical participants expressed significantly greater distrust compared to medical participants. This indicates that non-medical individuals are particularly wary of how the medical system manages organ donations, underscoring the need for enhanced transparency and communication efforts to build public trust. Moreover, non-medical participants showed significantly higher concern about the potential for organ trafficking compared to those with medical backgrounds. This heightened fear among non-medical participants suggests that public misinformation or sensationalized media reports may contribute to these anxieties, emphasizing the importance of clear, accurate information to alleviate such fears. These fears are not unique to Kazakhstan and have been observed globally. For instance, lessons from the Spanish model of organ donation highlight the critical importance of transparency, robust legal frameworks, and effective public communication to build public trust and dispel fears about organ trafficking [32]. Similarly, the Gift of Life Donor Program in the United States emphasizes the need for public awareness campaigns tailored to address misconceptions and highlight safeguards against unethical practices [1]. In Kazakhstan, adopting these approaches by improving public engagement, ensuring transparent communication about organ allocation processes, and involving trusted community leaders can effectively mitigate these fears and enhance public confidence in the organ donation system.

On the other hand, barriers related to religion and culture were less frequently mentioned among respondents, this was more pronounced among medical specialties. Moreover, discomfort with the idea of one's body being used for donation posthumously was slightly more among medical participants compared to non-medical ones. This suggests that the ethical, cultural, emotional and psychological aspects of organ donation need to be addressed sensitively, particularly within the medical community. While this study identified barriers and factors influencing organ donation willingness, further analytical methods, such as clustering, decision trees, or principal component analysis, could be employed in future research to identify distinct subgroups within the population. These approaches could provide deeper insights into the specific needs and concerns of different segments, enabling the development of more targeted and effective educational and outreach programs to promote organ donation. Enhancing trust in the medical system, improving public awareness, and addressing ethical concerns are crucial steps toward improving organ donation rates in Kazakhstan.

Factors influencing willingness to express consent

The regression analysis revealed a mix of significant and non-significant factors influencing the willingness to express consent for organ donation among participants. The non-significant factors included gender, where females were slightly more willing than males, though this difference was not statistically significant. Similarly, residence in urban or rural areas did not significantly influence willingness, nor did occupation, with no significant differences observed between various employment categories when compared to students. Educational level and specialization (medical vs. non-medical) also did not significantly impact willingness. Religious affiliation and religiousness were additional factors that did not significantly affect willingness, and economic well-being similarly showed no significant predictive value.

On the other hand, several factors were identified as significant. Age showed a statistically significant negative association with willingness, indicating that older participants were less inclined towards expressing consent. Ethnicity also emerged as a significant factor, with Russian participants being less willing compared to ethnic Kazakhs. Family status played an important role, particularly with widowed participants being significantly more likely to express willingness than married ones.

Knowledge about organ donation was one of the most critical factors influencing willingness to express consent. The analysis showed that higher knowledge levels were strongly associated with an increased likelihood of willingness (OR = 1.489, $p < 0.001$). This finding underscores the importance of educational efforts aimed at increasing public awareness and understanding of organ donation. Well-informed individuals are more likely to overcome fears and misconceptions, making them more willing to consent to donation [33, 34].

In addition to knowledge, the analysis highlighted several barriers that played significant roles in shaping willingness. Concerns about potential medical complications were linked to an increased likelihood of willingness (OR = 1.493, $p < 0.001$), suggesting that individuals who are particularly concerned about medical risks may feel more compelled to control their decisions regarding organ donation. However, barriers such as family members opposing to organ donation (OR = 0.782, $p < 0.005$) and concerns about the impact of organ donation on cultural or religious beliefs (OR = 0.773, $p = 0.002$) were associated with lower willingness to donate. These barriers reflect the influence of family dynamics and cultural norms on organ donation decisions.

Other significant deterrents included fear that expressing willingness to donate might lead to reduced medical care, as well as discomfort with the idea of the body being used for transplantation posthumously. These deep-seated fears highlight the need for public education campaigns that address such misconceptions directly, providing reassurance to potential donors.

Interestingly, insufficient awareness and education about organ donation in Kazakhstan was identified as a significant barrier, yet it paradoxically also correlated with higher willingness (OR = 1.456, $p < 0.001$). This suggests that individuals who recognize the lack of information may be more motivated to consent to donation, possibly out of desire to make informed and responsible decisions.

Overall, the interplay of knowledge and barriers, alongside socio-demographic factors, significantly influences the willingness to express consent for organ donation in Kazakhstan. Table 4 provides a synthesis of the key factors influencing willingness to express consent for organ donation based on our findings. This table highlights the complex interplay of socio-demographic variables, knowledge levels, and barriers in shaping participants' decisions. The findings highlight the need for targeted interventions that address these barriers while enhancing public knowledge to improve organ donation rates.

Study limitations

While this study provides valuable insights into the factors influencing willingness to express consent for organ donation in Kazakhstan, several limitations must be acknowledged. First, the study utilized a cross-sectional design, which captures participants' attitudes and behaviors at a single point in time. This design limits the ability to infer causality between the identified factors and the willingness to donate organs. Longitudinal studies

Table 4 Key predictors of willingness to express consent for organ donation in Kazakhstan

Factor	Effect	Implications
Age	Willingness declines with age, largely mediated by lower knowledge, concerns about posthumous body use, and having children.	These findings highlight the need for age-specific education and outreach strategies addressing these barriers.
Residence	Urban participants exhibited higher willingness mediated through knowledge, concerns about cultural/religious beliefs, and posthumous body use.	Targeted campaigns in rural areas should prioritize increasing access to accurate information about organ donation and addressing cultural and religious concerns through localized and culturally appropriate messaging
Knowledge	Greater knowledge on organ donation significantly increased willingness.	The significant positive impact of greater knowledge on willingness underscores the importance of public education campaigns that increase awareness of organ donation. These campaigns should address misconceptions, highlight the medical safeguards in place, and provide clear, accessible information about the process and benefits of organ donation.
Cultural / Religious beliefs	Concerns about cultural and religious beliefs significantly reduced willingness to donate.	Targeted campaigns involving faith leaders and culturally sensitive messaging are necessary to address these concerns.
Discomfort with posthumous body use	Discomfort with the idea of the body being used for transplantation posthumously emerged as one of the strongest barriers.	Public education highlighting ethical safeguards and addressing misconceptions is essential.
Insufficient awareness	Lack of awareness and education about organ donation reduced willingness.	Increasing knowledge through national educational campaigns and accessible informational resources is critical.
Fear of reduced medical effort	Fear that medical professionals may deprioritize care for individuals willing to donate organs lowered willingness.	Addressing this requires transparency about medical ethics, public reassurance of patient-first principles, and building trust in the medical system through consistent communication and accountability.

would be necessary to examine how these attitudes might change over time and in response to interventions. Second, the sample was heavily skewed and not fully representative of the general population of Kazakhstan. Specifically, the sample included an overrepresentation of women (78.3%) urban (79.4%), and highly educated (73.8%), with a substantial proportion of medical professionals (70.3%), likely reflecting a strong self-selection bias stemming from the recruitment method, which relied on convenience sampling through social media. While such bias is not uncommon in surveys of this nature, it limits the generalizability of the findings. Future research should aim to recruit a more balanced and representative sample by using more diverse recruitment strategies, such as stratified random sampling, to ensure greater variability in gender, specialization, residence, and educational backgrounds. Despite this limitation, the findings provide valuable insights into the barriers and factors influencing willingness to donate organs in this context. Third, the survey did not specify whether the willingness referred to living or post-mortem organ donation. This lack of distinction may have influenced participants' responses, as individuals may view living and post-mortem organ donation differently. Future studies should clarify these aspects to better understand the nuances of willingness to donate organs in different contexts. Fourth, the reliance on self-reported data introduces the possibility of social desirability bias, where participants may have provided responses, they believed to be more socially acceptable rather than their true beliefs or intentions. Incorporating qualitative methods, such as interviews or focus groups, in future research could complement the quantitative data by offering deeper insights into participants' personal experiences, motivations, and concerns regarding organ donation. This mixed-methods approach would provide a richer understanding of the factors influencing organ donation consent. Finally, the study primarily focused on sociodemographic factors, knowledge, and perceived barriers, but it did not explore other potentially influential factors such as psychological traits, personal experiences with organ donation, or detailed cultural and religious beliefs. Including these variables in future research could provide a more comprehensive understanding of the determinants of organ donation consent. Despite these limitations, the study offers important insights into the factors that influence organ donation consent in Kazakhstan and provides a foundation for future research and interventions aimed at increasing organ donation rates.

Future research should focus on longitudinal studies, and the exploration of additional factors, including psychological traits and personal experiences, to further understand the determinants of organ donation consent. By continuing to build on this foundational research, it will be possible to develop more effective interventions that resonate with the diverse population of Kazakhstan and beyond.

Conclusion

This study provides valuable insights into the sociodemographic factors, knowledge levels, and perceived barriers that influence individuals' willingness to express consent for organ donation in Kazakhstan. The findings highlight the complex interplay between these factors,

underscoring the importance of targeted interventions to address the specific concerns and misconceptions that may deter potential donors.

Key factors such as age, ethnicity, family status, and knowledge about organ donation significantly influenced willingness to donate, while other factors like gender, residence, occupation, and religious affiliation were found to be less impactful. Notably, higher levels of knowledge were strongly associated with greater willingness to consent, emphasizing the critical role of education in promoting organ donation.

Barriers such as distrust in the medical system, fears of unethical practices, and insufficient awareness were identified as significant obstacles that need to be addressed through public education campaigns and transparency initiatives. These efforts should aim to build trust, dispel myths, and provide clear, accurate information to the public, particularly among non-medical populations who exhibited greater concerns.

The study's findings suggest that enhancing public knowledge and addressing specific barriers could lead to increased organ donation rates in Kazakhstan. Policymakers and healthcare professionals should consider these insights when designing and implementing strategies to encourage organ donation, ultimately contributing to improved healthcare outcomes and saving more lives.

While this study provides valuable insights into the knowledge and perceptions of organ donation, caution is needed when generalizing these results to the entire Kazakhstani population. Future studies should focus on obtaining a more representative sample, incorporating socioeconomically diverse populations to develop more inclusive national policies.

Supplementary Information

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Supplementary Material 1

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Data availability
The dataset supporting the conclusions of this article available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate
The study was approved by the Local Bioethics Commission of the "University Medical Center" Corporate Fund (Protocol No. 3 dated July 14, 2023), and all methods were performed in accordance with the relevant guidelines and regulations, including those outlined by the Declaration of Helsinki and local ethical standards. Informed consent was obtained from all participants prior to their inclusion in the study.

Consent for publication
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Competing interests
The authors declare no competing interests.

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