Journal of Pioneering Medical Sciences
Received: February 05, 2026 | Accepted: June 09, 2026 | Published: July 05, 2026
Volume 15, Issue 06, Pages 229-235

DOI https://doi.org/10.47310/jpms2026150629

Awareness and Attitude of the People of Makkah Towards Liver Transplantation and Donation: A Cross-Sectional Study

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Abstract **Background:** The liver is a vital organ that executes numerous biological and metabolic processes. Multiple conditions can affect the liver and lead to cirrhosis and/or acute liver failure, for which liver transplantation could be warranted. The primary reasons for liver transplantation are hepatocellular carcinoma, decompensated cirrhosis and metabolic/autoimmune liver disease. Public awareness is generally increasing, but religious, cultural and personal reasons justify donation attitudes. **Aims:** This study aims to assess awareness and attitudes toward liver transplantation among the general population of Makkah, addressing a significant knowledge gap in the region. **Method:** This cross-sectional study was conducted among the population of Makkah, excluding healthcare workers and individuals under 18 years old. Data was collected via an online, Arabic- translated questionnaire from July to October 2024. The survey assessed demographics, awareness and attitude toward liver transplantation. A statistical analysis was performed using R software. Associations were analyzed using the Chi-square test, with significance set at $p<0.05$. Ethical approval was obtained from the Umm Al-Qura University Institutional Research Board and informed consent was obtained from all participants before data collection. **Results:** A total of 477 participants completed the survey. Most were between 18 and 65 years old, male (58.5%) and had a monthly income of less than 9,000 SAR. 84.5% have heard about liver transplantation, while most reported the media as their primary source. Even though 80.7% of people recognized that a liver could be partially donated and the majority knew about liver transplantation, just 5.7% were sure they would donate during their lives and 37.1% were eager to donate after death. Respondents identified funeral delays (45.5%) as the most significant perceived drawback of liver donation after death. The recipient's health status (48.4%) and the nature of the donor-recipient relationship (26.0%) emerged as key factors influencing individuals' willingness to donate during life. Younger age, low income, higher educational level, personal experience and knowing someone with liver disease were associated with a positive influence on the decision to donate during someone's lifetime, while fear of medical complications showed an inverse association with donation willingness. Awareness of the option to register for organ donation on Tawakkalna was notably higher among those willing to donate (81.5%). **Conclusion:** Awareness of liver transplantation is increasing among the population of Makkah. There are still many knowledge gaps, including medical indications, donor eligibility and registration. Most of the respondents are unwilling to donate during life or after death, predominantly due to religious/personal misconceptions. Targeted public health campaigns and programs are needed to clarify the Islamic stance and positions on organ transplantation.

Key Words Liver Transplantation, Makkah, Awareness, Attitude, Tawakkalna

INTRODUCTION

The liver is a vital metabolic organ responsible for numerous biological functions, including protein synthesis, detoxification and various other critical metabolic processes. [1]. The liver can be affected by many conditions that eventually lead to cirrhosis, with its complications including synthetic dysfunction and portal hypertensive complications [2]. A liver transplant means eliminating a damaged liver and replacing it with a healthy liver via surgery [3]. Hepatocellular carcinoma, decompensated cirrhosis, and

other liver-based systemic disorders, metabolic and alcohol related liver diseases represent the main indications for liver transplantation [4]. Donors may be alive or dead according to neurological or circulatory criteria [5,6]. On July 27, 1967, at the University of Colorado Medical Center in Denver, Dr. Thomas Starzl performed the world's first successful liver transplant [7]. Although the first liver transplant (LT) occurred in Saudi Arabia in 1991, the country did not establish its first LT program until 1994. In Saudi Arabia, organ donation and allocation, as well as regulatory assistance, are provided by the Saudi Center for Organ Transplantation (SCOT) [8]. One of the motivations for starting live donation programs was the limited availability of organ donors [4]. There have been more than 2,000 LTs done at the four sites in Saudi Arabia so far [8]. Research by Popp *et al.* [9] found that 46.8% of participants would donate their organs after death, while 26.6% of respondents claimed they would be prepared to donate a portion of their liver. Another study by Alolod *et al.* [10] indicated that 58.1% of participants were willing to donate their organs after death, whereas 40.7% were registered organ donors. According to a study on organ donation conducted in Faisalabad, 172 out of 200 participants were aware of liver donation. Barriers that may keep people from donating include frailty, infection and fear of pain [11]. Due to the prohibition of most scholars at that time, the pool of potential donors was limited, but as time passed and people's need for organs increased, the permissibility of organ donation was reconsidered. There is an updated fatwa issued by the Council of Senior Scholars in the Kingdom of Saudi Arabia, No. 99 of 1402 AH, which permitted the transfer of an organ or part of a living or deceased Muslim or non- Muslim, provided there is no risk in removing it and the transplant is likely to be successful [13].

Research conducted at Dhahran Military Hospital found that more than 90% of participants were aware of organ donation and transplantation and 73.4% were willing to donate their organs. We aim to assess the awareness and attitude toward liver transplants in Makkah, Saudi Arabia.

METHODS

This descriptive cross-sectional study was conducted on the general population of Makkah, Saudi Arabia. The study excluded individuals under 18 years old and healthcare workers. The sample size was calculated using OpenEpi version 3.0, based on a 95% confidence level and a margin of error 5%. Data were collected using a Google form survey, which was a multiple-choice questionnaire containing four sections:

- Consent form
- Demographic information
- Awareness of liver transplantation
- Willingness and attitude toward liver transplantation

The authors developed the questionnaire and validated it under the supervision of the primary investigator, a consultant gastroenterologist and transplant hepatologist. They then translated it into Arabic to ensure accessibility for participants. The survey was distributed online to reach a broad segment of the population. Data collection occurred from July 16, 2024, to October 22, 2024. Statistical analysis was performed using R version 4.3. Categorical variables were summarized using counts and percentages, while continuous variables were expressed as mean±standard deviation. A Chi-square test was conducted to assess associations between categorical variables. Hypothesis testing was performed at a 5% significance level ($p<0.05$). Ethical approval was obtained from the Umm Al-Qura University Institutional Research Board and informed consent was obtained from all participants before data collection.

RESULTS

A total of 477 respondents completed the questionnaire. The majority were aged 18-65 years (97.1%), with males comprising 58.5% of the sample. Most participants had lower income levels (<9000 SAR; 65.4%) and were either students (45.3%) or employed (28.5%). Half held bachelor's degrees (50.3%), while 38.4% had a high school education or less. The majority (87.0%) had no relatives or friends with chronic liver disease (Table 1).

Overall, 84.5% (n = 403) of participants have heard of liver transplantation. Figure 1 shows the primary information

Table 1: presents detailed demographic characteristics.

Parameter	Response	Did not hear of LT	Heard of LT	p-value
Age	N=477	N=74	N=403	0.464
> 65	14 (2.94%)	3 (4.05%)	11 (2.73%)	
18-65	463 (97.1%)	71 (95.9%)	392 (97.3%)	
Gender 0.181				
Female	198 (41.5%)	25 (33.8%)	173 (42.9%)	
Male	279 (58.5%)	49 (66.2%)	230 (57.1%)	
Monthly Income:				
< 9000 SAR	312 (65.4%)	51 (68.9%)	261 (64.8%)	0.675
9000 - 15000 SAR	81 (17.0%)	10 (13.5%)	71 (17.6%)	
> 15000 SAR	84 (17.6%)	13 (17.6%)	71 (17.6%)	
Education Level:				
Less than High school	10 (2.10%)	2 (2.70%)	8 (1.99%)	0.222
High school graduate	183 (38.4%)	22 (29.7%)	161 (40.0%)	
Bachelor's degree	240 (50.3%)	40 (54.1%)	200 (49.6%)	
Post-gradual degree	44 (9.22%)	10 (13.5%)	34 (8.44%)	
Occupation:				
Employed	136 (28.5%)	23 (31.1%)	113 (28.0%)	0.922
Retired	57 (11.9%)	9 (12.2%)	48 (11.9%)	
Student	216 (45.3%)	33 (44.6%)	183 (45.4%)	
Unemployed	68 (14.3%)	9 (12.2%)	59 (14.6%)	
Marital status:				
Single	250 (52.4%)	43 (58.1%)	207 (51.4%)	0.665
Married	198 (41.5%)	28 (37.8%)	170 (42.2%)	
Divorced	16 (3.35%)	1 (1.35%)	15 (3.72%)	
Widowed	13 (2.73%)	2 (2.70%)	11 (2.73%)	
Relative/friend with chronic liver disease:				
No	415 (87.0%)	68 (91.9%)	347 (86.1%)	0.241
Yes	62 (13.0%)	6 (8.11%)	56 (13.9%)	

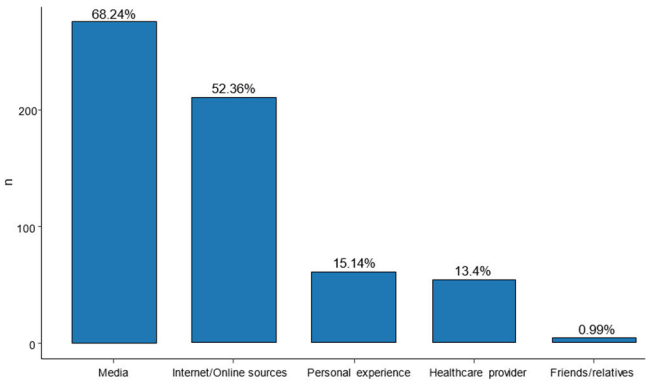

Figure 1: Source of information regarding LT

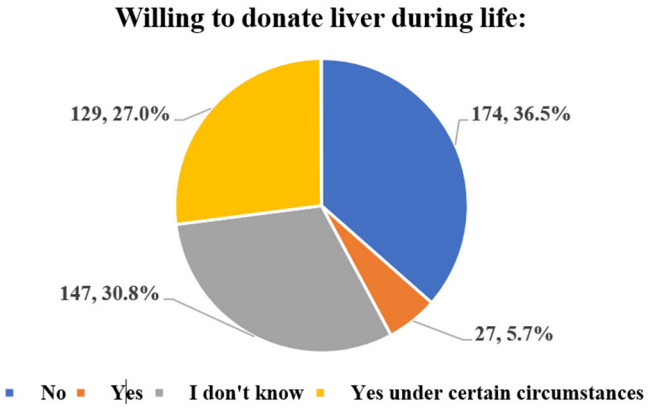

Figure 2: Willingness to donate during one's life

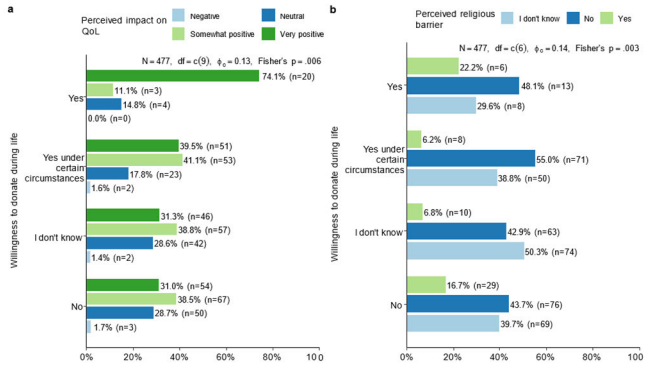

Figure 3a&b: Association between willingness to donate and (a) perceived impact on QoL and (b) perceived religious barrier

sources, with traditional media (television, radio, newspapers) being the most common (68.2%), followed by internet/online sources (52.4%). In comparison, personal experience (15.1%) and healthcare providers (13.4%) were less frequently cited as sources of information. The responses were dummy-coded and percentages were calculated from those who heard about LT (n = 403).

Overall, 84.5% (n = 403*) of* participants have heard about liver transplantation, primarily through traditional media (68.2%) and internet sources (52.4%) (Figure 1). Among all respondents, 55.3% correctly understood that LT involves both living and deceased donors, while 80.7% knew that partial liver donation is possible. Half of the participants (50.3%) correctly identified all medical indications for LT. The majority viewed LT's impact on recipients' quality of life positively (73.5%). However, substantial uncertainty existed regarding religious permissibility, 42.1% were unsure whether religious barriers existed, while 46.8% believed there were no barriers (Table 2).

Twenty-seven percent of the participants were willing to donate their organs under certain circumstances and only five percent were willing to become donors unconditionally. The majority of the participants, representing two-thirds of our population, were either refusing the idea of becoming donors or were reluctant.

Younger age, low income, higher educational level, personal experience and knowing someone with liver disease were associated with a positive influence on the decision to donating during someone's lifetime, while the fear of medical complications showed an inverse association with donation willingness (Figure 2, Table 3).

Awareness of the option to register for organ donation on Tawakkalna* was notably higher among those willing to donate (81.5%) compared to those not wanting to donate (59.2%) (p = 0.012). Practical knowledge of how to apply as a living liver donor also showed a positive association with willingness (p = 0.021). Among those willing to donate, 63.0% knew the application process, a higher percentage compared to those who did not want to donate (35.6%), the undecided (32.0%) and those willing to donate under certain circumstances (38.8%). Religious considerations also significantly influenced the willingness to donate (p<0.001). A substantial 46.2% of those willing to donate indicated they would proceed even with a religious barrier, in contrast to just 7.35% of those not wanting to donate, 11.5% of the undecided and 30.6% of those willing under certain circumstances.

In terms of QoL, 53.4% of those unwilling to donate perceived a reduction in QoL as a complication, compared to 37.4% of the undecided and 37.2% of those willing under certain circumstances. Only 29.6% of those definitively willing to donate considered it a concern (Figure 3). In addition, the perceived religious complications were significantly associated with the willingness to donate during life (p = 0.003).

Willingness to donate after death was similarly low, with 62.9% (n = 300) unwilling and only 37.1% willing. Among those willing to donate after death, preferences varied: 29.4% would donate only to family members, 25.8%

* Tawakkalna is a mobile application developed by the Saudi Data Artificial Intelligence Authority, launched during the COVID-19 pandemic for community protection and has evolved into a comprehensive platform for accessing various government services and information

Table 2: Awareness regarding Liver Transplantation (N=477)

Variable	n (%)
Understanding of liver transplantation	
Both living and deceased donors (correct)	264 (55.3)
Only deceased donors	32 (6.7)
Only living donors	86 (18.0)
Don't know	95 (19.9)
Aware that partial liver donation is possible	385 (80.7)
Correctly identified all indications for LT	240 (50.3)
Perceived impact of LT on recipients' QoL	
Very positive/Somewhat positive	351 (73.5)
Neutral	119 (24.9)
Negative	7 (1.5)
Religious barrier to liver donation	
No religious barrier	223 (46.8)
Yes, there is a barrier	53 (11.1)
Unsure	201 (42.1)
Aware of Tawakkalna organ donation registration	314 (65.8)
Know how to apply as a living donor	176 (36.9)

Table 3: Factors Associated with Willingness to Donate During Life

Variable	No (n=174)	Uncertain (n=147)	Yes, conditionally (n=129)	Yes (n=27)	p-value
Age					
18-65 years	170 (97.7)	145 (98.6)	125 (96.9)	23 (85.2)	0.004
>65 years	4 (2.3)	2 (1.4)	4 (3.1)	4 (14.8)	
Monthly Income (SAR)					
<9000	100 (57.5)	111 (75.5)	88 (68.2)	13 (48.1)	0.006
9000-15000	40 (23.0)	18 (12.2)	17 (13.2)	6 (22.2)	
>15000	34 (19.5)	18 (12.2)	24 (18.6)	8 (29.6)	
Education					
High school or less	53 (30.5)	68 (46.3)	62 (48.1)	10 (37.0)	0.009
Bachelor's degree	101 (58.0)	72 (49.0)	56 (43.4)	11 (40.7)	
Post-graduate	20 (11.5)	7 (4.8)	11 (8.5)	6 (22.2)	
Know someone who had LT ¶	25 (14.4)	24 (16.3)	30 (23.3)	14 (51.9)	<0.001
Aware of Tawakkalna registration ¶	103 (59.2)	93 (63.3)	96 (74.4)	22 (81.5)	0.012
Would donate despite religious barrier ¶	10 (7.4)	13 (11.5)	38 (30.6)	12 (46.2)	<0.001
Fear of medical complications as a barrier ¶	119 (68.4)	104 (70.7)	88 (68.2)	10 (37.0)	<0.001

Table 4: Factors Associated with Willingness to Donate After Death

Variable	No (n = 300)	Yes (n = 177)	p-value
Perceived impact of LT on recipients' QoL			
Very positive	94 (31.3)	77 (43.5)	0.027
Somewhat positive	124 (41.3)	56 (31.6)	
Neutral	79 (26.3)	40 (22.6)	
Negative	3 (1.0)	4 (2.3)	
Primary concern about living donation			
Liver failure	68 (22.7)	61 (34.5)	0.017
Reduction in QoL	138 (46.0)	66 (37.3)	
Other complications	94 (31.3)	50 (28.2)	
Primary concern about posthumous donation			
Funeral delay	124 (41.3)	93 (52.5)	<0.001
Lack of respect for the deceased	104 (34.7)	30 (16.9)	
Impact on relatives	51 (17.0)	42 (23.7)	
Financial implications	21 (7.0)	12 (6.8)	
Reason for refusing donation			
Fear of medical complications	200 (66.7)	121 (68.4)	0.043
Religious barriers	77 (25.7)	31 (17.5)	
Other reasons	23 (7.7)	25 (14.1)	

to anyone and 39.8% would not donate at all. Those willing to donate after death more frequently perceived the LT's impact as very positive (43.5% vs. 31.3%, p = 0.027). Primary concerns about donation after death differed between groups; those willing cited funeral delays (52.5%), while those unwilling emphasized lack of respect for the deceased (34.7%) (p<0.001) (Figure 4, Table 4).

DISCUSSION

The liver can be affected by a multitude of processes, including viral infection, alcohol, metabolic, genetic and biliary conditions, culminating in liver fibrosis, cirrhosis and portal hypertensive complications like ascites and variceal bleeding [15]. In 2021, according to the WHO, cirrhosis and complications of end-stage liver disease ranked ninth among

the top ten causes of death in lower-middle-income countries [16]. In Saudi Arabia, cirrhosis and its complications were the eighth leading cause of mortality in the kingdom [17]. Hepatic synthetic dysfunction, as evidenced by rising MELD/MELD-NA and portal hypertensive complications in the form of ascites, hepatic encephalopathy, SBP and variceal bleeding, in addition to hepatobiliary malignancies, represents the main indications for liver transplantation referral [18]. There is a fatwa by Ibn Uthaymeen, one of the reputable Islamic scholars, in which he said: "It is not permissible for anyone to donate anything from his body, neither during their life nor after their death, except blood transfusion [12] which could have been one of the contributing factors for the low level of acceptance for the process and thought of organ donation including liver donation [11]. Which was then followed by a new fatwa issued by the Council of Senior Scholars in the Kingdom of Saudi Arabia No. 99 of 1402 AH, which permitted the transfer of an organ or part of a living or deceased Muslim or non-Muslim provided there is no significant uninformed risk in removing it and the transplant is likely to be successful [13].

Of the survey respondents (N = 477), approximately 55.3% (n = 264) correctly identified that liver transplantation (LT) can involve both living and deceased donors, whereas 19.9% (n = 95) demonstrated a lack of understanding of the concept of organ procurement in liver transplantation. In research conducted in Ha'il City, 66.0% of the participants correctly identified that organs can be procured from living and deceased donors. 80.5% (n = 384) of the participants in our study were aware of the concept of partial grafts in living donation, which more or less was similar to the results of the study conducted in Western Region of Saudi Arabia by Abdulrahman *et al.* which showed that 71.4% (n329) were aware that part of the liver could be donated [19]. Moreover, comparing our results to the studies that addressed living donation in the realm of kidney transplantation, 87.5% (n = 617) of the participants were aware that one kidney can be donated during one's lifetime [20]. Furthermore, half of the respondents (50.3%, n = 240) correctly identified all relevant medical indications for LT, while 30.0% (n = 143) were unaware of these indications. These findings highlight the need for comprehensive and targeted educational programs to increase public awareness and understanding of liver transplantation, particularly with relation to donor selection and medical indications. This will enhance societal engagement and boost public support for transplantation programs and help improve the infrastructure of liver transplantation in the kingdom.

In our study, classic media channels, such as TV and radio, were the primary sources of knowledge, in contrast to the study conducted by Wahaibi *et al.* [21], where social media platforms represented the most important source of information about solid organ transplantation, including the liver. This difference may stem from differences in the sociodemographic composition of the populations and cultural influences. Moreover, this may highlight the continued importance of traditional media in promoting and enhancing community awareness programs related to medical issues, including organ donation and transplantation.

Less than half of the participants 46.8% (n = 223) believed there were no religious barriers to liver transplantation/donation, while 42.1% (n = 201) were unsure which reflects an area of uncertainty in the majority of our population which stands in contrast compared to a study in Jordan where most of the participants did not consider organ donation/transplantation to be in conflict with their religious or cultural beliefs [22]. In another study conducted in Saudi Arabia, approximately 225 (23.7%) of the participants were unaware of the fatwa regarding organ donation and around 108 (11.4%) of the participants responded with "N0" to the question, "Did the fatwa allow organ donation in KSA [23]?" This ambiguity regarding the religious position on organ donation was not limited to the Arab world; in fact, it extended to Muslims in the Western world [24]. Despite the recent fatwa of the Council of Senior Scholars, which permits and encourages organ donation and transplantation.

This reflects the increased need for awareness campaigns about organ donation/transplantation and highlights its religious acceptability and permissibility. Although a smaller number of responders (36.9%, n = 176) knew how to apply to become living liver donors, the majority were aware of the Tawakkalna option to register for organ donation. This is also seen in a study conducted in the UAE, where most of the participants were not fully aware of all the details of the deceased organ donation program, even if they had heard about it [25]. Additionally, a study conducted in Hong Kong found that around 32.8% of those willing to donate but not yet registered were unaware of the process for registering as a prospective organ donor [26]. This should help shape the campaigns to improve community awareness, including the clarification of organ donation policies, where and how to apply as a donor. Our findings reveal that 36.5% (n = 174) of participants are unwilling to donate during their lifetime, while 30.8% (n = 147) remain uncertain about their decision. Only 5.66% (n = 27) expressed a definite willingness to donate during their lifetime, whereas 27% (n = 129) indicated willingness to donate only under specific circumstances. Additionally, 62.9% (n = 300) reported that they would not donate after death, while 37.1% (n = 177) expressed willingness to do so. Younger age, lower income, higher education levels, personal experience and knowing someone with liver disease were factors positively associated with the decision to donate organs during one's lifetime. In comparison, a 2023 study [27] found that 33% of participants would not donate and 41.9% would donate only under exceptional circumstances. Funeral delay, perceived lack of respect for the dead, surgical scar and donor's mutilation and fear of potential financial implications on relatives were cited as the most important factors why people would refuse donation after death in our study. In a systematic review by Rosa *et al.* which was published in 2025 and included 28 studies across different populations from different geographic locations, the most

important factors cited as reasons why people might refuse or oppose donation after death in descending orders were the following: lack of knowledge about the donation process, religious believes, fear of mutilation or damage to body integrity, conflicts with health care providers during hospitalization, difficulties in accepting brain death and fear of organ trafficking [28]. Barriers to donation during life in our study included fear of medical complications like liver failure, scars and reduction in the quality of life, religious beliefs, potential impact on job application in the military field and possible implications for marriage were the most important reasons for people to refuse donation during their lifetime , which stands in contrast to a study conducted in Faisalabad which shows that the majority of respondents believed their religion permits organ donation. This disagreement with regards to the impact of religion on the decision to donate may be due to regional differences and differing religious interpretations [11]. Additionally, both our study and a study conducted among American Muslims identify religious beliefs as significant barriers to organ donation. Surprisingly, personal connections to liver disease and transplant experience did not significantly influence the decision to donate [29].

CONCLUSIONS

The level of awareness about liver transplantation is increasing in the population of Makkah. There are still many knowledge gaps regarding medical indications for liver transplantation, donor selection and registration that need to be addressed by public health programs. The overwhelming majority of the population in Makkah are not willing to become donors during their lives or after death, which is partly related to their interpretation of the religion's stance on organ transplantation, which has been addressed and corrected by the fatwa of the Islamic scholar issued 1996, therefore, we need more programs and educational campaigns to clarify the Islamic stance and the Islamic position about organ transplantation.

Limitations and Strengths

Several limitations may impact this study. One potential limitation is sampling bias, as the sample may not be sufficiently diverse to represent the entire population of Makkah, thereby limiting the generalizability of the findings. Additionally, a significant proportion of the participants were students aged 18-25, which may not fully capture variations across different age groups. Furthermore, restricting the study to a single city may reduce the applicability of the results to other regions in Saudi Arabia, where demographic characteristics and healthcare accessibility may differ.

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