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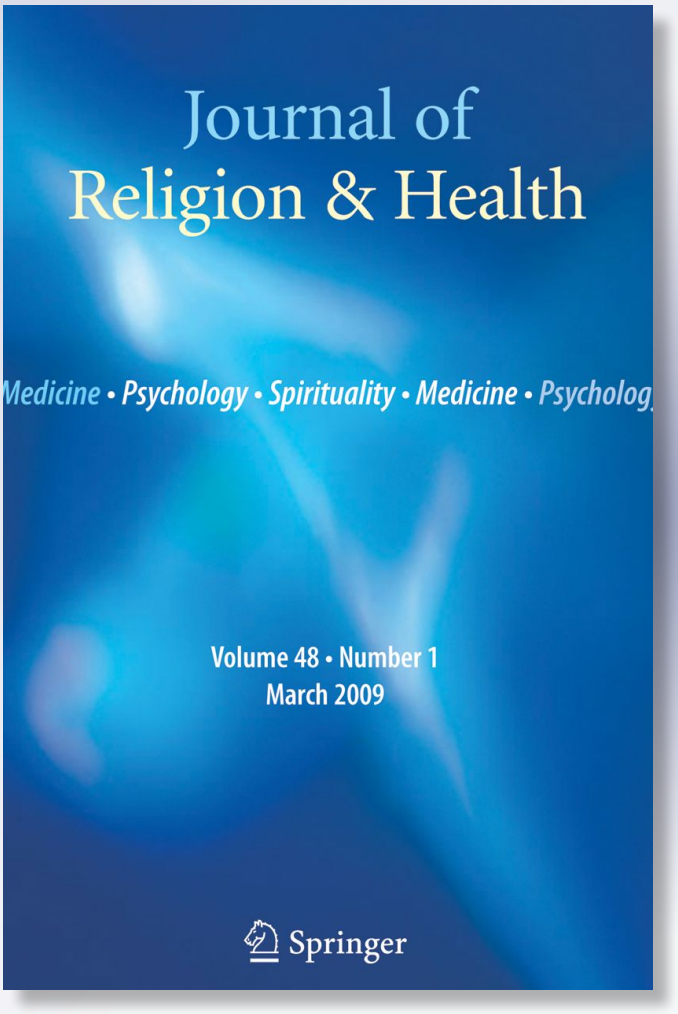

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ORIGINAL PAPER

Religiosity for Promotion of Behaviors Likely to Reduce New HIV Infections in Uganda: A Study Among Muslim Youth in Wakiso District

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Abstract The study was done to determine the association between religiosity and behaviors likely to reduce new HIV infections among 1,224 Muslim youth. Respondents with Sujda, the hyperpigmented spot on the forehead due to prostration during prayers, were more likely to abstain from sex, be faithful in marriage, and avoid alcohol and narcotics. Males wearing a Muslim cap were more likely to abstain from sex and avoid alcohol and narcotics. Females wearing the long dress (Hijab) were also more likely to avoid alcohol. This data should be used by stakeholders in promoting behaviors likely to reduce new HIV infections among Muslims.

Keywords Religiosity · HIV infections · Muslim youth · Uganda · Behaviors

Introduction

Many Muslims in sub-Saharan Africa believe that adherence to their religious teachings leads to sex-related behaviors likely to prevent new HIV infections. This would eventually

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result in protecting their communities from the HIV/AIDS epidemic (Becker 2007; Balogun 2010).

However, large gaps still exist in our knowledge about the relationship between Islamic thought and sexuality (Smerecnik et al. 2010). For example, there is limited empirical data on the association between religiosity and high-risk behaviors likely to reduce new HIV infections for Muslim faith-based organizations to use in planning their HIV prevention interventions. Most references to success or limitations of faith-based organizations in HIV prevention are theoretical and ideological (Casale et al. 2010).

Literature Review

Theories on Religion, Behavior, and Health

Theories are important but they need empirical data to support them. In theorizing religious effects among adolescents, Christian Smith proposes that religion may exert positive constructive influences in lives of American youth through three major factors: (1) moral order, where religions promote specific moral directives of self-control grounded in the authority of religious traditions; (2) learned competencies where religion provides youth with skills such as coping skills; and (3) social and organizational ties where religion provides social capital and social networks that support the youth. Smith suggests that cross-national research is warranted to assess whether these hypotheses work in an American religio-cultural context or whether they identify more general human processes and mechanisms that go beyond cultural and religious particularities (Smith 2003).

Religiosity is one of the psychosocial determinants of health. It is suggested that religion may affect health by promoting healthy practices, enhancing social support and offering comfort in situations of stress (Koenig 1999). From his social cognitive theory, in order to promote psychosocial changes society-wide, Albert Bandura proposes three major components: (1) a sound theoretical model that specifies determinants of psychosocial change; (2) a translational and implementation model that converts theoretical principles into an innovative operational model; and (3) a social diffusion model to promote adoption of psychosocial programs in diverse cultural milieus. Bandura suggests that theories are well constructed but we often fail to develop effective translational and social diffusion models (Bandura 2004).

Theories and Models Used in Behavior Change for HIV Prevention

As far as HIV/AIDS is concerned, there are many theories and models that have been used as the basis for promoting behavior change. They include the following: (1) the health belief model which assumes that individuals will take preventive actions when they are susceptible to a disease and acknowledge the consequences as severe, believing that these actions will be beneficial in reducing the threat of acquiring the disease; (2) the theory of reasoned action which stipulates that behavior is based on intention, and intention is influenced by positive and negative feelings that determine whether to perform or not to perform a particular act; (3) the social cognitive theory which is based on the assumption that individual behavior is the result of interaction among cognition, behavior and environment; (4) the theory of emotional responses which propose that emotional responses precede and condition cognition and attitudes, suggesting that highly emotional messages are more likely to influence behavior than low emotional ones; (5) the cultivation theory of

mass media which proposes that repeated intense exposure of ideas in mass media results in social legitimization of the issue, which can influence behavior; (6) the diffusion of innovation theory which proposes the processes through which a new idea is passed on from its invention, to diffusion or communication using various networks that include opinion leaders who may influence audience behavior; (7) the hierarchy of effects model which proposes that individual behavior occurs in a linear fashion beginning with exposure to information and assumes that knowledge, attitudes, trial, and adoption of the desired behavior will necessarily follow; (8) the social marketing theory in which activities are calculated to influence acceptability of social ideas by considering packaging the product, its price, the place where it is offered, and planning for its promotion through communication, distribution, and marketing research; (9) the entertainment–education behavior change model which proposes that messages should have an educative and entertainment appeal to satisfy people's needs for new information, entertainment, news, and relaxation; and (10) AIDS risk reduction and management model which proposes three stages of behavior change with stage one consisting of labeling high-risk behavior as problematic, stage two making a commitment to change the high-risk behavior, and stage three taking steps to adopt and adhere to new low-risk behavior (Hanan 2009).

Communication Campaigns for HIV Prevention

Using these theories, it is proposed that communication campaigns for HIV prevention should combine both interpersonal and mass communication strategies involving the following stages: (1) identification of objectives which usually include creating awareness, reinforcing existing low-risk behavior, replacing high-risk behaviors with low-risk ones, and building relationships; (2) identification of target audience; (3) identification of resources; (4) message construction to produce persuasive messages that obtain audience attention, convince audience that a problem exists, suggest solutions, help audience visualize the future with or without solutions, and outline specific steps for action; (5) selection of medium of communication such as interpersonal, electronic, and print media; (6) identifying organizational structure for implementation; (7) identification of implementers such as religious leaders; (8) identifying financial requirements; (9) identifying time and space for the campaign; (10) monitoring the campaign; (11) evaluating campaign success and (12) assessing the impact of the campaign.

Effective campaign messages should include the following: (1) supporting material to enhance the credibility and acceptability of the message, such as scientific data or personal testimony; (2) provision of two sided arguments to gain attention and convince audience about behavior change; (3) use of visual aids since pictures leave a greater impact than words; (4) use of appropriate humor which can be attention drawing especially in interpersonal communication; (5) use of a positive emotional appeal to draw the attention of the audience; (6) provision a reference group to which people aspire to associate with; (7) ensuring acceptability to audience; (8) use of the fear appeal to scare people by describing terrible things that may happen if they do not comply with the message and the solutions to the fear; (9) consideration for the socio-cultural and religious context; (10) repetition of the message to increase understanding and motivation for action and to highlight the importance of the issue; (11) consideration for the demographic and geographic profile of the audience including the education level; (12) consideration of language to make the message culturally and educationally understandable; (13) adequate campaign duration with longer campaign being more likely to be successful; and (14) usefulness of contents with messages thought-provoking and enhancing knowledge (Hanan 2009).

Controversies About Religion and Health

Those Against Religion Having a Positive Effect on Health

There are some scholars who say that the association between religion and health is weak and inconsistent (Sloan et al. 1999). They argue that there is no convincing evidence to prove that religious activities are associated with improved health. Praying, reading the Bible, and watching religious television programs may be valuable for a religious life, but there is insufficient evidence linking these activities to health. Attempting to link religion to health is thought to be oversimplification of both. Religious practices can be disruptive as well as healing. Conflicts are well known to occur between Catholics and Protestants and among Christians, Jews, and Muslims at local, national, and international levels. There are also disagreements about religious practices among individuals and families about religious practices and belief especially in interfaith marriages. These differences result from different interpretations of doctrine or conflict over acceptable behavior. Religion does not need science to justify its existence or appeal. Religion and science and religion and medicine exist in different domains and are qualitatively different. Attempts to use religion as one uses antibiotics or surgical procedures to treat diseases may be offensive to some people. Measuring religion is also problematic. It results from the need to define variables for use in scientific studies. It may succeed in that one can record, for example, the self-reported frequency of prayer. However, this is only superficially related to the personal and underlying meaning of religion. Religion is therefore made to look trivial and suggests that the value of religion comes from its effects on health. Religion is more than a collection of views and practices, and its value cannot be determined by instruments. It is a spiritual way of being in the world (Sloan et al. 2000).

There were other scholars who had similar ideas. Mental health experts took religion to be a neurotic influence on psychological functioning. One of these is Sigmund Freud who described religion as a universal obsessive neurosis that was expected to die off as people learnt to use their intellects more rationally. This view was held for nearly a century from the early 1900s, and some experts may still be holding on to this view. One geriatric specialist noted that when patients brought a Bible with them to hospital, this indicated a neurotic patient who was likely to be problematic for the physician. Another psychologist noted that the less religious people are the more emotionally healthy they tend to be. One psychiatrist made a conclusion that the evidence that religion is irrelevant and harmful to humans should be of interest to behavioral scientists and anyone who does not want to live an unexamined life (Koeing et al. 2001a). Most of these views were based on personal opinion and personal clinical experiences with limited empirical data.

Those in Favor of Religion Having a Positive Effect on Health

There are many scholars who have a different view suggesting that religion has a positive impact on the health of people. A survey among the American people reported in 2000 found that 95% of Americans believed in God and the same proportion indicated that religious beliefs are important in their lives. Many people use religion to cope with illness. Religious beliefs and practices provide a cognitive framework that can reduce suffering and increase one's purpose and meaning in life when faced with illness. For example, praying to God may reduce the patients' loneliness in that an all powerful God is there to handle the situation. The close personal relationship with God is a motivator to the believer to try to please God by serving Him. When people direct their efforts to serve God by

serving others, it gives those with illness a sense of self-worth and self-esteem even when they are ill. Their attention is diverted from their own problems as they think of the good they can do for others.

Religious involvement has also been found in studies to be associated with greater well-being, life satisfaction, greater purpose and meaning in life, greater hope and optimism, less anxiety and depression, more stable marriages, and lower rates of substance abuse. Religiously committed people are less likely to be involved in unhealthy behaviors such as cigarette smoking, excessive alcohol use, and risky sexual practices. However, religious beliefs and activities when taken to extremes can be harmful to mental and physical health. Religion may be used to justify anger, hatred, aggression, and prejudice. Religion may be used to exclude others. Some religions may promote faith healing and exclude recognized medical care that may worsen the patient's condition (Koenig et al. 2001a).

There are other researchers who have found religion important in the lives of both physicians and patients. In one study in Malaysia that is a predominantly Muslim country, almost all doctors believed in the existence of God, life after death, and the healing power of prayer. Among their patients in this study, 79% noticed an increase in their faith due to illness. The authors concluded that religiosity deserves greater attention in health professional practice because it goes a long way in making the practice of medicine more holistic, ethical, and compassionate (Rathor et al. 2009). In another study in USA, investigators found that 35% of their respondents, obtained through a national household telephone survey, used prayers for health concerns. Of these, 75% prayed for wellness and 22% prayed for specific medical conditions. Among those who prayed for specific medical conditions, 69% found prayer very helpful. The authors suggested that prayer may help one to cope by facilitating acceptance of illness or by counteracting the feelings of isolation that might accompany severe illness. They concluded that physicians should consider exploring the patients' spiritual practices to enhance their understanding of these patients' response to illness and health (McCaffrey et al. 2004).

Possible Causes of Controversies About Religion and Health

Even with a substantial body of empirical data, professional disagreements persist regarding whether to what extent and in what ways religion influences health. The disagreements may arise partly because physicians have their own religious beliefs and practices that shape their interpretation of the empirical data and their clinical experiences. In studies among US physicians, it was found that most of them believed that religion had a substantial and generally positive influence on patients' health and that on occasion the influence is due to divine intervention. The majority agreed that like other health-related patient behaviors such as regular exercise, proper diet, and avoiding tobacco use, patients' religious beliefs positively affect health. Most of the physicians applied medical science while maintaining a belief that God intervenes in patients' health. However, the religious beliefs and practices of physicians also strongly influenced the ways they interpreted the clinical observations and empirical data. Compared with those with low religiosity, physicians with high religiosity were more likely to report that patients' religion strongly influences health and to interpret the influence of religion in positive rather than negative ways. What the secular physician may not notice or may ignore, the religious physician may emphasize or exaggerate. The influence that one may interpret as weak or negative, the other may interpret as strong or positive (Curlin et al. 2007).

Some scholars have said that it will take years to develop widespread acceptance of the importance of religiosity in health even within psychology where its effects are most likely

to be mediated. These scholars suggest that an overabundance of more evidence is needed to establish a positive place for religiosity within the realm of health (Zeiders and Schaller 1998).

Religion and Health in Islam

It has been noted that more than 90% of the research on religion and health has been performed in predominantly Christian and Jewish populations. More studies are needed from other religious traditions (Koening et al. 2001a). Islam is the world's second largest religion with 1.57 billion followers representing nearly a quarter of the global population. It follows Christianity with about 2.1 billion adherents. Islam generally encourages the use of science, medicine, and biotechnology as solutions to human suffering. From Islamic teachings, God created human beings and gave them their bodies as gifts to be cared for. Keeping one's body in good health is important. Islam emphasizes the importance of maintaining a healthy lifestyle. This includes maintaining the cleanliness of food, abstaining from drinking alcohol, and resorting to prayer to promote healing. Muslims are encouraged to seek knowledge about their diseases and to seek for medical care from qualified practitioners (Inhorn and Serour 2011).

Islam and HIV/AIDS

In countries in the Middle East and North Africa with predominantly Muslim populations, the HIV prevalence is low at around 0.2% of the adult population. In low-prevalence areas, HIV infections tend to start among those with high-risk behaviors such as commercial sex workers, men who have sex with men, intravenous drug users and prisoners, before spreading to the population at large. It is thought that in the Middle East and North Africa, Islamic practices such as circumcision may have slowed the spread of HIV infections. However, changes in the region such as conflicts and migration make the region vulnerable to HIV infections. Some religious leaders in this region are participating in addressing this challenge and wish to talk more about HIV infections from their pulpits armed with scientific knowledge and evidence. Some of them give sermons during Friday congregational prayers dedicated to HIV/AIDS (Shreen El-Feki 2006).

Some researchers have noted that as far as HIV/AIDS is concerned, Africa has two regions: the Muslim dominated North Africa with low HIV infections and sub-Saharan Africa with high HIV infections causing generalized epidemics. They suggest that Islam has played a role in keeping HIV infections low in North Africa. However, the place of religion in prevention of HIV infection is not well understood. They conclude that it is important to study the effect of adherence to behavior standards recommended by religion on the efficiency of HIV transmission (Valeyati et al. 2007).

In sub-Saharan Africa, Senegal with 96% of its population being Muslims had the lowest HIV prevalence rate at 0.9% in 2006. It is thought that adherence to Islamic principles could have contributed to this low prevalence. For example, intoxication from drugs or alcohol is forbidden in Islam. This prohibition decreases the chances of casual unprotected sex that might occur during intoxication. In the capitals of non-Muslim countries neighboring Senegal, it was observed that three to four times as many men reported having multiple casual sexual partners compared to men in Dakar, Senegal's capital. The age of first sex was also lower in the non-Muslim capitals. In a study to describe how Islam may function in maintaining a low HIV prevalence rate in Senegal, it was concluded that high Muslim religiosity increases behaviors such as sexual abstinence.

It was recommended that similar studies be done in other Muslim communities in sub-Saharan Africa (Gilbert 2008).

Among Muslim communities in Nigeria, Islamic teachings on sexual abstinence outside marriage and faithfulness in marriage are seen as solutions to prevent HIV transmission. The argument is that if married and unmarried people practice the Islamic teachings related to sexual behaviors, the spread of HIV would be greatly diminished. However, these options are hard to follow by some Muslims and they need to take them as acts of worship for them to be able to strengthen their compliance with these regulations (Balogun 2010).

The difficulty of compliance with official pronouncements has been noted among Muslims in Tanzania. It has been observed that many people listen to official pronouncements, applaud them, and ignore them. The official pronouncement of abstinence, being faithful, and condom use (ABC) were often treated in this manner. Everybody knew about them, and everybody was on their own when it came to following them. Islamic groups in Tanzania felt that such messages without the support of Islamic teachings were inadequate. They argued that adherence to the teachings of the Holy Qur'an regarding sex would have prevented the HIV epidemic. They believed that science and rationalism were supported by Islamic teachings and could be used to support their point of view (Becker 2007.)

In Muslim societies such as that in Malaysia, there is a concern that although Islam and its rich history are capable of transforming human beings, the prevalence of social problems among Muslims raises many questions in relation to Islamic understanding and practice. Scholars therefore suggest that there is an urgent need to understand and assess the key areas of religious commitment among youth and how they can influence nation building (Krauss et al. 2005a). Indeed, some researchers in Malaysia found that the more religious the person is, the less he or she becomes involved in social problems (Noon et al. 2003). The Malaysian scholars have also noted that the majority of religiosity instrumentation has been grounded in the Judeo-Christian religious worldview, which does not adequately represent the uniqueness of the other non-Judeo-Christian worldviews such as the Islamic one. They suggest a need to fill this gap in research (Krauss et al. 2005b). Our study was done to assess the association between religiosity and behaviors likely to reduce new HIV infections among Muslim youth in Uganda, while putting the Islamic culture and practices into consideration.

Methods

Study Setting

The Islamic Medical Association of Uganda (IMAU) that is a faith-based non-governmental organization has been running a hospital called Saidina Abubakar Islamic Hospital (SAIH) since 2005. The hospital is located 14 km north of Kampala city, on Bombo road. The IMAU hospital staff in conjunction with Imams and their assistants regularly provide health education to surrounding Muslim communities on issues of HIV prevention. They use a curriculum that has scientific information as well as supportive Islamic teachings (Islamic Medical Association of Uganda 2007).

Study Participants

A convenience sample of 30 mosques surrounding the hospital was selected to participate in the study. Participants were 15–24-year-old individuals. These were selected because

their HIV prevalence is a proxy indicator of HIV incidence (Bertozzi et al. 2008). This suggests that high-risk behaviors in this age group are likely influence new HIV infections.

The sample size was obtained from a table that provides estimated sample sizes for behavioral surveys that measure trends over time using the cluster sampling methodology. The prevalence of abstaining from sex overall in this age group was estimated to be 10%. Assuming a 5% change is expected to occur in 2–3 years, then the required sample size is 1198 (United Nations High Commissioner for Refugees, Great Lakes Initiative Against HIV/AIDS, World Bank 2008).

Measurements

Religiosity

Religiosity was measured using the instrument called the Brief Multidimensional measurement of religiousness/spirituality for use in health research (Fetzer Institute 2003). It was modified by adding some questions that were thought to be relevant to the target community. For example, the presence of Sujda, the hyperpigmented spot on the forehead of Muslims due to prostration of regular prayers, was added to the instrument. The instrument was found to have adequate validity and reliability among Ugandan respondents. This instrument had also been found to have adequate validity and reliability among adolescents in Boston USA (Harris et al. 2008).

Behaviors

The instrument had questions on high-risk behaviors and practices that may influence new HIV infections. IMAU nurses and counselors from SAIH were trained to administer the instrument.

Statistical Analysis

Double data entry was done in Epidata 2.1b. Data analysis was done in STATA version 10.0. The information was organized into categorical frequency data. The chi-squared test was used to assess the association between any two groups. A P value of less than 0.05 was considered significant.

Ethical Consideration

The study was approved by Makerere University School of Public Health Institutional Review Board and the Uganda National Council of Science and Technology.

Results

Between July and December 2010, a total of 1,224 Muslim youth between 15 and 24 years were interviewed. They were equally distributed by gender 50% being males. Religiosity was measured using ordinal variables. For example, regarding the daily spiritual experience of finding strength and comfort in religion, each respondent was asked to measure himself or herself. The statement used was "I find strength and comfort in my religion."

The levels of religiosity to select from in descending order of intensity were as follows: (1) many times a day, (2) everyday, (3) most days, (4) some days, (5) once in a while, and (6) never or almost never.

The responses to this question among the Muslim youth were as follows: (1) many times a day 299 (24%), (2) everyday 797 (65%), (3) most days 93 (8%), (4) some days 28 (2%), and (5) once in a while 6 (1%). This was a typical response on measures of religiosity. It indicated that the majority of the respondents were religious people. For the purpose of comparison, the respondents were divided into two groups: group 1 respondents were those with high religiosity who gave the highest level category 1 response and group 2 respondents were those with moderate religiosity who gave the remaining responses, categories 2–6. Since there were very few respondents with the lowest levels of religiosity, they were included in group 2 for the sake of data analysis.

Religiosity Dimensions Associated With Abstaining From Sex (Table 1)

Respondents who tried hard at the highest level to avoid telling lies and to be trustworthy in accordance with their religious teachings were more likely to abstain from sex. Those who had Sujda, the hyperpigmented spot on the forehead as a result of prostration from regular prayers, were also more likely to abstain from sex. Males who were wearing a Muslim cap were also more likely to abstain from sex.

Table 1 Religiosity dimensions associated with abstaining from sex and being faithful in marriage among Muslims

Dimension	Ever had sex Yes n %	Ever had sex No (Abstaining) n %	Odds ratio	95% CI	*P* value
Trying hard to avoid telling lies					
High	221 (65)	120 (35)	1.60	1.22–2.10	<0.001
Moderate	646 (75)	219 (25)			
Trying hard to be trustworthy					
High	270 (68)	130 (32)	1.37	1.06–1.79	0.017
Moderate	602 (74)	211 (26)			
Having Sujda					
Yes	320 (66)	167 (34)	1.69	1.31–2.20	<0.001
No	513 (76)	158 (24)			
Wearing Muslim cap					
Yes	74 (65)	39 (35)	1.74	1.12–2.73	0.014
No	354 (77)	107 (23)			

Dimension	Sex outside marriage Yes n %	Sex outside marriage No (Being faithful) n %	Odds ratio	95% CI	*P* value
Having Sujda					
Yes	57 (40)	86 (60)	1.69	1.11–2.57	0.012
No	139 (53)	124 (47)			

Table 2 Religiosity dimensions associated with avoiding multiple lifetime sexual partners and multiple sexual partners outside marriage (Partner reduction)

Dimension	One life-time sexual partner n %	Multiple lifetime sexual partners n %	Odds ratio	95% CI	*P* value
Listening to or watching religious programs					
High	32 (29)	79 (17)	1.92	1.22–3.04	0.004
Moderate	124 (17)	589 (83)			
Giving charity to needy					
High	16 (30)	38 (70)	1.92	1.04–3.56	0.034
Moderate	137 (18)	626 (82)			
Attending mosque prayers					
High	68 (23)	226 (77)	1.53	1.07–2.18	0.019
Moderate	87 (16)	442 (84)			
Participation in other mosque activities					
High	19 (31)	42 (69)	2.09	1.18–3.72	0.010
Moderate	135 (18)	625 (82)			
Wearing a Muslim cap					
Yes	16 (24)	52 (76)	2.52	1.30–4.91	0.005
No	36 (11)	295 (89)			
Dimension	One sexual partner outside marriage n %	Multiple sexual partners outside marriage n %	Odds ratio	95% CI	*P* value
Trying hard to implement religious teachings					
High	41 (55)	34 (45)	1.84	1.03–3.29	0.036
Moderate	53 (40)	81 (60)			

Religiosity Dimension Associated With Being Faithful in Marriage (Table 1)

Respondents with Sujda were more likely to be faithful in marriage.

Religiosity Dimensions Associated With Avoiding Multiple Lifetime Sexual Partners (Table 2)

Respondents with the highest levels of the following religiosity dimensions were more likely to have one lifetime sexual partner: listening to or watching religious programs on radio and TV, giving charity to the needy, attending mosque prayers, and participating in other mosque activities. Males wearing a Muslim cap were also more likely to have one lifetime sexual partner.

Religiosity Dimensions Associated With Avoiding Multiple Sexual Partners Outside Marriage (Table 2)

Respondents who tried hard at the highest level to implement religious teachings were more likely to have only one sexual partner outside marriage.

Religiosity Dimensions Associated With Avoiding Drinking Alcohol (Table 3)

Respondents with the highest levels of the following religiosity dimensions were more likely not to have ever drunk alcohol: using religion in dealing with stress, believing sex outside marriage is forbidden, trying hard to implement religious teachings, attending mosque prayers, and participating in other mosque activities. Respondents with Sujda and males wearing a Muslim cap were also more likely not to have ever taken alcohol. Females wearing a long dress (Hijab) were also more likely not to have ever taken alcohol.

Religiosity Dimensions Associated With Avoiding Drinking Alcohol Nowadays (Table 3)

Respondents with the highest levels of the following religiosity dimensions were more likely to report avoiding drinking nowadays: feeling God's presence, finding strength and comfort in religion, and praying privately other than at a mosque. Those who had Sujda were also more likely to report avoiding drinking nowadays.

Religiosity Dimensions Associated With Avoiding Drinking Alcohol Before Sex (Table 3)

Respondents with the highest levels of the following religiosity dimensions were more likely to avoid drinking alcohol before sex: feeling God's presence, believing in God and His angels, and trying hard to implement religious teachings. Those with Sujda and women wearing Hijab were also more likely to avoid drinking alcohol nowadays.

Religiosity Dimensions Associated With Avoiding Use of Narcotics for Recreation (Table 4)

Respondents with the highest levels of praying privately and believing in God and His angels were more likely not to have ever taken narcotic drugs for recreation. Those with Sujda and males wearing a Muslim cap were also more likely not to have ever taken narcotics for recreation.

Religiosity Dimensions Associated With Ever Using Condoms (Table 5)

Respondents with the highest levels of the following religiosity dimensions were more likely to have ever used condoms: listening to or watching religious programs on radio and TV, trying hard to love God, and participating in other mosque activities.

Religiosity Dimensions Associated With Avoiding Sex During Menstruation (Table 6)

Respondents with the highest levels of the following religiosity dimensions were more likely to avoid sex during menstruation: fasting, believing sex outside marriage is forbidden, and self-ranked religiosity.

Religiosity Dimensions That Remain Significant in Combination (Table 7)

When significant religiosity dimension associated with specific behaviors on bivariate analysis was combined in logistic regression models, some of the dimensions still remained

Table 3 Religiosity dimensions associated with avoiding drinking alcohol, avoiding drinking nowadays and avoiding drinking before sex

Dimension	Ever drank alcohol Yes n %	Ever drank alcohol No n %	Odds ratio	95% CI	*P* value
Fasting					
High	152 (15)	861 (85)	1.26	0.66–2.40	0.491
Moderate	50 (31)	112 (69)			
Using religion in dealing with stress					
High	132 (15)	725 (85)	1.46	1.05–2.01	0.022
Moderate	70 (21)	264 (79)			
Believing sex outside marriage forbidden in religion					
High	85 (14)	504 (86)	1.42	1.04–1.92	0.026
Moderate	117 (19)	490 (81)			
Trying hard to implement religious teachings					
High	63 (13)	423 (87)	1.63	1.18–2.25	0.003
Moderate	139 (20)	573 (80)			
Attending mosque prayers					
High	62 (14)	395 (86)	1.47	1.06–2.04	0.019
Moderate	139 (19)	601 (81)			
Participating in other mosque activities					
High	8 (9)	84 (91)	1.47	1.06–2.04	0.019
Moderate	192 (17)	906 (83)			
Having Sujda					
Yes	35 (7)	446 (93)	3.70	2.48–5.50	<0.001
No	150 (22)	517 (78)			
Wearing Muslim cap					
Yes	9 (8)	104 (92)	2.79	1.35–5.76	0.004
No	89 (19)	369 (81)			
Wearing Hijab					
Yes	17 (9)	178 (91)	2.29	1.28–4.11	0.004
No	55 (18)	251 (82)			
Dimension	Drinking nowadays Yes n %	Drinking nowadays No n %	Odds ratio	95% CI	*P* value
Feeling God's presence					
High	6 (13)	42 (87)	3.33	1.30–	0.008
Moderate	48 (32)	101 (68)		8.53	
Finding strength and comfort in religion					
High	6 (15)	35 (85)	2.52	0.98–	0.046
Moderate	48 (30)	111 (70)		6.47	
Praying privately					
High	29 (22)	105 (78)	2.24	1.17–	0.013
Moderate	26 (38)	42 (62)		4.30	
Having Sujda					
Yes	5 (13)	34 (87)	2.8	1.01–7.76	0.039
No	42 (29)	102 (71)			

Table 3 continued

Dimension	Ever drank before sex Yes n %	Ever drank before sex No n %	Odds ratio	95% CI	*P* value
Feeling God's presence					
High	7 (18)	33 (82)	2.41	0.98–5.95	0.049
Moderate	45 (34)	88 (66)			
Believing in God and His angels					
High	23 (22)	82 (78)	2.52	1.28–4.98	0.006
Moderate	29 (41)	41 (59)			
Trying hard to implement teachings					
High	10 (19)	43 (81)	2.20	0.99–4.88	0.046
Moderate	41 (34)	80 (66)			
Having Sujda					
Yes	3 (9)	29 (91)	5.00	1.39–17.95	0.006
No	44 (34)	85 (66)			
Wearing Hijab					
Yes	1 (6)	15 (94)	9.64	1.03–90.40	0.015
No	18 (39)	28 (61)			

Table 4 Religiosity dimensions associated with avoiding use of narcotics

Dimension	Ever used narcotics Yes n %	Ever used narcotics No n %	Odds ratio	95% CI	*P* value
Praying privately					
High	33 (3)	912 (97)	1.88	1.02–3.48	0.041
Moderate	16 (6)	235 (94)			
Believing in God and angels					
High	7 (44)	9 (56)	3.86	1.03–14.40	0.030
Moderate	27 (75)	9 (25)			
Having Sujda					
Yes	13 (3)	468 (97)	2.12	1.11–4.05	0.019
No	37 (6)	627 (94)			
Wearing a Muslim cap					
Yes	3 (3)	110 (97)	3.62	1.09–12.00	0.024
No	41 (9)	415 (91)			

significant. This suggests that those dimensions that remain significant in combination are more likely to independently influence the specific behaviors. With regards to abstaining from sex, the religiosity dimensions that remained significant were trying hard to avoid telling lies and having Sujda. With regards to partner reduction and having one lifetime sexual partner, it was listening to or watching religious programs on radio and TV.

Drinking alcohol has been associated with acquisition of new infections in Uganda (Zablotska et al. 2006). The religiosity dimensions that remained significantly associated with avoiding drinking alcohol, avoiding drinking nowadays, and avoiding drinking before

Table 5 Religiosity dimensions associated with ever using condoms

Dimension	Ever used condom Yes n %	Ever used condom No n %	Odds ratio	95% CI	*P* value
Listening to or watching religious programs					
High	103 (84)	19 (16)	1.69	1.00–	0.044
Moderate	560 (76)	175 (24)		2.85	
Trying hard to love God					
High	370 (80)	92 (20)	1.40	1.02–	0.038
Moderate	292 (74)	102 (26)		1.94	
Participating in other mosque activities					
High	616 (78)	171 (22)	1.76	1.03–	0.037
Moderate	45 (67)	22 (33)		3.02	

Table 6 Religiosity dimensions associated with avoiding sex during menstruation

Dimension	Sex during menses Yes n %	Sex during menses No n %	Odds ratio	95% CI	*P* value
Fasting					
High	100 (15)	583 (85)	1.92	1.21–3.06	0.005
Moderate	30 (25)	91 (75)			
Believing sex outside marriage forbidden					
High	54 (13)	363 (87)	1.59	1.09–2.33	0.016
Moderate	77 (19)	325 (81)			
Self-ranked religiosity					
High	18 (10)	155 (90)	1.81	1.06–3.07	0.026
Moderate	113 (17)	538 (83)			

sex were fasting and having Sujda. In the case of avoiding using narcotics for recreation, the dimensions that remained significant were praying privately other than at the mosque and having Sujda. Regarding ever using condoms, it was listening to or watching religious programs on radio and TV that remained significant. The religiosity dimension that remained significantly associated with avoiding sex during menstruation in the logistic regression model was fasting.

In the logistic regression models, the religiosity dimensions associated with behaviors likely to reduce new HIV infections with an odds ratio greater than 2 were having Sujda and fasting. This suggests that these dimensions may have a stronger influence on the behaviors compared to the others.

Discussion

The HIV epidemic in Uganda is mature and generalized with an estimated HIV prevalence of 6.4%. The behaviors driving the epidemic resulting in new HIV infections include sexual activity especially with multiple sexual partners, transactional sex in exchange for

Table 7 Logistic regression models with religiosity dimensions that remain significant in promotion of behaviors that may reduce HIV transmission among Muslims

Behavior and associated religiosity dimension	Odds ratio	95% CI	*P* value
Abstaining from sex			
Trying hard to avoid telling lies	1.52	1.08–2.13	0.017
Having Sujda	1.63	1.25–2.11	<0.001
Partner reduction (having one life-time partner)			
Listening to or watching religious programs on radio & T.V	1.71	1.06–2.275	0.028
Avoiding drinking alcohol			
Fasting	2.18	1.10–4.32	0.026
Having Sujda	3.19	1.81–5.64	<0.001
Avoiding drinking nowadays			
Having Sujda	3.20	1.05–9.75	0.041
Avoiding drinking alcohol before sex			
Having Sujda	4.1	1.16–14.61	0.029
Avoid using narcotics for recreation			
Praying privately other than at mosque	1.97	1.05–3.71	0.035
Having Sujda	2.19	1.11–4.31	0.023
Ever using condoms			
Listening or watching religious programs on radio & T.V	1.92	1.11–3.31	0.019
Avoiding sex during menstruation			
Fasting	1.64	1.02–2.64	0.043

money or other benefits, cross-generational sex with sexual partners having an age gap of more than 10 years, lack of circumcision, lack of condom use, and alcohol and drug use (Uganda AIDS Commission 2009). The study has shown that higher levels of many dimensions of religiosity were associated with lower levels of several behaviors driving the HIV epidemic. These findings are similar to what others have observed. In studies in USA, religious persons had fewer sexual partners, had less extramarital sex, and were more likely to abstain from sex (Koenig et al. 2001b). In a study in Malawi, regular attendance at religious services was associated with reporting fewer extramarital sexual partners among married men (Trinitapoli and Regnerus 2006).

Our findings suggest that behaviors associated with higher levels of several dimensions of religiosity may counter behaviors likely to lead to new infections. If higher levels of these dimensions of religiosity are promoted, it is possible that behaviors likely to reduce new HIV infections will also increase. The findings provide empirical evidence for Uganda's strategic plan for HIV prevention. In this plan, one of the goals is to reduce the incidence rate of HIV infection. In order to achieve this goal, one of the objectives is to accelerate prevention of sexual transmission of HIV through established as well as new and innovative strategies. The strategic actions to achieve this objective include the following: promoting ABC+, which includes Abstinence, being faithful, and condom use with risky sexual encounters plus other strategies to reduce sexual transmission. Another strategic action is to utilize all social, religious, health, economic and cultural institutions for delivery of HIV prevention messages, and advocacy services (Uganda AIDS Commission 2007). The Uganda AIDS Commission recommends evidence-based planning and decision making through periodic population surveys both behavioral and serologic

(Uganda AIDS Commission 2009). Our study is a contribution to this recommendation for the Muslim communities.

Muslim religious leaders and other stakeholders may use the data from the study to plan their HIV prevention response. This may be done by promoting those religiosity dimensions significantly associated with behaviors likely to reduce new HIV infections. For example, having Sujda that is due to regular prayers and fasting may be promoted massively at the community level by supporting religious leaders to use appropriate communication channels that reach Muslim communities. This may be one of the innovative ways to interrupt HIV transmission among Muslim communities (Parkhurst and Whiteside 2010). The strategy would be to use scientific information such as what we found in the study and support it with Islamic teachings. This is the strategy of the Islamic Approach to HIV/AIDS (Islamic Medical Association of Uganda 2007).

The study had limitations in that most of the respondents were quite religious people. Some of the respondents might have given socially desirable answers to the interviewers thereby disguising the true picture. However, the presence of Sujda was objectively verified by the interviewers. Another limitation was that because most people were religious, the difference between the comparison groups of the highest levels of religiosity and the moderate group of religiosity was narrow. Some of the significant dimensions of religiosity associated with behaviors likely to reduce new HIV infections might not have been detected by the study instrument as a result of this limitation.

In conclusion, through community surveys, data can be generated to inform Muslim leaders and other stakeholders regarding what dimensions of religiosity may be emphasized for promotion of behaviors likely to reduce new HIV infections. This is likely to strengthen the Muslim community HIV prevention response.

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