J Relig Health (2016) 55:403–421
DOI 10.1007/s10943-015-0154-y

ORIGINAL PAPER

Predictors of Physician Recommendation for Ethically Controversial Medical Procedures: Findings from an Exploratory National Survey of American Muslim Physicians

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Published online: 27 November 2015

Abstract Physician religiosity can influence their ethical attitude toward medical procedures and can thereby impact healthcare delivery. Using a national survey of American Muslim physicians, we explored the association between physician recommendation of three controversial medical procedures—tubal ligation, abortion, and porcine-based vaccine—and their (1) religiosity, (2) utilization of bioethics resources, and (3) perception of whether the procedure was a medical necessity and if the scenario represented a life threat. Generally, multivariate models found that physicians who read the Qur'an more often as well as those who perceived medical necessity and/or life threat had a higher odds recommending the procedures, whereas those who sought Islamic bioethical guidance from Islamic jurists (or juridical councils) more often had a lower odds. These associations suggest that the bioethical framework of Muslim physicians is influenced by their reading of scripture, and the opinions of Islamic jurists and that these influences may, paradoxically, be interpreted to be in opposition over some medical procedures.

Keywords Physician decision-making · Islamic bioethics · Religiosity · ḍarūrāh

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Introduction

Certain medical procedures can present ethical challenges to physicians because of the nature of the procedure in question or because of the resulting outcome it leads to. Surely some physicians may question whether certain types of procedures are within the scope of medical practice, or they may alternatively question whether the clinical outcome achieved by a certain procedure is one that the medical profession should attend to. In these controversial domains of healthcare, a physician's values and beliefs may impact clinical service delivery in various ways—some that are measurable and overt and some that are less visible. For example, if a physician believes that a certain procedure is ethically problematic, they may choose not to perform the procedure, not recommend or recommend against patients obtaining the procedure, or not provide information to their patients about such procedures as clinical options. A series of national surveys of American physicians have demonstrated that physicians' values may contribute to variations in clinical care, particularly in areas where clinical controversy exists and where physicians' religious values may deem certain medical procedures ethically problematic (Curlin et al. 2007a; Rasinski et al. 2011; Lawrence et al. 2011a). Understanding the factors that influence physician's recommendations for procedures that may be ethically controversial is important because it provides a vantage point for considering the scope and bounds of medical practice and the duties of medical professional, and because it may provide additional insights into how healthcare disparities may be produced and how they may be addressed.

Physician recommendations for ethically controversial medical procedures may be influenced by a multitude of intertwined factors including the underlying clinical indication and patient's health status, the patient's articulated healthcare values and preferences, and the likelihood of therapeutic success, and available alternatives to that particular intervention. Alongside these more obvious considerations, a number of sociodemographic characteristics may influence physician recommendations for or against some medical procedures. Sociodemographic characteristics influence a physician's recommendation because they indicate social experiences and norms that can affect one's view of a procedure; a female physician, for example, may view ethically controversial interventions in the reproductive clinic differently to male physicians because many of those procedures disproportionately affect female sexual and reproductive health when compared to males (Curlin et al. 2007b).

Alongside such personal characteristics and social experiences that may influence a physician's recommendations, a physician's religion also informs their view of medical procedures (Curlin et al. 2006; 2007b). Indeed, religion provides a set of normative beliefs and an ethical framework that can inform the physician's ethical evaluation of controversial procedures. Similarly, religiosity, defined as "the extent to which an individual embraces his religion as the 'master motive'" (Allport and Ross 1967), impacts the relevance of the religious ethical framework to the physician's professional medical practice. Taken together, religious beliefs and the ethical framework they entail, as well as the affinity of the treating physician to religious teachings (their religiosity) impact physician recommendations for controversial medical procedures.

Reproductive health services represent an area of ethical controversy for some physicians, and a number of studies report relationships between the religion and religiosity of physicians and their recommendation of certain reproductive health procedures. For example, Stulberg et al. (2011) found that amongst practicing US obstetrician–

gynecologists, those with high religiosity when compared to those with medium or low religiosity, as well as those who were Catholics or Protestant when compared to those with no religious affiliation, were significantly less likely to provide abortion services. Aiyer et al. (1999) surveyed practicing obstetricians and gynecologists in New York and found that one of the most important factors influencing the physician's decision not to perform an abortion was their religion. Abdel-Aziz et al. (2004) surveyed primary care physicians in the UK and found a significant difference between Christian physicians and those with no religion when asked about abortion; the former group was less likely to agree with a number of reasons to allow termination than the latter group. With respect to contraceptive methods, Lawrence et al. (2011b) surveyed a nationally representative sample of American obstetricians and gynecologists and found that religious physicians were more likely to object to and withhold some contraceptive methods than non-religious physicians. In another study by the same group, physicians who never attended religious services were more comfortable providing sterilization services than those physicians who attended religious services more frequently (Lawrence et al. 2011a).

Similar associations between religiosity and a physician's recommendation of a controversial medical procedure have been observed in other clinical areas such caring for newborns with congenital anomalies (Todres et al. 1977), HPV vaccination provision (Ishibashi et al. 2008), and end-of-life care (Cohen et al. 2008; Seale 2010; Wolenberg et al. 2013). In the first study, physicians who were more religiously active were more likely to recommend surgery for congenital anomalies than their less religiously active colleagues. In the latter studies, religious physicians were less likely to recommend or implement the controversial medical procedure than their less religious colleagues. It can therefore be said that the religious identity of some treating physicians and the strength of their affiliation to that religion as represented by religiosity, influence the nature of the physician's recommendation for ethically controversial medical procedures.

Scant research notes that religion and religiosity might influence the medical practice of physicians from the Muslim community. A qualitative study of Muslim physicians residing in the USA found that Islam was consistently identified as the source of the physician's professional ethics and that a reluctance by some Muslim physicians to recommend certain procedures, such as abortion, was rooted in their understanding of Islamic ethics (Padela et al. 2008). A study of Muslim physicians in Saudi Arabia found that physicians of higher religiosity were more likely to share their own religious ideas and experiences with the patient (Al-Yousefi 2012). This finding suggests that patient decisions about medical procedures might be influenced by the physician's religious views.

The present study builds upon these findings among Muslim physicians and the studies of the physician community more broadly that recount how physicians' religion may influence views of medical procedures. Using a national survey of American Muslim clinicians, we assess how physician religiosity relates to their recommendation of medical procedures which are ethically controversial from the vantage point of Islam. Additionally, we will explore relationships between bioethics resource utilization, physician perception of the procedure in question being a medical necessity and the patient scenario reflecting a life threat, and physician recommendation of the controversial medical procedure.

As will be described in greater detail below, this study focuses on medical procedures related to reproductive health and vaccination because studies of other groups of physicians (also described above) find these areas to be controversial and also find this area to be one where physician religiosity appears to influence clinical service delivery. Further these areas are ethically controversial from an Islamic perspective as well. Physician perception of whether the procedure is a medical necessity and whether there is a life threat to the

patient, was selected to study because these concepts can be interpreted to have resonance with the Islamic ethical construct of "*ḍarūrāh,*" or necessity, and the ethico-legal maxim "*ad-ḍarūrātu tubīḥ al-maḥẓūrāt,*" or dire necessity renders the unlawful licit (Kamali, n.d.; Mahmassani 1961). These ethico-legal constructs are often used in Islamic juridical writings to ground the religious permissibility of normatively prohibited medical procedures.

We hypothesize that more religious Muslim physicians will have lower odds of recommending the ethically controversial medical procedures, as will those who utilize bioethics resources more frequently than those who do not. We also believe that a physician's perception of there being a life threat and a medical necessity will have positive associations with physician recommendation for the procedure.

Methods

Participant Recruitment and Data Collection

National databases of physicians, like the American Medical Association Masterfile, do not collect data on religious affiliation, and experience shows that naming and country of origin algorithms have poor specificity for identifying Muslims (Curlin 2010; Rasinski 2010). Consequently, our national sampling frame drew upon the membership of the Islamic Medical Association of North America (IMANA), the largest organization of American Muslim clinicians ($n = 1968$ members in 2013).

We first selected 746 members at random and mailed them a letter introducing the study. For letters returned undeliverable, we sought alternative addresses through postal records and the Internet. After excluding members with nonworking addresses ($n = 100$), those no longer in the USA ($n = 1$), deceased persons ($n = 2$), those not practicing medicine ($n = 17$), and non-Muslims ($n = 1$), we mailed the self-administered questionnaire to 626 potential respondents.

The first questionnaire mailing included a $2 incentive. We sent a postcard reminder 10 days after the first mailing, and another copy of the survey 5 weeks later to non-respondents. A third survey mailing was sent five weeks after the second and included the promise of a book on Islam and medicine as an additional incentive. We sent one final postcard reminder to remaining non-respondents which we included a web address linked to an online version of the questionnaire. During the data collection period, intermittent email reminders about the study were sent via an IMANA listserv, and several weeks after the final postcard, we sent a final email noting that all respondents would be entered into a raffle for an iPad.

Survey Instrument and Key Measures

We used the tailored design method to guide our survey design (Dillman et al. 2011). The questionnaire comprised of items and measures available in the extant health literature as well as some created de novo. The initial item-pool was refined through expert panel review with experienced survey researchers, cognitive pretesting with several local Muslim physicians, and time-trails with clinician-researchers. These methods helped reduce redundancy of items and revise item wording for clarity.

Survey domains relevant to this paper were (1) physician recommendation of ethically controversial medical procedures related to 3 case vignettes (described below), (2) physician perceptions of medical necessity and life threat, (3) Islamic religiosity, (4) utilization of bioethics resources, and (5) participant sociodemographic characteristics.

Case Vignettes

We constructed three case vignettes that focusing on medical procedures that are ethically controversial to a cross section of the physician community and can be ethically controversial from the perspective of Islam as well. The cases describe patients who are faced with the decision to pursue procedures that are normatively proscribed in Islam: tubal ligation (Atighetchi 1994; Al-Kawthari 2006), abortion (Asman 2004; Al-Kawthari 2006; Nasir 2011), and porcine-based vaccination (Isa 2015; Padela et al. 2014).

The ethical controversy regarding these three procedures from the Islamic perspective is briefly summarized as follows. In the case of tubal ligation, the Rabat Conference on Islam and Family Planning ruled in 1965 that permanent sterilization was not allowed according to Islamic law, a position that was aligned with the view of prohibition held by al-Azhar University's International Center for Population Studies and Research (Karim 2005). This view of impermissibility is grounded upon using a legal analogy to the explicit prohibition of castration in the Prophetic statements, a reported consensus of Islamic jurists that prohibits permanent sterilization, and an ethical argument founded upon Quranic statements that suggest that unessential changes to the human body are impermissible. (Ebrahim 1988; Yacoub 2001). However some scholars, such as Shaykh Jad al-Haqq, contend that since there is no explicit scriptural source-text that directly prohibits permanent sterilization it should not be categorically impermissible (Yacoub 2001), and some allow for permanent sterilization, e.g. tubal ligation, when a patient's health is at grave risk due to pregnancy by invoking the ethico-legal construct of *ḍarūrāh* (Ebrahim 2008).

The issue of abortion is similarly ethically controversial for Muslims, with the four schools of Sunni Islamic law regarding abortion to be normatively prohibited after ensoulment (Musali 1937; Dardir, n.d.; Ramli 1938; Ibn-Qudamah 1981a). However, invoking the ethico-legal construct of *ḍarūrāh*, Shaykh Al-Qardawi (1980) holds that a life-threat to a pregnant mother lifts the prohibition. Other scholars invoke the idea of choosing the lesser of two harms to life the normative prohibition when the mother's health is at risk (Yacoub 2001). The Islamic Fiqh Academy of India suggests that rape is another acceptable reason for the prohibition to be lifted (Al-Kawthari 2006).

Porcine-based medications are also ethically controversial from the vantage-point of Islam. The contention lies in using a substance that is normatively prohibited to consume for therapeutic purposes. Ibn-Qudamah (1981b), a Hanbali jurist, argues that it is 'not permissible to treat disease with religiously impermissible things or anything that contains religiously impermissible things… because the Prophet [Muhammad] peace and blessings of God be upon him said: 'God does not put the cure for my nation in that which He has forbidden to them'. Modern juridical councils have invoked the Islamic ethico-legal construct of *ḍarūrāh* to permit usage of porcine-based medications when a significant health threat exists (Isa 2015), and others use construct of transformation to conclude that porcine products changed in nature during pharmaceutical processes are permissible to consume for medical purposes (WHO 2001; Padela et al. 2014).

As outlined above, these procedures may become licit according to Islamic law under conditions of "dire necessity" or *ḍarūrāh*. The clinical context for each of these cases entailed a possible extenuating circumstance that may qualify as a medical necessity and/or represent a life threat. The tubal ligation scenario described a Muslim female patient with dilated cardiomyopathy associated with severe heart failure. The patient's ob/gyn physician advised her to undergo surgical sterilization (bilateral tubal ligation) to prevent future conception. The abortion scenario described a Muslim female with leukemia and on

intensive chemotherapy. The patient is found to be pregnant at a gestational stage where, according to Islamic tradition, fetal ensoulment has already occurred. Her oncologist and gynecologists recommend an abortion. The porcine-based vaccination case described an influenza outbreak with no reported deaths but one where the Centers for Disease Control recommends that all individuals without contraindications be vaccinated. The only vaccination available contains porcine components.

Physician Recommendation of Ethically Controversial Medical Procedures

After describing each vignette respondents were asked whether they would recommend the procedure; this variable represented the primary outcome measure.

Physician Perception of Medical Necessity and Life Threat

After each vignette, physicians were also asked whether they believed that the medical procedure entailed (tubal ligation, abortion, or vaccination) was a medical necessity (yes/no/don't know), and whether the clinical state of the patient described constituted a life threat (future pregnancy, continued pregnancy, or potential influenza, respectively; yes/no/don't know).

Islamic Religiosity

Islamic religiosity was assessed by items covering three subdomains of religiosity. *Religious importance* (Curlin et al. 2006) was measured with the item, "How important would you say your religion is in your life?" ("not important" to "most important part of my life"). This question has been used in multiple physician surveys assessing religion-associated variations in physicians' clinical practices (Chung et al. 2012; Yoon et al. 2015). *Religious practice* was measured with five items. The first three assessed the frequency with which participants (a) attended congregational worship (daily to less than once a year), (b) performed Islamic ritual prayers (five times a day to never), and (c) read the Qur'an (daily to never). Each of these was slightly modified versions of items that have been used widely to assess Islamic religiosity. The fourth assessed the extent to which the participant keeps the Ramadan fasts (strictly to not at all) and was used in a prior national physician survey (Curlin, n.d.). The fifth item was created by our team and assessed adherence to Islamic legal injunctions regarding the consumption of meat (participants reported whether they would eat meat slaughtered according to Islamic law [zabihah], kosher meat, any meat save for pork, or did not eat meat). In consultation with Muslim team members and religious scholars, we grouped individuals into four categories: those who reported only eating zabihah meat were deemed most religious, those who reported eating both zabihah and kosher meat or only kosher meat were rated as very religious, those who reported eating meat without concern for religious injunctions were deemed not religious, and all others were deemed fairly religious. Notably no respondents reported not eating meat. To assess *religious appearance*, we asked male respondents if they wore a beard and female respondents if they wore a *hijab* (yes/no).

Bioethics Resource Utilization

To assess the frequency with which physicians sought guidance from various ethics resources, we asked "How often do you seek guidance from the following resources when

facing an ethical challenge in medicine?" along a frequency scale. The resources mentioned were as follows: imams at local mosques, Islamic scholars with specialized legal training, books on Islamic bioethics and law, other Muslim physicians, hospital ethics committee(s), and the opinions of specialized Islamic juridical councils. Additionally, participants were asked the extent to which Islamic bioethics influences their medical practice ("not at all" to "a great deal").

Sociodemographic Characteristics

The questionnaire captured conventional individual sociodemographic descriptors (gender, age, ethnic/racial background, location of medical school matriculation, and immigration status,) and practice-level data (years in medical practice, medical specialty, primary work setting, and location) as well as sectarian affiliation within Islam (Sunni, Shi'ite).

Data Analyses

After generating descriptive statistics, where possible, all variables were transformed for ease of interpretation in the following ways: (1) collapsing response categories where responses totaled less than 5 % of the sample into adjacent categories, and (2) dropping the "other" response category. In addition, the religious importance variable was made dichotomous by collapsing the categories of "most" and "very" important and dropping the "not at all important" category which was marked by only 3 respondents.

In order to assess relationships between the predictor variables within the domains noted above and the outcome variable of physician recommendation for each vignette, ordered logistic regression modeling utilizing a block method was performed. Each domain of interest (physician perception of medical necessity and life threat, religiosity, bioethics resource utilization, and sociodemographic characteristics) was entered sequentially into a logistic regression model, and Akaike information criteria (AIC) were used to select variables with significant relationships that would be carried forth from each domain into the final model. The block order was based on our hypotheses (described above) and involved religiosity as the first domain, then bioethics resource utilization, followed by physician perception of medical necessity and life threat, and finally sociodemographic variables. AIC were used as the entrance/exit criteria for candidate variables within subdomains in order to avoid multiple testing issues introduced when statistical significance of each variable is determined at each step. Regression coefficients were converted to odds ratios, and p values less than 5 % were deemed statistically significant.

Final model selection was based on complete case analyses; hence, participants with missing data were excluded from the analysis. We adopted this approach because of the exploratory nature of the study and because our analyses are not focused on prediction but rather on a subjective assessment of how various qualitative factors might impact physician recommendations. Furthermore, using the AIC criteria allowed us to avoid multiple testing issues due to sample size reductions resulting from complete case analysis. Nonetheless, as a sensitivity analysis, we also performed the model selection analysis on an imputed dataset using the multiple imputation by chained equations (MICE) algorithm (Azur et al. 2011). These analyses confirmed the relationships found using complete case analyses (at times substituting one religiosity variable for another but maintaining directionality), but

also found significant relationships between a few additional sociodemographic variables and physician recommendation (data not shown).

Results

Participant Sociodemographic Characteristics

Two hundred fifty-five physicians completed the survey (41 % response rate). Most were male (70 %), South Asian (70 %), and migrated to the USA as adults (65 %) (Table 1).

Participant Religiosity Profile

Nearly all respondents indicated their religion was the most or a very important part of their life (89 %) and strictly perform Ramadan fasting (85 %), while most report praying five times daily (63 %). Almost half wore a beard (44 % of men) or *hijab* (44 % of women) (Table 2).

Bioethics Resource Utilization

Nearly a third (33 %) of respondents felt Islamic bioethics greatly impacted their medical practice. Nearly half (45 %) reported often seeking guidance from their local imam when faced with an ethical challenge in medicine (45 %), and nearly half sometimes sought the counsel of other Muslim physicians (47 %). On the other hand, juridical council opinions were never used by over half of respondents (56 %) (Table 3).

Descriptive Analysis of Case Scenarios

Participants were presented with three case vignettes (as described above) centering around the provision of tubal ligation, abortion, and vaccination. When asked if they would recommend the procedures, the majority answered yes (77, 61, and 76 %, respectively). Additionally, 57, 45, and 61 % believed the respective procedure to be a medical necessity, whereas 81, 49, and 61 % believed the clinical context represented a life threat to the patient (Table 4).

Predictors of Physician Recommendation of Ethically Controversial Medical Procedures

Tubal Ligation

Multivariate modeling yielded that frequency of reading Quran, seeking guidance from opinions of juridical councils, and medical necessity judgement variables were significantly associated with physician recommendation for the procedure.

Respondents who read Quran weekly or less but more than never or on special occasions had greater odds of recommending tubal ligation (OR 31, $p < 0.01$). Participants reading Qur'an daily also tended to have a greater odds of recommending the procedure (OR 22, $p = 0.08$). With respect to seeking bioethical guidance from specialist Islamic juridical councils, those who rarely (OR 0.01, $p < 0.01$), sometimes (OR 0.01, $p = 0.02$),

Table 1 Sociodemographic characteristics of participants ($n = 255$)

Characteristics	No.	(%)
Age, $n = 238$, mean = 52, S.D. 15.8		
24–39	66	(27.7)
40–55	58	(24.4)
56–69	76	(31.9)
70–84	38	(16)
Gender, $n = 246$		
Male	172	(69.9)
Race/ethnicity, $n = 247$[a]		
Arabs	54	(22)
South Asian	172	(69.6)
Residency status, $n = 247$[a]		
Immigrated as a child/born in USA	86	(34.8)
Immigrated as an adult	158	(64)
Participant completed medical school in the USA, $n = 243$	77	(31.7)
Years of medical practice since completion of medical school, $n = 239$, mean = 24, S.D. = 15.4		
0–10	66	(27.6)
11–20	36	(15.1)
21–30	48	(20.1)
32–41	58	(24.3)
42–57	31	(13)
Primary medical specialty, $n = 241$[a]		
Primary care specialties	72	(29.9)
Internal medicine subspecialties	43	(17.8)
Surgical subspecialties	30	(12.4)
Obstetrics/gynecology	13	(5.4)
Psychiatry	13	(5.4)
Practice type, $n = 225$[a]		
Multispecialty group practice or clinic	11	(4.9)
Non-teaching hospital	31	(13.8)
Physician office or single specialty group	34	(15.1)
Physician office/solo practice	64	(28.4)
Teaching hospital	71	31.6)
Religious affiliation, $n = 244$[a]		
Sunni	222	(91.0)
Shi'ite	11	(4.5)
Participant responses by region, $n = 255$		
Midwest	66	(25.9)
Northeast	88	(34.5)
South	85	(23.3)
West	16	(6.3)

[a] The sum of the subcategories does not equal n because the other category was dropped

Table 2 Religiosity profile of participants ($n = 255$)

Characteristic	No.	(%)
Importance of religion in respondent's life, $n = 254$		
"The most important part"	136	(53.5)
"Very important"	90	(35.4)
"Fairly important"	25	(9.8)
"Not at all important"	3	(1.2)
Frequency of attendance at congregational worship services, $n = 251$		
More than once a year but less than once a month	59	(23.5)
More than once a month but less than several times a week	128	(51)
Several times a week or daily	64	(25.5)
Frequency of prayer (salat/namaz), $n = 251$		
Never/at least once a week but less than once a day	28	(11.2)
At least once a day but less than five times a day	65	(25.9)
Five times a day	158	(62.9)
Keeping Ramadan fast, $n = 253$		
Not at all	7	(2.8)
Somewhat	31	(12.3)
Strictly	215	(85)
Frequency of reading the Quran outside of prayer, $n = 251$		
Never/on special occasion	90	(35.9)
Weekly or less	82	(32.7)
Daily	79	(31.5)
Dietary practices, $n = 248$		
Not religious	14	(5.7)
Fairly religious	96	(38.7)
Very religious	74	(29.8)
Most religious	64	(25.8)
Religious appearance		
Keep a beard (males), $n = 171$	76	(44.4)
Wear the hijab (females), $n = 71$	31	(43.7)

and often (OR 0.0011, $p = 0.03$) sought guidance had lower odds of recommending tubal ligation than those who never sought the opinions of juridical councils. As far as physician perception of medical necessity, those who believe that tubal ligation is a medical necessity (OR 295, $p < 0.001$) and those who do not know (OR 123, $p = 0.03$) whether it is had significantly higher odds of recommending tubal ligation in comparison with those who do not believe it to be a medical necessity (Table 5).

Abortion

Physician perception of medical necessity and patient life threat were the only variables significantly associated with physician recommendation. Respondents who believed that abortion, in the face of intensive chemotherapy, was a medical necessity had a greater odds

Table 3 Utilization of bioethics resources of participants ($n = 255$)

Characteristic	No.	(%)
Extent to which Islamic bioethics influences medical practice, $n = 252$		
Not at all	44	(17.5)
A little	59	(23.4)
Somewhat	67	(26.6)
A great deal	82	(32.5)
Frequency of seeking guidance from Imams at local mosques when facing bioethics challenge, $n = 249$		
Never	12	(4.8)
Rarely	59	(23.7)
Sometimes	65	(26.1)
Often	113	(45.4)
Frequency of seeking guidance from Islamic scholars with specialized legal training when facing bioethics challenge, $n = 250$		
Never	106	(42.4)
Rarely	56	(22.4)
Sometimes	68	(27.2)
Often	20	(8)
Frequency of seeking guidance from books on Islamic bioethics and law when facing bioethics challenge, $n = 244$		
Never	86	(35.2)
Rarely	48	(19.7)
Sometimes	80	(32.8)
Often	30	(12.3)
Frequency of seeking guidance from other Muslim physicians when facing bioethics challenge, $n = 248$		
Never	30	(21)
Rarely	117	(19.8)
Sometimes	49	(47.2)
Often	52	(12.1)
Frequency of seeking guidance from hospital ethics committee(s) when facing bioethics challenge, $n = 246$		
Never	64	(26)
Rarely	70	(28.5)
Sometimes	77	(31.3)
Often	35	(14.2)
Frequency of seeking guidance from opinions of specialist Islamic bioethics juridical councils when facing bioethics challenge, $n = 247$		
Never	139	(56.3)
Rarely	56	(22.7)
Sometimes	41	(16.6)
Often	11	(4.5)

of recommending abortion than their colleagues who did not think so (OR 108, $p < 0.01$) or did not know (OR 87, $p < 0.01$). Similarly, those who perceived continued pregnancy to constitute a life threat had greater odds of recommending abortion in comparison with those who did not (OR 22, $p = 0.01$) and those who do not know (OR 17, $p = 0.01$) (Table 6).

Table 4 Frequencies representing participant responses to case vignette

Variable	Tubal ligation scenario			Abortion scenario			Vaccine scenario		
	Yes *n* (%)	No *n* (%)	Do not know *n* (%)	Yes *n* (%)	No *n* (%)	Do not know *n* (%)	Yes *n* (%)	No *n* (%)	Do not know *n* (%)
Physician judgement that the procedure requested is a medical necessity	145 (57.1)	78 (30.7)	31 (12.2)	113 (44.8)	68 (27)	71 (28.1)	155 (61.2)	82 (32.4)	16 (6.3)
Physician judgement that the clinical context represents a life threat to the patient	206 (81.1)	14 (5.5)	34 (13.4)	123 (49.2)	52 (20.8)	75 (30.0)	154 (61.1)	74 (29.3)	24 (9.5)
Physician recommendation of the procedure	189 (76.5)	58 (23.5)	Not a response category	138 (60.8)	89 (39.2)	Not a response category	186 (76.2)	58 (23.8)	Not a response category

Table 5 Multivariate logistic regression model exploring relationships between sociodemographic characteristics of participants, participant religiosity, participant utilization of bioethics resources, and their recommendation for tubal ligation in the case scenario

Variable	OR	95 % CI	*p* value	OR	95 % CI	*p* value
Frequency of reading the Quran outside of prayer						
Never/on special occasion	Reference	Reference	Reference			
Weekly or less	31.11	2.95–327.94	0.004[b]			
Daily	22.01	0.69–688.38	0.08			
Frequency of seeking guidance from opinions of specialist Islamic bioethics juridical councils when facing bioethics challenge						
Never	Reference	Reference	Reference			
Rarely	0.006	0.0002–0.18	0.003[b]			
Sometimes	0.009	0.0002–0.44	0.02[a]			
Often	0.001	0.000003–0.49	0.03[a]			
Physician judgement that the procedure requested is a medical necessity						
Yes	2.40	0.06–96.46	0.64	295.36	15.53–5617.46	0.0002[c]
No	0.008	0.0001–0.61	0.03[a]	Reference	Reference	Reference
Do not know	Reference	Reference	Reference	122.82	1.63–9268.55	0.03[a]

[a] $p < 0.05$

[b] $p < 0.01$

[c] $p < 0.001$

Porcine-Based Vaccine Administration

Analyses yielded that frequency of reading Quran, seeking guidance from Islamic scholars with specialized legal training, and the perception of medical necessity and life threat were significantly associated with physician recommendation of a porcine-based influenza vaccination.

Participants who read Quran weekly or less but more than never or on special occasions had a greater odds of recommending the vaccine (OR 36, $p = 0.02$) in comparison with those who never read Quran or read it only a special occasions. Additionally, respondents who rarely (OR 0.08, $p = 0.04$) and sometimes (OR 0.05, $p = 0.01$) sought guidance from Islamic jurists have significantly lower odds of recommending porcine-based vaccinations in comparison with those that never seek such bioethical guidance. Additionally, respondents who perceived porcine-based vaccinations as a medical necessity had significantly greater odds of recommending the vaccine in comparison with those who did not (OR 148, $p < 0.001$) and those who did not know whether it was (OR 161 $p = 0.02$). Respondents practicing medicine in the Northeast and West of the USA had a significantly greater odds of recommending the vaccine (OR 15, $p = 0.04$ and OR 181, $p = 0.03$, respectively) in comparison with those practicing in the South (Table 7).

Table 6 Multivariate logistic regression model exploring relationships between sociodemographic characteristics of participants, participant religiosity, participant utilization of bioethics resources, and their recommendation for abortion in the case scenario

Variable	OR	95 % CI	*p* value	OR	95 % CI	*p* value
Physician judgement that the procedure requested is a medical necessity						
Yes	87.06	4.15–1825.08	0.004[b]	108.10	5.13–2278.66	0.003[b]
No	0.81	0.11–5.73	0.83	Reference	Reference	Reference
Do not know	Reference	Reference	Reference	1.24	0.18–8.83	0.83
Physician judgement that the clinical context represents a life threat to the patient						
Yes	17.12	2.07–141.67	0.01[b]	21.87	2.19–218.51	0.01[b]
No	0.78	0.07–8.44	0.84	Reference	Reference	Reference
Do not know	Reference	Reference	Reference	1.28	0.12–13.76	0.84

[a] $p < 0.05$

[b] $p < 0.01$

[c] $p < 0.001$

Discussion

This exploratory study of predictors of Muslim physician recommendation for ethically controversial medical procedures yielded several noteworthy results. Similar to studies of American physicians in general and of segments of this population, we found that among Muslims, at least one aspect of religiosity, religious practice, correlates with physician recommendation of controversial medical procedures. Specifically respondents who had a habit of reading Qur'an on a regular basis had greater odds of recommending tubal ligation and porcine-based flu vaccination than colleagues who never read the Qur'an or read the Qur'an only on special occasions. Somewhat paradoxically respondents who sought bioethical guidance from Islamic juridical authorities had lower odds of recommending these two procedures. Additionally, across the three scenarios, physician perception of medical necessity for the procedure positively associated with recommendation of the procedure. In what follows, we comment on these core findings in turn.

The positive association of Qu'ran reading with physician recommendation of the tubal ligation and porcine-based vaccination, procedures that are judged to be normatively prohibited by Islamic law, contradicts our hypothesis that more religious physicians would have a more cautious attitude toward these procedures. This finding could be explained in several ways. It is possible that physicians who have a habit of reading the Qur'an feel comfortable in deriving ethical teachings from scriptural sources themselves and thus could interpret a variety of verses to be in accordance with the procedures. For example, verses that instruct individuals to avoid harming themselves (2:195), and those that extol the virtue of saving life (5:32) among others may be seen as consistent with recommending tubal ligation for a patient whose heart failure may be exacerbated by pregnancy, and verses that suggest that swine flesh is prohibited to eat (6:145) may not be perceived to render pig products to be impermissible to utilize. This explanation might be supported by the finding that other measures of religiosity (importance and other measures of practice—habit of prayer, fasting, and food) did not have independent relationships with physician recommendation of ethically controversial medical procedures although these were highly correlated with frequency of Qur'an reading. Furthermore, it is important to note that the

Table 7 Multivariate logistic regression model exploring relationships between sociodemographic characteristics of participants, participant religiosity, participant utilization of bioethics resources, and their recommendation for porcine-based vaccination in the case scenario

Variable	OR	95 % CI	*p* value	OR	95 % CI	*p* value
Frequency of reading the Quran outside of prayer						
Never/on special occasion	Reference	Reference	Reference			
Weekly or less	36.31	2–660.68	0.02[a]			
Daily	0.53	0.05–5.61	0.60			
Frequency of seeking guidance from Islamic scholars with specialized legal training when facing bioethics challenge						
Never	Reference	Reference	Reference			
Rarely	0.08	0.007–0.94	0.04[a]			
Sometimes	0.05	0.005–0.55	0.01[b]			
Often	0.07	0.001[d]–5.93	0.24			
Physician judgement that the procedure requested is a medical necessity						
Yes	160.71	2.33–11,092.28	0.02[a]	147.61	8.32–2619.07	0.001[c]
No	1.09	0.03–41.40	0.96	Reference	Reference	Reference
Do not know	Reference	Reference	Reference	0.92	0.02–34.93	0.96
Region						
Northeast	14.53	1.17–180.21	0.04[a]			
Southwest	1.08	0.12–9.66	0.95			
West	180.64	1.72–18,963.38	0.03[a]			
South	Reference	Reference	Reference			

[a] $p < 0.05$

[b] $p < 0.01$

[c] $p < 0.001$

Qur'an is not the sole, and according to some schools of Islamic law not the ultimate, source of ethico-legal values according to Islamic moral theology and law (Kamali 2003). Rather the Qur'an is interpreted alongside traditions of the Prophet which are seen to explain verses and offer additional insight into the rationale underlying Qur'anic text (Khalāf 2004; Kamali 2003; Abdur-Rashid et al. 2013). Additionally other formal sources of moral law, prominent among them scholarly consensus and analogical reasoning, are investigated and utilized prior to make ethico-legal assessments of acts (Khalāf 2004; Kamali 2003). Therefore, scriptural reasoning solely on the basis of the Qur'an may provide an incomplete ethical valuation, and juridical authorities may be able to provide a more complete vision of Islamic ethico-legal injunctions and a more nuanced reading of scriptural source-texts.

The context mentioned above may also help to explain the finding that physicians who sought the guidance of Islamic juridical authorities had lower odds of recommending tubal ligation and porcine-based vaccination. Notably, the normative Islamic ethico-legal stance against permanent sterilization, e.g., tubal ligation and porcine-based medical treatments, is derived from Prophetic traditions and others legal sources in addition to Qur'anic texts. Hence, physicians who seek out guidance from Islamic jurists may gain access into

additional scriptural source-texts that speak to the issue at hand, receive insight into the formal sources of ethico-legal guidance in Islam, or gain knowledge about conditions and circumstances that allow for invoking ethico-legal constructs such as necessity in clinical contexts. Accordingly, the negative association between seeking out bioethical guidance from Islamic legal scholars and physician recommendations might also be a reflection of a more cautious approach adopted by this group of physicians toward controversial medical practices, even though an Islamic ethico-legal argument could legitimately be made that would render the procedures noted in the vignettes above licit. Physicians who exert time and effort to seek out scholars or juridical council writings may, by nature, opt to not recommend ethically vexing procedures.

The finding that notions of medical necessity positively associate with recommendation of all three procedures suggests that this bioethical construct is important to physician decision-making. Unfortunately, the concept is multifaceted and used in various ways by Islamic legists and even in our study does not exactly correspond to there being a life threat to the patient (Padela et al. 2014; Isa 2015). Since the term life threat has an Islamic ethico-legal connotation in addition to a medical one, the finding that a perception of medical necessity is independently associated with physician recommendation of Islamically controversial procedures might suggest the dominance of medical culture and values over religious ones. Although we acknowledge that the scenarios outlined are ones where an Islamic ethico-legal argument of permissibility can be, and has been, made it is possible that physician's religious ethical frameworks take a back seat to medical considerations. In other words, Muslim physicians may rightly hold that medical values take precedence over their own religious values during the course of caring for patients and accordingly ethical assessments are more readily grounded arguments based on perceived medical necessity than other ethical constructs.

Additionally, physician perception of a life threat to the mother was positively associated with recommendation for abortion. However, in the other two scenarios (tubal ligation and porcine-based vaccination), no relationship was found. This finding may result from the fact that in the abortion scenario, there was an actual life (the mother) and an evolving life threat (without the abortion both she and the fetus will deteriorate). In the vaccination and tubal ligation scenarios, however, the scenario was one involving a potential life threat and the controversial medical procedure is a preventive in nature. Perhaps respondents more readily invoke life threat to recommend an ethically controversial treatment when the life threat is more proximate and appreciable. This hypothesis should be tested further through additional case-based investigations as well as qualitative ones for if true it provides great insight into the threshold conditions that are used by Muslim clinicians when applying the *ḍarūrāh* construct in clinical practice.

Our findings must be interpreted in light of several limitations. First, while using the IMANA membership roster allowed for the generation of a national sample of Muslim physicians, it also introduces selection bias toward a respondent pool that has a more prominent religious identity and practice. Further non-respondents may have differed from respondents. Hence, our findings that religious practice and seeking out Islamic bioethical guidance impacts recommendations for controversial medical practices may not be generalizable to the larger Muslim community. However, our respondent pool was similar to that of other national studies of American Muslim physicians in terms of religiosity, gender distribution, percentage of participants matriculating from medical school in the USA, and contained physicians across the USA, suggesting that our sample likely represents an authentic cross section of this community (Abu-Ras et al. 2012). As this study assessed hypothetical recommendations in light of case scenarios, it is possible that participants

expressed intentions may not reflect actual clinical practice. Furthermore, a significant proportion of our respondent sample does not practice in the realm of reproductive health, and although they may advise Muslims in the community setting, their ability to translate their attitudes into practice is limited. As such our findings here should be considered as hypothesis to motivate future studies that gathering objective clinical data from Muslim physician practices. Our statistical analysis methods also warrant interpreting the results with some caution. Given the exploratory nature of our work, we restricted the analyses to complete case analyses which reduced power to detect relationships between the variables and construct that may be of lesser magnitude but still important. The fact the imputation yielded similar results lends strength to our findings, however.

In summary, our national survey of American Muslim physicians reveals that their attitude toward controversial medical procedures may be influenced, at least partially, influenced by their reading of scripture, and the opinions of Islamic jurists. Future studies of the ethical frameworks of Muslim clinicians should account for these sources of bioethical guidance. To further develop the field of applied Islamic bioethics, detailed studies into the ways in which Muslim clinicians apply Islamic ethico-legal values in practice as well as the extent to which juridical sources are used to modulate their practices are needed. Such data would enable deliberative and mutually informative dialogue between jurists and clinicians that attends to the pressing ethical challenges of modern medicine in a comprehensive and nuanced way.

Acknowledgments We thank the Islamic Medical Association of North America (IMANA) for collaborating on this project and providing access to their membership roster. Notably we recognize Rasheed Ahmed, Akrama Hashmi, and Dr. Ayaz Samadani's efforts through IMANA. We also acknowledge the following individuals for their invaluable assistance: Maha Ahmad and Zahra Hosseinain for managing the data collection and survey development processes, Dr. Farr Curlin for assistance with study conceptualization, grant writing, instrument development, survey design and analysis, Julie Johnson for data-entry, John Yoon for critical commentary and survey design, and Heba Abdel-Latief for literature review and survey instrument development.

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