

ORIGINAL ARTICLE

Informing American Muslims about living donation through tailored health education: A randomized controlled crossover trial evaluating increase in biomedical and religious knowledge

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Funding information

Health Resources and Services Administration R39OT31104 (principal investigator: Padela); National Institute of Diabetes and Digestive and Kidney Diseases, Grant/Award Number: K23 DK103111 and R21 DK121262 (principal investigator: Saunders)

Biomedical and religious knowledge affects organ donation attitudes among Muslims. We tested the effectiveness of mosque-based, religiously tailored, ethically balanced education on organ donation among Muslim Americans. Our randomized, controlled, crossover trial took place at 4 mosques randomized to an early arm where organ donation education preceded a control educational workshop or a late arm with the order reversed. Primary outcomes were changes in biomedical (Rotterdam Renal Replacement Knowledge Test living donation subscale, R3KT) and religious (Islamic Knowledge of Living Organ Donation, IK-LOD) living kidney donation knowledge. Statistical analysis employed a 2 (Treatment Arm) X 3 (Time of Assessment) mixed-method analysis of variance. Of 158 participants, 59 were in the early arm and 99 in the late arm. A between group *t* test comparison at Period 1 (Time 1 – Time 2), demonstrated that the early arm had a significantly higher mean IK-LOD (7.11 v 5.19, $P < .05$) and R3KT scores (7.65 v 4.90, $P < .05$) when compared to the late arm. Late arm participants also had significant increases in mean IK-LOD (5.19 v 7.16, $P < .05$) and R3KT scores (4.90 v. 6.81, $P < .05$) postintervention (Time 2-Time 3). Our novel program thus yielded significant kidney donation-related knowledge gains among Muslim Americans (NCT04443114 Clinicaltrials.gov).

KEYWORDS

disparities, education, ethics and public policy, health services and outcomes research, organ transplantation in general

1 | INTRODUCTION

Muslim Americans are a large, diverse, and growing population. Numbering between 3 and 5 million individuals, they will double in number by 2030.¹ The majority are of African, Arab, and South Asian ancestry, with over 60% being first-generation immigrants.² These communities have high rates of diabetes and hypertension

that increase their risk of kidney failure, portending a greater need for transplantation.³⁻⁷ However, they may be less likely to receive a kidney transplant. Many reasons underlie this disparity including patient values surrounding different therapeutic options, community trust of clinicians and transplant centers, clinician referral patterns, and system-level organ allocation policies.⁸⁻¹⁰ Living donation can offer a remedy, yet disparities in living donation access for racial and ethnic minorities persist.¹¹⁻¹³

Compounding the issue for Muslim Americans is that they appear to be less accepting of donating organs in general and deceased

Abbreviations: CKD, chronic kidney disease; DUREL, Duke University Religion Index; ESRD, end-stage renal disease; IK-LOD, Islamic Knowledge of Living Organ Donation; PMIR, Psychological Measure of Islamic Religiousness; R3KT, Rotterdam Renal Replacement Knowledge Test.

donation in particular. Surveys demonstrate support for deceased donation among Muslim Americans ranges from 23% to 51%, depending on the sample, compared to 95% of the US population overall.¹⁴⁻¹⁷ Muslims' negative views on deceased organ donation have been found throughout the diaspora.¹⁸⁻²¹ Across studies, individuals report deceased organ donation is not compatible with Islam based on personal interpretation of scripture and/or on edicts from religious leaders.^{18,19} Concerns about preserving human dignity and maintaining corporeal integrity after death fuel this lack of interest.^{18,20,22} Studies also find that Muslims who have greater knowledge about the need for organ donation, for example by having greater awareness of organ shortages, or by having a family member on dialysis or who has registered to donate, hold more favorable views toward donation.^{14,19,21,23-25}

In general Muslim views on living donation are more favorable though less well studied.^{20,26-28} In international studies living donation is considered more religiously permissible than deceased donation and individuals report a greater willingness to donate.^{20,26} Our qualitative research in Chicago found that most participants viewed living kidney donation as permissible but deceased donation as impermissible, and nearly all clamored for detailed religious guidance on the issue.²⁸ Many Islamic religious scholars support living kidney donation because it aligns with duties to preserve life, brings about a general public benefit, and attends to the dire need of those with kidney failure.^{29,30} However, Muslim communities may still voice cultural/religious concerns about living donation related to preservation of modesty during donation and the need to retain bodily integrity.^{27,28}

Thus, American Muslims may benefit from tailored education on living kidney donation because of the increased risks of needing a transplant, negative attitudes toward deceased organ donation, and lack of knowledge about the religious and biomedical aspects of donation. Our prior work has demonstrated the value of interventions that are mosque based, involve religious scholarship, and address biomedical, theological, and practical concerns.³¹ Accordingly, we sought to address living kidney donation via an ethically balanced

and religiously tailored educational intervention set in mosques. Here we report on the effectiveness of that intervention.

2 | MATERIALS AND METHODS

Principal design elements and protocols are noted here. Greater details are available elsewhere.³²

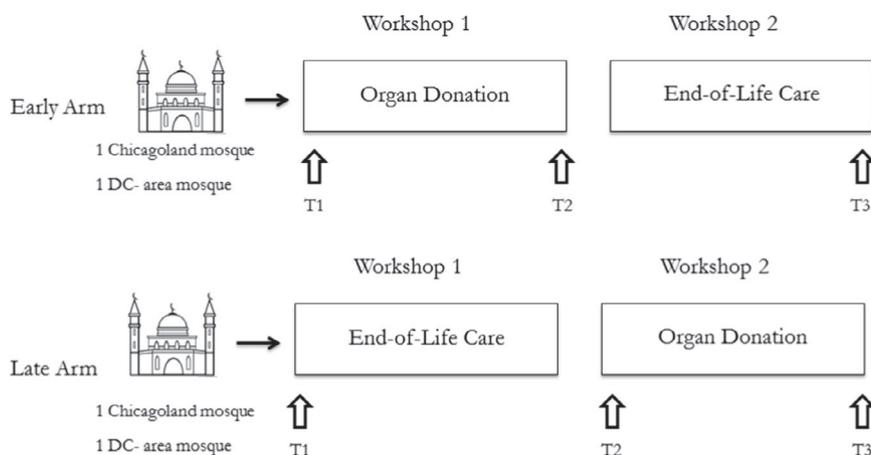
2.1 | Setting and randomization

At 4 mosques representing large and diverse Muslim communities in the Washington, DC and Chicago region, we conducted a randomized controlled crossover trial of educational workshops. The study consisted of 2 arms; the early arm received the intervention (organ donation) workshop first, whereas the late arm started with a control workshop on end-of-life care (Figure 1). Mosques were matched by predominant ethnic/racial composition of the congregation and randomized to arm via a coin toss.

2.2 | Peer educator and participant recruitment

Recruitment took place between November 2018 and July 2019. Peer educators were recruited from within mosque communities via personal contact with existing peer educators, by word of mouth, and by solicitation on the Initiative on Islam and Medicine's listserv and social media. Recruits received 4 hours of didactic instruction and group facilitation practice. They learned how to establish a safe and nonjudgmental setting where participants could explore their ambivalence and elaborate on their perspectives on organ donation, a process designed to promote central, rather than peripheral cognitive processing.^{33,34}

Targeted approaches to intervention design refer to selecting population subgroups based on intrinsic characteristics relevant to



T₁-T₃ = Time of survey assessment

FIGURE 1 A randomized controlled, crossover trial of educational workshops

the intervention's health promotion goals.^{35,36} In light of the pervasive knowledge gaps and lack of interest surrounding organ donation, we targeted Muslim Americans and implemented this targeting by recruiting at mosques. Participants were recruited by trained research staff through dedicated tables at Friday prayers and social events (4-8 recruitment sessions/mosque). Advertisements on mosque websites, flyers on bulletin boards, notices on closed listservs, and word of mouth were also used. After individuals indicated interest by sharing their contact details, they received a follow-up phone call to complete oral consent and ensure eligibility. On the day of the first workshop of the 2-session intervention, walk-ins were screened and underwent consent procedures in person. Participants were subject to the following inclusion criteria: self-reported Muslims, aged 18 years or older and proficient in English. Exclusions were having donated or received an organ or a close family member having done so and being unable to attend the 2 workshop sessions. Workshop participants received a total of \$60 in gift cards, and peer educators \$50 per session led. Participants, peer educators, and guest speakers were blinded as to which workshop was control and which experimental. This study was approved by the Institutional Review Board at the University of Chicago (IRB#s 17-1344, 18-1378, and 19-1909).

2.3 | Theoretical considerations and curriculum design

The workshop curriculum was religiously tailored and ethically balanced. Tailoring refers to applying various methods to design interventions that conform to specific values and norms (eg, cultural tailoring) or to behavioral characteristics (eg, readiness for behavior change).^{35,37,38} Some scholars hold that tailoring must occur at the level of individual characteristics,³⁸ whereas others suggest that adaptations based on group-level characteristics also represent a tailoring strategy.^{35,39} Our intervention tailored at the group level in that learning objectives addressed specific religious and cultural beliefs known to shape attitudes about organ donation in the Muslim community. These beliefs and values were identified from the extant literature and from our formative research and teaching.^{30,40} Religious tailoring also involved adaptations for religious sensibilities such as gender segregation of peer-led group discussions.

Workshops were ethically balanced in that lectures covered religious arguments for and against organ donation, as well as important end-of-life care decisions. Moreover, the biomedical pros and cons (eg, risks and benefits from the individual, family, and societal perspectives) as well as the costs and medical risks associated with living donation were discussed. All of these topics were broached in a nondirectional manner so that participants could resolve their own views with credible information in hand. We sought to enhance informed choices rather than persuade participants to make a behavioral commitment to organ donation; our curriculum did not advocate a certain position with respect to donation; instead

it provided medical, procedural, and Islamic contextual knowledge needed to build participants' capacity for informed decision-making.⁴¹ Consistent with the knowledge-related aspects of behavioral capability in social cognitive theory,⁴² perceived behavioral control in the theory of planned behavior,⁴³ and self-efficacy in the health belief model,⁴⁴ we viewed the knowledge imparted as antecedent to the action of making a personal donation decision, either for or against. Our choice of this upstream action was based on the plural views on organ donation within the Islamic tradition; both views prohibiting donation as well as those approving of donation are considered valid and actionable.^{30,45,46} Not prioritizing one view over another also engendered trust in the community that our program served their interests rather than a healthcare system need. This format was consistent with best-practices for living donor education.⁴⁷

2.4 | Workshop design

The organ donation workshop covered the biomedical, procedural and religio-ethical aspects of organ donation through expert-led didactics, moderated panel presentations, and peer-facilitated small group discussions. Held on a weekend morning, the workshop lasted approximately 5 hours and began with a self-administered survey composed of criterion variables. Didactic sessions by a living donor advocate physician and an organ donation professional followed. These addressed the societal context of renal disease and the need for organ donation, as well as the biomedical risks, benefits, costs, types, and processes involved with living and deceased donation. Thereafter, an Islamic bioethicist reviewed juridical views for and against organ donation by presenting illustrative fatwas and discussing their underlying rationale.^{29,30,48-51} The workshop concluded with small group discussions on the pros, cons, and unresolved questions regarding organ donation. This format allowed for exploring ambivalence while promoting central cognitive processing, which leads to persistent attitudes that are more likely to influence future behavior.^{33,34} The control workshop was similarly structured. Greater details are available in a replication toolkit.⁵²

2.5 | Outcomes

Surveys were collected at 3 time points to assess change in knowledge across time and by intervention assignment (see Figure 1). Primary study outcomes were changes in biomedical and religious knowledge of living organ donation. Knowledge outcomes were selected because they are important antecedent components of organ donation attitude and behavior and are integral to enhancing our behavioral target of making an *informed* organ donation decision.

Biomedical knowledge was assessed by the living donation subscale of the Rotterdam Renal Replacement Knowledge Test (R3KT).⁵³ This subscale consists of 10 items rated true/false/do not know with higher scores indicating greater knowledge. The R3KT has been used in educational interventions among Arab and Turkish

populations in the Netherlands.^{53,54} We utilized a 9-item measure to assess knowledge about the religious arguments for and against living organ donation (Islamic Knowledge of Living Organ Donation, IK-LOD). IK-LOD items were also rated as true/false/do not know. The IK-LOD was designed using literature review and qualitative methods and statistically validated.^{30,55,56}

2.6 | Independent variables

These covered sociodemographic characteristics including those known to associate with organ donation attitude (such as age and sex), acculturation-related items (primary language, country of origin, and duration of US residency),⁵⁷ and recorded whether participants had prior donation-related experience, that is, whether they had a relative or close friend who needed, received, or donated an organ and whether they had previously registered as an organ donor. Additional items included the 1-item health status short form^{58,59}; the Duke University Religion Index (DUREL)⁶⁰; and 2 subscales of the Psychological Measure of Islamic Religiousness (PMIR),⁶¹ the Positive Religious Coping and Identification subscale and the punishing Allah Reappraisal subscale.¹⁴ All 3 scales were adapted slightly as discussed elsewhere.³² Finally, a short version of the Everyday Discrimination Scale (5-items) and an healthcare-oriented adaptation of the original Everyday Discrimination Scale (7-items) were included.^{32,62}

2.7 | Data management and transformation

Printed surveys were self-administered by participants anonymously. These were double-entered into RedCap by a team of research assistants, after which the versions were merged and discrepancies adjudicated by referring to original surveys. Several data transformations were made before analysis. For the R3KT and IK-LOD scales, “do not know” responses were collapsed into the “false” response category, and a scale was generated by summing correct answers into a knowledge test score (R3KT 0-10, IK-LOD 0-9). For sociodemographics we collapsed ethnic backgrounds into South Asian and Other, and primary language spoken at home into English, Urdu and Other. An acculturation measure was developed by combining the variable “country of origin” (US = 1, Other = 0) and “primary language spoken at home” (English = 1, Urdu/Other = 0) into a summed score from 0 to 2.

2.8 | Statistical analysis

A sample size of 90 (45 participants in each group) was calculated to have 80% power to detect a medium size intervention effect of 0.6 SD units. Estimates of knowledge change attributable to an educational intervention are derived from a study which showed a large increase in living kidney donation knowledge (0.8 SD units) via a home-based educational program.⁶³ Statistical analyses employed

a 2 (Treatment Arm) X 3 (Time of Assessment) mixed-method analysis of variance, with treatment arm treated as a between subjects’ factor and time treated as a within-subjects’ factor. Post hoc paired *t* tests were used to test within-subject comparisons across time, and independent sample *t* tests were used to test between subject comparisons within each assessment interval. The Bonferroni correction was used to adjust for multiple comparisons. Participant baseline characteristics that, in bivariate analysis, were found to vary significantly by treatment arm, or to be significantly associated with change in religious or biomedical knowledge scales (IK-LOD and R3KT) at Time 2 were used as covariates in adjusted analysis of covariance (ANCOVA) models. All data analysis was conducted using SPSS version 25.⁶⁴

3 | RESULTS

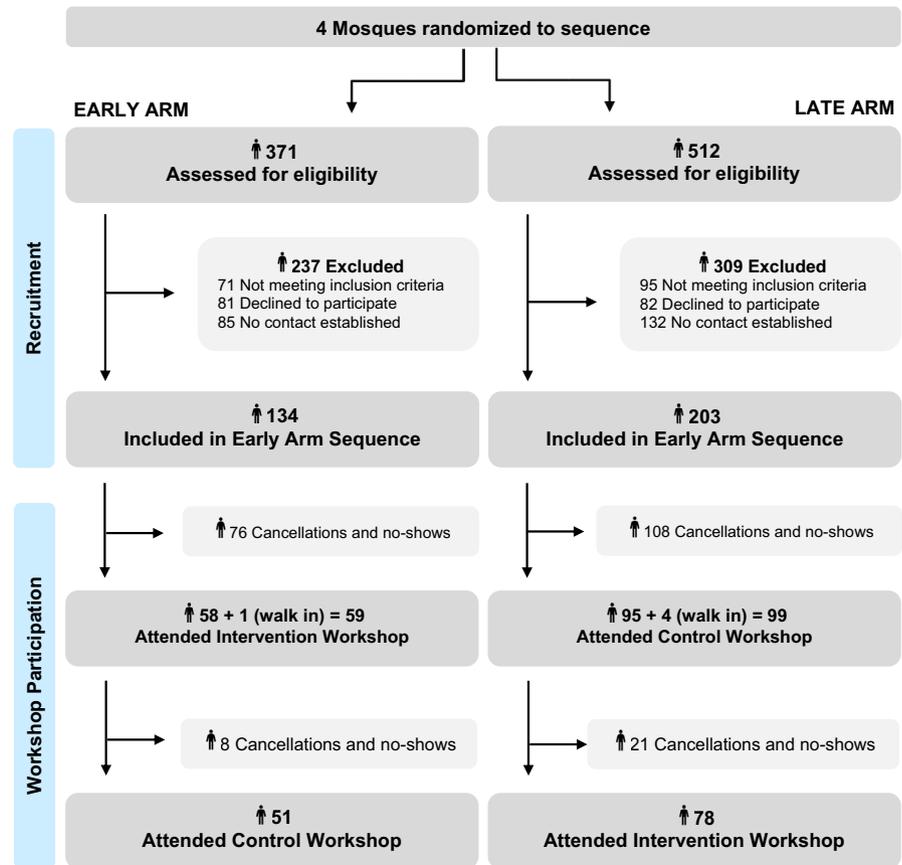
3.1 | Participant flow

Overall 500 individuals met eligibility criteria, and 337 individuals were randomized to the 2 arms (67% participation rate). Out of this group 158 attended the first workshop session in the series (47% attendance rate), and 136 completed the intervention workshop. By arm, of the 134 individuals recruited into the early arm, 59 attended the intervention workshop and 51 attended both workshops. Of the 203 individuals recruited into the late arm, 99 attended the control and 78 attended the intervention workshop (see Figure 2). Chi-square and *t* tests indicated no significant differences in baseline characteristics (gender, health status, age, religiosity, duration in United States, whether they had a relative or close friend who needed, received, or donated an organ and whether they had previously registered as an organ donor) between the 129 individuals who completed all assessments compared to the 29 individuals who attended one but not both workshop sessions (results not shown).

3.2 | Participant characteristics

Most of the 158 participants (those attending at least the first workshop in each arm), were predominantly South Asian (83%), and born outside of the United States (76%). There were nearly equal numbers of men and women, and a wide age range (median age 47 years). A small minority (18%) were registered organ donors. Overall, participants were highly religious (mean composite DUREL score of 23.1 out of 27). Participants in the early and late arms did not differ significantly on gender, racial background, religiosity, health status, or organ donation experience. However, early arm participants were younger (56% vs. 29% under 40 years old), had fewer foreign-born members (67% vs. 82%), and had shorter tenure in the United States (58% vs 25% in United States less than 20 years). (See Table 1; Peer Educator Characteristics are reported in Table S1.)

FIGURE 2 Participant flow diagram



3.3 | Outcomes: Change in religious and biomedical knowledge of living donation

The impact of the intervention is demonstrated when individuals' religious knowledge (IK-LOD) and biomedical knowledge (R3KT) postintervention scores are compared with preintervention scores. For religious knowledge, there was no significant difference in mean IK-LOD scores between the 2 arms at baseline (4.02 v 4.53, $P = .065$; Time 1). We analyzed intervention effect over Period 1 (Time 1 – Time 2) through a between-group t test comparison, which demonstrated that the early arm (intervention-control sequence) had a significantly higher knowledge score as a result of the intervention compared to the late arm (control-intervention sequence) (7.11 v 5.19, $P < .05$; Time 2). Knowledge gained by means of the intervention was retained 2 weeks postintervention with IK-LOD scores in the early arm at Time 3 being significantly greater than at Time 1 (7.09 v 4.02, $P < .05$). Additionally, there was significant increase in IK-LOD score postintervention in the late arm (5.19 v 7.13, $P < .05$, Time 2-Time 3). The impact of the intervention was then assessed by means of a within-subjects ANCOVA (Time), in which participants function as their own control, which further demonstrated intervention effectiveness in both the late and early arms ($P = .000$) (see Table 2). The observed Treatment Arm X Time (between subjects X within subject) interaction was also observed in follow-up ANCOVAs that adjusted for potential confounders of differences in baseline IK-LOD scores, $F_{1,113} = 56.113$, $P = .000$; age, acculturation,

and ethnicity characteristics, $F_{2,192} = 13.257$, $P = .000$; and having a close friend or a relative who needed, received, or donated an organ, $F_{2,222} = 42.693$, $P = .000$.

For biomedical knowledge, at baseline there was no significant difference between the 2 arms in mean R3KT scores (4.52 vs 4.00, $P = .273$; Time 1). We analyzed intervention effect over Period 1 (Time 1 – Time 2) through a between group t test, which demonstrated that the early arm (intervention-control sequence) had a significantly higher knowledge score as a result of the intervention compared to the late arm (control-intervention sequence) (7.65 v 4.90, $P < .05$; Time 2). Knowledge gained through the intervention was retained 2 weeks post intervention with mean R3KT scores in the early arm at Time 3 being significantly greater than at Time 1. Additionally there was a significant increase in R3KT score postintervention in the late arm (4.90 v. 6.81, $P < .05$, Time 2-Time 3). The impact of the intervention was further assessed by means of a within-subjects ANCOVA (Time), in which participants function as their own control, which further demonstrated intervention effectiveness in both the late and early arms ($P = .000$). After adjustment for potential confounders, including differences in baseline R3KT scores, age, acculturation, religious coping (positive and negative), donor designation status, and having a close friend or a relative who needed, received, or donated an organ, there remained a significant difference in religious knowledge because of the intervention (ANCOVA Time x Arm, $P < .05$). (See Table 3.) The observed Treatment Arm X Time interaction was observed in follow-up ANCOVAs that adjusted for the potential

TABLE 1 Participant characteristics by study arm (n = 158)

Characteristics	Overall No. (%)	Early arm (N = 59)	Late arm, (N = 99)	P value
Socio-demographics				
Sex (n = 152)				
Female	83 (54.61)	34 (58.62)	49 (52.13)	0.435
Racial/ethnic background (n = 151)				
South Asian	125 (82.78)	47 (81.03)	78 (83.87)	0.653
Other	26 (17.22)	11 (18.97)	15 (16.13)	
Age, mean (range) (n = 151)				
18-30 years old	47 (18, 85)	20	9	0.000
31-40 years old	29 (19.21)	12	18	
41-50 years old	30 (19.87)	12	20	
51-60 years old	32 (21.19)	12	20	
61-70 years old	23 (15.23)	9	14	
71-85 years old	21 (13.91)	2	19	
6 (10.60)	2	14		
Country of origin (n = 151)				
United States	36 (23.84)	19 (32.76)	17 (18.28)	0.042
Other	115 (76.16)	39 (67.24)	76 (81.72)	
Residency in the US (n = 117)				
20 years or less	42 (35.90)	23 (57.50)	19 (24.68)	<0.001
More than 20 years	75 (64.10)	17 (42.50)	58 (75.32)	
Primary language (n = 151)				
English	67 (44.37)	30 (51.72)	37 (39.78)	0.033
Urdu	61 (40.40)	16 (27.59)	45 (48.39)	
Other	23 (15.23)	12 (20.69)	11 (11.83)	
Religiosity				
Positive religious coping, mean (range) (n = 145)	26.34 (7, 28)	26.07 (19, 28)	26.52 (7, 28)	0.383
Negative religious coping, mean (range) (n = 149)	6.47 (3, 12)	6.14 (3, 12)	6.67 (3, 12)	0.297
DUREL, mean (range) (n = 148)	23.14 (6, 27)	23.38 (16, 27)	22.98 (6, 27)	0.419
Organ donation experience				
Organ donor registrant (n = 150)				
Yes	27 (18.00)	11	16	0.746
Relative or close friend who needed, received, or donated an organ (n = 152)				
Yes	43 (28.29)	18 (31.03)	25 (26.60)	0.555
Health (short form 1)				
Very poor/poor	0 (0.00)	0 (0.00)	0 (0.00)	0.906
Fair	21 (13.82)	7 (11.86)	14 (15.05)	
Good	46 (30.26)	17 (28.81)	29 (31.18)	
Very good	47 (30.92)	19 (32.20)	28 (30.11)	
Excellent	38 (25.00)	16 (27.12)	22 (23.66)	

Abbreviation: DUREL, Duke University Religion Index.

confounders of differences in baseline R3KT scores, $F_{1,106} = 36.106$, $P = .000$; age and acculturation, $F_{2,182} = 9.779$, $P = .000$; positive and negative religious coping scores, $F_{2,194} = 13.957$, $P = .000$; and donor designation on one's will and having a close friend or a relative who needed, received, or donated an organ, $F_{2,202} = 16.763$, $P = .000$.

4 | DISCUSSION

In a randomized controlled crossover trial, we found that mosque-based, religiously tailored, and ethically balanced education significantly increases biomedical and religious knowledge about living

TABLE 2 Change in Islamic knowledge (IK-LOD)^a over the intervention period

	Intervention period (2 weeks)			Within-subjects difference
	Time 1 (baseline)	Time 2 (postintervention; preintervention)	Time 3 (postcontrol, postintervention)	
Early arm				
Mean (SD)	4.02 (1.95)	7.11 (0.99)	7.09 (1.07)	
Sample size				46
Late arm				
Mean (SD)	4.53 (2.48)	5.19 (2.09)	7.16 (1.39)	
Sample size				70
Treatment effect				
Sample size				116
Between group <i>t</i> test comparison	<i>P</i> = .065	<i>P</i> = .000*	<i>P</i> = .304	
ANCOVA Time				0.000*
ANCOVA Time x Arm				0.000*

Note: Paired *t* tests:

Early arm: T1-T2: $t_{45} = -9.9, P = .000$; T2-T3: $t_{45} = 0.14, P = .888$; T1-T3: $t_{45} = -10.55, P = .000$.

Late arm: T1-T2: $t_{69} = -2.7, P = .008$; T2-T3: $t_{69} = -8.34, P = .000$; T1-T3: $t_{69} = -7.95, P = .000$.

^aCronbach's α IK-LOD: 0.728.

*Significant at level of $P < .05$.

TABLE 3 Change in biomedical knowledge (R3KT)^a over the intervention period

	Intervention period (2 weeks)			Within-subjects difference
	Time 1 (baseline)	Time 2 (postintervention, preintervention)	Time 3 (postcontrol, postintervention)	
Early arm				
Mean (SD)	4.52 (2.41)	7.65 (1.65)	7.35 (1.54)	
Sample size				46
Late arm				
Mean (SD)	4.00 (2.46)	4.90 (2.28)	6.81 (1.82)	
Sample size				63
Treatment effect				
Sample size				109
Between group <i>t</i> test comparison	<i>P</i> = .273	<i>P</i> = .015*	<i>P</i> = .274	
ANCOVA Time				0.000*
ANCOVA Time x Arm				0.000*

Note: Paired *t* tests:

Early Arm: T1-T2: $t_{45} = -8.21, P = .000$; T2-T3: $t_{45} = 1.66, P = .104$; T1-T3: $t_{45} = -7.32, P = .000$.

Late Arm: T1-T2: $t_{62} = -3.34, P = .001$; T2-T3: $t_{62} = -6.90, P = .000$; T1-T3: $t_{62} = -8.39, P = .000$.

^aCronbach's α R3KT: 0.682.

*Significant at level of $P < .05$.

kidney donation among Muslim Americans. Prior research on this topic in mosques has been observational,^{14,28} and religion-based interventions focused on promoting donation have yielded uneven results.^{16,65} To our knowledge this is the first educational intervention to successfully increase knowledge about living donation among Muslims in the “west.”

Our intervention increased religious knowledge on living donation even after accounting for participant baseline knowledge and characteristics such as age, acculturation, and having a close friend or a relative who needed, received, or donated an organ. Importantly, that knowledge was retained; participants had significantly higher religious knowledge scores at follow-up. Prior work has noted that

for Muslims a lack of awareness of religious views on living donation fuels uncertainty,^{24,55} and religious education on permissive rulings has not been successful in changing attitudes.⁶⁵ We presented ethically balanced religious views seeking to educate rather than persuade. Our work suggests that a balanced presentation may enable individuals to better assimilate information that can be challenging to their prior beliefs.⁶⁶ Moreover, given the plurality of views within the Islamic tradition on the matter such an approach may be more ethical and prudent.⁴⁵

Our intervention also improved participant biomedical knowledge.⁶⁷ Most educational interventions on living organ donation have focused on African Americans and Hispanics, our work innovates by adding data on Muslim Americans to this body of knowledge.⁶³ Muslim Americans, like other minority communities, are at higher risk for end-stage renal disease (ESRD) and are underrepresented among living kidney donors.³ Yet, there are a dearth of interventions in community settings. Many interventions have focused on educating individuals with chronic kidney disease (CKD) and their families about living kidney donation.^{54,68-70} Other campaigns have focused on educating the general public. Our work is targeted and provides information on the need for living donors as well as a balanced presentation of the benefits and potential harms of living donation. Research shows that greater awareness of societal and community need for organs is associated with more positive attitudes toward organ donation.^{19,25} Moreover, the lack of awareness about the types of, and procedures associated with, donation can fuel hesitancy.^{71,72} Our success in increasing knowledge may forecast improved organ donation attitudes.

Our design had several strengths. The randomized design allowed for controlling unmeasured confounders between study arms and thus added rigor to findings. Additionally the project built community capacity for similar educational programs. We trained and employed peer educators, involved religious leaders in delivering key lectures, and convened a multisectoral community advisory board to direct outreach and dissemination efforts. The benefits of such capacity building includes minimizing community dependency on outside experts, generating a sense of ownership over the health attitudes and behaviors of the community, and fostering continued health education within community institutions once research ends. In this way sustainability of our program may be fostered, and to this end we produced a replication guide to promote implementation with fidelity to the ethically balanced curriculum. Relatedly, involving mosque leadership legitimizes both health research and educational endeavors and locating workshops within mosques signals to community members that mosques and mosque leaders are available to discuss ethically important, yet controversial, topics. Further, mosque leadership may be able to better educate all mosque members because Muslims often rely on religious leaders to provide guidance on bioethical issues such as organ donation and end-of-life care.⁷³ Scholars have critiqued allowing organ donation programs in mosques arguing that they present biased, pro-donation information.⁷⁴ Our workshops addressed this trust issue by discussing religious views for and against, as well as

benefits and risks to, organ donation thus preparing attendees to make informed choices.

Study findings should be interpreted in light of several limitations. First, although we sought a representative sample of Muslims from metropolitan areas, our findings might not be generalizable to US Muslims overall as our sample was majority South Asian yet only 28% of the US Muslim population is of South Asian background.¹ Future work should assess effectiveness in a more racially/ethnically diverse sample. Relatedly, though 43% of US Muslims report attending mosque at least weekly, recruitment through mosques selected for a highly religious cross-section of community.⁷⁵ Because the intervention targeted improvements in religious knowledge, less religious segments of the community may have different knowledge gains. We hypothesize less religious Muslims would have greater religious knowledge gain; however, this must be explored empirically.

The use of biomedical (procedural and contextual) and Islamic knowledge regarding living donation as primary outcomes might also be considered limitations in that organ donation intention and/or actions were not obtained. Although there remains a gap between knowledge and action in both theory and practice, increasing such knowledge has been shown to enhance self-efficacy for engaging in target behaviors.⁴⁴ Moreover, our targeted action was informed decision-making. We viewed asking participants to make a living organ donation commitment at the time of the study as being hypothetical and artificial given that such decisions are often made within close-knit social circles and based on urgent need. Nonetheless, future studies should assess how knowledge gains associate with perceptions of self-efficacy, preparedness, and donation decisions. We recognize that future donation decisions might be less well informed because of poor knowledge retention. The peer educator-led group discussions were designed to aid such retention,³⁴ yet without longer-term follow-up we cannot know whether that knowledge was retained or used in making informed donation decisions in the future. All in all, we call for more research linking organ donation knowledge improvements to behavioral intention change and subsequently to organ donation in the Muslim community.

Our successful study can serve as a model worthy of replication. The curriculum can easily be used in non-mosque settings such as cultural, civic, or educational centers and could be used to educate Muslims in the United Kingdom, Canada, or other diasporic communities with robust living organ donation programs based on informed choice. Our project focused on increasing knowledge within the Muslim community, yet future iterations could focus more specifically on Muslims connected to someone with ESRD. This could entail referrals from dialysis units and transplant centers or community-based recruitment where having a close friend or a relative with ESRD is part of the eligibility criteria. Adapting the curriculum for use in Muslim-majority nations must be done cautiously as the legal and biomedical context of donation may differ significantly from the American one. A more significant challenge to sustainability, scalability, and implementation is the resource-intensive nature of our mosque-based program. Despite their success, the in-person workshops were time and resource intensive. Many potential participants

reported lack of time as a barrier to participation, and many who signed up did not complete the 2 sessions. In addition, staff spent significant time and resources to identify lecturers, recruit participants, and train peer educators. Some of these concerns may be addressed by moving to an online, self-paced format and future research should compare the acceptability, efficacy, and cost of such with in-person workshops. It is also important to recognize that the effect of the speakers on our observed results is unknown. Presenters' speaking style and expertise may have played an important role in the effectiveness of our educational program though unmeasured.³⁴ Given the human and health system costs of dialysis compared to living donor transplant, payors and transplant centers may find subsidizing community-based and online programs to be valuable.

^{76,77} Finally, our curricular approach may be broadly applicable. There are other communities that hold plural views on the question of organ donation, and indeed there are many ethical justifications for and against donating one's organs while living. As such, other communities may take our lead by constructing educational programs to ensure donation decisions are based on biomedical facts and not myths and based on well-informed religious and ethical arguments.

In conclusion, racial and ethnic minorities are at a higher risk for ESRD and are underrepresented among living donors. Programs to educate communities about donation should be ethically balanced, culturally tailored, and rigorously designed. Our educational intervention successfully increased both biomedical and religious knowledge about living kidney donation for participants in large, diverse urban mosques. In so doing the program supported informed donation decisions among Muslim Americans.

ACKNOWLEDGMENTS

This work was funded by the Health Resources and Services Administration (HRSA R39OT31104, PI: Padela). Milda Saunders was supported by the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK K23 DK103111, R21 DK121262). The research study involved a collaboration between the Initiative on Islam and Medicine (II&M) at University of Chicago (UC), the National Kidney Foundation of Illinois (NKF-I), and Gift of Hope (GoH). The project team comprised of the following individuals: Jennifer Aguilar (GoH), Susan Cochran (GoH), Megan Craig (NKF-I), Dr Rosie Duivenbode (II&M), Dr Aasim I. Padela (II&M), Dr Michael Quinn (UC), and Dr Milda Saunders (UC). In addition, this project could not have been successful without our peer educators and many others at the Initiative on Islam and Medicine (II&M). These people include: Moussa Abdelhak, Raed Aluofi, Mubashira Aziz, Anam El-Jabali, Mariam Eldeib, Masood Iqbal, Saleha Jabeen, Taher Kehil, Mushtaq Merchant, Shifa Mohiuddin, Afroz Rafi, Nancy Romancheck, Nadhirah Rashid, Rul Kashif, Phyllis Tarver-Kashif, Hira Palla, Sarah Khasawinah, Roxie France-Nuriddin, Ayah Nuriddin, Faiza Alvi, Awa Sanneh, Samsiah Abdulmajid, Parvez Khan, Samiha Ahmed, Fahad Abbasi, Abdul Hakim Aghil, Zayd Ahmed, Nida Alam, Imadul Chowdhury, Nadine Faisal, Stephen Hall, Zeeshan Khan, Ibrahim Khan, Mohammed Muqsith, Dr Shaheen Nageeb, Orhan Önder, Anas Qatanani, Ali Siddiqui, and Khadija Snowber. We would also like to thank members of our Community Advisory Board (CAB) and mosque

leaders, including Tareq Abedin, Mohammad Yahya Alvi, Jaseem Anwer, Naeem Baig, Fawzia Fazily, Irfan Galaria, Mahsin Habib, Muhammad Nabeel Hasan, Kamran Husain, Mohammad Khalid, Fauzia Lodhi, Saulat Pervez, Rafiq Rakhangi, Latif A. Rasheed, Irfan Shaikh, Neima Surur, Sabih Uddin, and Abdul Rahman Wajid. Finally, the success of the project depended on many guest lecturers: Dr Ruba Azzam (UC), Karen Cameron (Gift of Hope), Dr Basit Javid (Georgetown University Hospital), Dr Khalid Khan (Georgetown University Hospital), Dr Abdul Rauf Mir, Dr Ermin Sinanovic (Center for Islam in the Contemporary World), Azfar Uddin (Islamic Foundation North)

DISCLOSURE

The authors of this manuscript have no conflicts of interest to disclose as described by the *American Journal of Transplantation*.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy and ethical restrictions.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section.

How to cite this article: Padela AI, Duivenbode R, Quinn M, Saunders MR. Informing American muslims about living donation through tailored health education: A randomized controlled cross-over trial evaluating increase in biomedical and religious knowledge. *Am J Transplant.* 2020;00:1-11. <https://doi.org/10.1111/ajt.16242>