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Religious Involvement and Health in Dialysis Patients in Saudi Arabia

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Abstract Patients on hemodialysis experience considerable psychological and physical stress due to the changes brought on by chronic kidney disease. Religion is often turned to in order to cope with illness and may buffer some of these stresses associated with illness. We describe here the religious activities of dialysis patients in Saudi Arabia and determined demographic, psychosocial, and physical health correlates. We administered an in-person questionnaire to 310 dialysis patients (99.4 % Muslim) in Jeddah, Saudi Arabia, that included the Muslim Religiosity Scale, Structured Clinical Interview for Depression, Hamilton Depression Rating Scale, Global Assessment of Functioning scale, and other established measures of psychosocial and physical health. Bivariate and multivariate

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analyses identified characteristics of patients who were more religiously involved. Religious practices and intrinsic religious beliefs were widespread. Religious involvement was more common among those who were older, better educated, had higher incomes, and were married. Overall psychological functioning was better and social support higher among those who were more religious. The religious also had better physical functioning, better cognitive functioning, and were less likely to smoke, despite having more severe overall illness and being on dialysis for longer than less religious patients. Religious involvement is correlated with better overall psychological functioning, greater social support, better physical and cognitive functioning, better health behavior, and longer duration of dialysis. Whether religion leads to or is a result of better mental and physical health will need to be determined by future longitudinal studies and clinical trials.

Keywords Religion · Religiosity · Hemodialysis · Saudi Arabia · Islam · Mental health · Physical functioning

Introduction

A growing volume of research conducted in Christian-majority countries in the West has reported a positive relationship between religious involvement and both mental and physical health (Koenig et al. 2012). Much less research, however, has been done in Muslim-majority countries in the Middle East that has examined these relationships, particularly in medically ill patients with a specific health condition (Koenig and Alshohaib 2014). The Kingdom of Saudi Arabia (KSA) is one of the most religious countries in the world and is the birthplace of Islam. Little is known, however, about religiosity and health in this country.

Chronic kidney disease (CKD) is widespread in KSA whose populace is experiencing increasing rates of obesity, diabetes, and hypertension due in part to the wealth that came into the region as a result of large oil discoveries in 1938 in the Dammam Dome near the Arabian Gulf. The number of people requiring dialysis is increasing rapidly in KSA and the Middle East, where the prevalence is now up to 462 per million (much higher than many other countries) (Abboud 2006). Dialysis poses serious challenges to both mental and physical health due to the stresses, fears, family problems, and physical discomforts associated with CKD. Not surprisingly, problems with coping are common among these patients. Inability to deal with the mental and physical health problems associated with dialysis has been linked to greater mortality (Kimmel et al. 1998; Drayer et al. 2006; Chilcot et al. 2011; Mapes et al. 2003), increased risk of discontinuing dialysis (McDade-Montez et al. 2006), and worse interdialytic weight control (Taskapan et al. 2004).

Religious involvement is a common way that persons cope with physical illness, in both KSA (Jazieh et al. 2012) and around the world (Pargament 1997), and chronic kidney disease (CKD) is no exception (Patel et al. 2002; Berman et al. 2004; Ramirez et al. 2012). There is also considerable research showing that religious coping and religiosity are related to less depression and predict a faster remission of depressive symptoms in those with chronic medical illness and with (Koenig et al. 1992, 1998; Koenig 2007) better coping among patients with CKD in Christian (Patel et al. 2002; Berman et al. 2004; O'Brien 1982; Baldree et al. 1982; Tanyi and Werner 2003; Kutner et al. 2004; Weisbord et al. 2007) and non-Christian populations (Kao et al. 2003). Religious beliefs may convey a

sense of meaning to illness and hope for better days, thereby providing the strength to endure unpleasant physical symptoms and the desire to survive even though quality of life may be poor. Thus, religiosity has the potential to influence the mental and physical health of dialysis patients, including their decision to continue dialysis treatment over time (Pruchno et al. 2006).

To our knowledge, only one study has examined religiosity among dialysis patients in KSA (Al-Ghamdi et al. 2009). That study surveyed 100 patients at King Fahd National Guard Hospital in Riyadh and King Abdulaziz University Hospital in Jeddah. The focus was on identifying predictors of advanced care planning preferences, not mental or physical health. Investigators measured religion with a single question that asked respondents to rate their religiosity from 0 (not at all) to 100 (very religious). While 70 % scored 70 or higher on the scale, religiosity was unrelated to advanced care planning preferences in that study.

No studies have yet examined the role that religiosity plays in maintaining the emotional and physical health of persons with CKD on dialysis in KSA (or for that matter, any group of people in KSA with a chronic medical condition). We recently completed a study examining the prevalence and correlates of depression in 310 CKD patients on dialysis in Jeddah, finding that significant depressive symptoms on the Hamilton Depression Rating Scale (8 or higher) were present in 24.2 %, depressive disorder or subthreshold depression in 12.6 %, and significant overall psychological distress in many more (Al Zaben et al. 2014). None of the 310 patients surveyed, including those with major or minor depressive disorder, were receiving treatment with antidepressant medication. No medical treatment was being provided for the emotional symptoms of these patients, requiring them to depend on other resources to deal with the stress of dialysis. Religion may be one such resource.

In this paper, we report relationships between religious involvement and the mental and physical health of patients receiving dialysis in the region in and surrounding Jeddah. We hypothesized that those who were more religious would experience better overall mental health and physical health, largely due to the role that religion might play in coping with the stresses of dialysis (as shown in non-Muslim populations).

Methods

We surveyed 310 patients with CKD from dialysis centers in and around Jeddah, Saudi Arabia, associated with King Abdulaziz University, King Fahad, and Al-Noor hospitals. Eligibility criteria were aged 18–85, a score of 14 or higher on the Brief Mini-Mental State Exam, a primary or secondary diagnosis of CKD, currently receiving dialysis, able to communicate without difficulty, and physically able and willing to undergo a 60-min in-person interview.

Procedure

Interviewers (psychiatry residents and medical students) were trained as a group by psychiatry faculty to obtain informed consent and conduct the structured interviews. Interviews took place while patients were receiving dialysis in the clinic or during acute hospitalization. Information on demographics, mental health, recent stressful life events, social support, and physical health was collected. Consent was obtained from all participants, and the research committee of the Unit of Biomedical Ethics of King Abdulaziz University's Faculty of Medicine approved the study.

Measures

Age (years), gender (female = 1, male = 0), education (years), family income (<60,001 Saudi riyals/year = 1, >60,000 SAR/year = 0), marital status (married = 1, unmarried = 0), and nationality (Saudi = 1, immigrant = 0) were assessed.

Religiosity

Religiosity was measured using the 13-item Muslim Religiosity Scale (Koenig et al. 2014). The scale consists of two subscales: a 10-item religious practices scale and a 3-item intrinsic religious beliefs scale. The Cronbach's alpha (standardized) for the full scale in this sample was 0.68; for the religious practices, scale was 0.64; and for the intrinsic beliefs, scale was 0.93. Principal components analysis of the full scale revealed three factors with most of the variance explained by factors 1 and 2 (2.58 and 1.63, respectively), with factor 3 explaining the residual (0.69). Items of the intrinsic beliefs subscale loaded heavily on factor 1 and of the religious practices subscale on factor 2. The face validity of the scale is evident based on item content (see "Appendix").

Mental Health

Depressive disorder, depressive symptoms, and global psychological functioning were assessed using clinician-rated measures. Prior psychiatric history (excluding depression) and family psychiatric history (including depression) were also assessed.

Depression Major and minor depressive disorder was diagnosed using the Structured Clinical Interview for DSM-IV (SCID-I/NP, version 2.0) administered in Arabic (First et al. 1996). To reduce the length of the interview given the frailty of patients, only the depressive disorder module of the SCID was administered. Depression severity was assessed using the clinician-rated Hamilton Depression Rating Scale (HDRS) (Hamilton 1967).

Psychological Functioning Overall emotional and psychological functioning of patients was assessed using the Global Assessment of Functioning (GAF) scale, a commonly used measure in clinical practice that ranges from 0 to 100, with higher scores indicating better psychological function (Endicott et al. 1976).

Psychiatric History Past psychiatric history and family psychiatric history were assessed using a section of the Duke Depression Evaluation Schedule (1994). Patients were asked if they had ever experienced a mental or nervous condition that required some form of treatment (besides depression). They were also asked if any first-degree relative (parents, siblings, children, grandchildren) had ever had a mental or nervous condition, been seen by a psychiatrist, admitted to a psychiatric hospital, took nerve medicine for 3 months or more, made a suicide attempt or committed suicide, or ever had a problem with drugs or alcohol.

Physical Health

Clinician-rated measures of illness severity and self-rated measures of physical functioning were used to determine physical health status.

Cognitive Functioning Cognitive functioning was determined using the Brief Mini-Mental State Exam, an 18-item version of the standard 30-item exam widely used to assess cognition (Koenig 1996). Only patients who scored 14 or higher on the scale were enrolled, which is the cutoff for lack of significant impairment, with the exception of one patient who scored 12.

Medical Illness Severity The Cumulative Illness Rating Scale is a standard 12-item clinician-rated measure of impairment of 12 organ systems (cardiovascular, respiratory, etc.), each system scored on a 0 to 4 scale (range 0–48) (Linn et al. 1968). Medical comorbidity was determined using the Charlson Comorbidity Index, which identifies, classifies, and assigns comorbidity scores to 31 medical illnesses based on ICD-9 criteria (range 0–49) (Charlson et al. 1987). Interviewers also rated patients' overall severity of CKD (0 = extremely severe illness to 100 = no disease). Length of time (months) receiving dialysis was also recorded.

Physical Functioning Patients were asked ten questions from the SF-36 regarding their physical functioning. Scores ranged from 10 to 30, with higher scores indicating better functioning (Ware and Sherbourne 1992).

Life Stressors and Social Support

The experience of twelve common stressful life events in the past year unrelated to the patient's health was also inquired about (Blazer et al. 1987). Examples of stressful events included unexpected separation from loved ones, separation or divorce, serious illness of a family member, and other negative life events commonly experienced by those in midlife or older age (range 0–12). A 4-item subscale of the Duke Social Support Index assessing size of the social network was also administered (range 0–28) (Koenig et al. 1993).

Health Behaviors

Single questions were administered that asked about the current cigarette smoking and alcohol use (with yes–no response options). Since only one subject indicated that they used alcohol, this variable was excluded from analyses.

Statistical Analyses

Descriptive statistics were used to summarize participant characteristics. Pearson correlation test (r) and Student's t test examined bivariate associations between patient characteristics and religious practices, intrinsic religious beliefs, and overall religiosity. Demographic, mental health, and physical health correlates significant at $p \leq 0.10$ in bivariate analyses were included in a series of general linear models using a backward elimination procedure to identify the strongest correlates in each of these categories. Trend and significant level correlates in each category were then included in a final regression model predicting each religious dependent variable using a backward elimination method to identify the strongest independent correlates across all categories; results are reported using unstandardized betas (b) with standard errors. We assumed that associations were significant if $p < 0.05$ and weak if $p \leq 0.10$. Given the exploratory nature of these analyses, significance levels were not adjusted for multiple comparisons. The SAS statistical

package (version 9.3; SAS Institute Inc, Cary, North Carolina) was used to manage the data and perform the analyses.

Results

A total of 310 patients were enrolled between February 2013 and February 2014. The average age of participants was 46 years, and the majority were male (61 %), Saudi nationals (75 %), married (58 %), had low education (average 8.2 years) and yearly family incomes of less than 60,000 SAR (16,000 USD) (79.4 %) (Table 1). All were receiving hemodialysis except for one patient on peritoneal dialysis, the average length of time on dialysis was 4.5 years (54.7 months), and the number of sessions per week was three.

Religious Involvement

Religious affiliation for most participants was Muslim (99.4 %). Religious practices were widespread with three quarters (75 %) engaging in obligatory prayers (*Fard*) five times daily either at the Mosque or in a small group at work or at home, even though poor health for some may have interfered with this practice. In addition, about one-third (34 %) often or very often prayed alone in private. Half of participants (50 %) said that they never skipped their daily prayers. Many read or recited the Qur'an (39 %) or watched/listened to religious programs (38 %) at least several times per week. A significant proportion gave money to the poor as required (*Zakat*) (40 %) and some exceeded the required amount (21 %); most participants were quite poor themselves and so were excused from giving by Islamic law. Many said that they fasted from food/water (*Sawm*) during part of Ramadan (40 %), over one-quarter fasted the entire month of Ramadan (26 %), and one out of five (19 %) fasted during Ramadan and at other times as well (*Nawafl*); again, the poor physical health of participants likely interfered with fasting practices. The majority had made a pilgrimage at least once to Mecca during the 12th month of the Islamic calendar (*Hajj*) (63 %), and almost all (97 %) had made a pilgrimage to Mecca at least once outside of Hajj (*Umrah*) (not surprising since all patients lived within an hour's drive of Mecca). Intrinsic religious beliefs were also widespread, with 85 % saying that they definitely experienced the presence of Allah/God in their daily lives, 80 % that their religious beliefs were the basis for their entire approach to life, and 78 % that they tried hard to carry their religion over into all other dealings in life. Religiosity overall was significantly higher among patients recruited from the hospital in Mecca compared to hospitals in Jeddah (49.2 vs. 47.2, $p < 0.01$).

Demographic Characteristics

Religious practices and intrinsic religious beliefs were associated with several demographic and social characteristics.

Bivariate Analyses

Patients were more engaged in religious practices if they were older, better educated, had higher incomes, were married, and were Saudi nationals (Table 2). Intrinsic religious beliefs were more common among those with higher education, males, and married

Table 1 Characteristics of the sample ($n = 310$)

	% (*N*)	Mean (SD)
Demographics		
Age, years		46.4 (15.2)
Education, years ($n = 297$)		8.1 (5.4)
Yearly income (≤60,001 SAR)	79.4 (246)	
Gender, female	38.6 (119)	
Marital status, married (vs. unmarried)	58.1 (180)	
Nationality (Saudi)	74.8 (232)	
Dialysis unit		
King Fahd	55.8 (163)	
King Abdulaziz University	18.8 (55)	
Makkah (Mecca)	25.3 (74)	
Mental health		
Major depressive disorder	3.2 (10)	
Minor depressive disorder	3.6 (11)	
No. of depression criterion symptoms (0–9)		1.0 (1.5)
Hamilton Depression Rating Scale (0–52)		5.8 (5.2)
Global assess of function (0–100) ($n = 265$)		78.2 (12.7)
Length of depression (weeks)		18.2 (86.6)
Past depression (1 or more episode)	30.3 (94)	
Family psychiatric history	13.9 (43)	
Stressful life events (past year) (0–12)		3.2 (1.5)
Social support (social network) (0–28)		9.4 (6.4)
Physical health		
Physical function (SF-36, range 10–30)		21.5 (6.2)
Cognitive function (BMMSE, range 0–18)		17.1 (1.9)
Medical comorbidity (CCI, range 0–49)		4.7 (2.4)
Severity of illness (CIRS, range 0–48)		6.9 (3.7)
Severity of kidney disease (range 0–100)		51.7 (17.0)
Hemodialysis	99.7 (309)	
Months receiving dialysis		54.7 (55.4)
Smoking, yes	20.4 (63)	
Religious practices		
Obligatory prayer as group (5 times/day)	75.4 (233)	
Pray alone in private (often or very often)	34.3 (106)	
Never skip 5 daily prayers	49.8 (154)	
Read/recite Qu'ran (several times/week)	39.2 (121)	
Watch/listen religious programs (several/week)	37.9 (117)	
Give to poor (*Zakat*) (very often)	39.8 (123)	
Give to poor (not required) (very often)	21.0 (65)	
Fasting (*Sawm*) (during Ramadan or more)	45.0 (139)	
Make *Hajj* to Mecca (more than once)	35.9 (111)	
Make *Umrah* to Mecca (more than once)	89.9 (277)	

Table 1 continued

	% (*N*)	Mean (SD)
Religious beliefs		
Experience presence of Allah (definitely)	84.5 (261)	
Beliefs behind approach to life (definitely)	80.3 (248)	
Carry religion into life dealings (definitely)	78.3 (242)	
Religiosity scales		
Religious practices scale (range 14–48)		33.4 (5.8)
Religious beliefs scale (range 3–15)		14.2 (1.7)
Total religiosity (range 25–63)		47.7 (6.2)

Sample size varies by <1 %

SAR, Saudi riyal (0.27 USD); SF-36, physical functioning subscale; BMMSE, Brief Mini-Mental State Exam; CCI, Charlson Comorbidity Index; CIRS, Cumulative Illness Rating Scale

individuals. Religiosity overall was higher among those with better education, higher incomes, married patients, and Saudi nationals.

Multivariate Analyses

Controlling for other demographics only, religious practices remained associated with older age ($b = 0.04$, $p = 0.05$), higher education ($b = 0.18$, $p = 0.005$), higher income ($b = -1.67$, $p = 0.04$), and being married ($b = 2.59$, $p = 0.0002$). Saudi nationality lost significance. Intrinsic religious beliefs continued to be related to higher education ($b = 0.05$, $p = 0.02$) and male gender ($b = -0.60$, $p = 0.005$), but no longer to marital status. Overall religiosity was related to higher education ($b = 0.20$, $p = 0.002$), higher income ($b = -1.76$, $p = 0.04$), and being married ($b = 3.41$, $p < 0.0001$), but no longer to age or Saudi nationality. In multivariate analyses that also controlled for mental and physical health (Table 3), older age was the strongest independent predictor of religious practices ($b = 0.11$, $p < 0.0001$), followed by marital status (married) ($b = 2.28$, $p < 0.001$) and higher education ($b = 0.17$, $p < 0.01$). There was also a weaker trend for those with higher incomes to be more actively religious ($b = -1.53$, $p \leq 0.10$).

Mental Health

Relationships were also present between religiosity and several indicators of mental health.

Bivariate Analyses

Religious practices were inversely related to depressive disorder ($t = 2.45$, $p = 0.015$). Likewise, GAF scores (interviewer-rated global assessments of psychological functioning) were higher among those frequently engaged in religious practices ($r = 0.24$, $p = 0.0001$). Greater social support (social network size) was also associated with religious practice ($r = 0.27$, $p < 0.0001$). Similarly, intrinsic religious beliefs were related to higher GAF scores ($r = 0.32$, $p < 0.0001$). Overall religiosity was related to a lower likelihood of depressive disorder ($t = 2.55$, $p = 0.01$), tended to be related to fewer criterion symptoms

Table 2 Bivariate associations between participant characteristics and religiosity

	Religious practice *r/t value*	Religious belief *r/t value*	Religiosity (total) *r/t value*
Demographics			
Age, years	0.13*	−0.05	0.11^{T}
Education, years	0.17**	0.18**	0.21***
Yearly income (≤60 K SAR)	3.6***	1.6	3.5***
Gender, female	−0.6	3.4**	0.5
Marital status, married	−5.4****	−2.4*	−5.7****
Nationality (Saudi)	−2.6**	1.0	−2.2*
Dialysis unit (King Fahd)	−0.5	1.2	−0.1
Mental health			
Depressive disorder (maj/min)	2.5*	0.9	2.6*
Criterion symptoms	−0.09	−0.05	−.09^{T}
Hamilton Depression Scale	−0.05	−0.09	−0.08
Global assessment of function	0.24****	0.06	0.24****
Length of depression (weeks)	−0.01	0.02	0.00
Past depression	−0.1	0.0	−0.1
Family psychiatric history	−0.6	−0.3	−0.7
Stressful life events	0.06	0.00	0.06
Social support	0.27****	0.32****	0.34****
Physical health			
Physical function	0.17**	0.06	0.18**
Cognitive function	0.09	0.18**	0.13*
Medical comorbidity	0.04	0.07	0.06
Severity of illness	0.10^{T}	0.08	0.12*
Severity of kidney disease	0.09	−0.07	0.06
Months receiving dialysis	0.16**	0.01	0.15**
Smoking, yes	1.9^{T}	−1.1	1.5

^{T} $.05 < p \leq 0.10$; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$; **** $p < 0.0001$

r = Pearson r for continuous correlates

t value = from student's t-test for categorical correlates

of depression ($r = -0.09$, $p = 0.10$), higher GAF scores ($r = 0.24$, $p < 0.0001$), and greater social support ($r = 0.34$, $p < 0.0001$).

Multivariate Analyses

Controlling only for other indicators of mental health, religious practices remained associated with overall psychological functioning ($b = 0.09$, $p = 0.002$) and social support ($b = 0.24$, $p < 0.0001$), but not with depressive disorder (once GAF scores were controlled). Intrinsic religious beliefs also remained associated with social support ($b = 0.09$, $p < 0.0001$), but no longer with other indicators of mental health. Overall religiosity remained associated with GAF scores ($b = 0.12$, $p = 0.0003$) and with social support ($b = 0.34$, $p < 0.0001$), but the association with SCID criterion symptoms and depressive disorder lost significance. When adjusting for demographic and physical health

Table 3 Multivariate analyses examining relationships between religiosity and participant characteristics

	Religious practices *B* (SE)	Religious beliefs *B* (SE)	Overall religiosity *B* (SE)
Demographics			
Age, years	0.11 (0.02)****	–	–
Education, years	0.17 (0.06)**	–	0.16 (0.07)*
Yearly income, poor	−1.53 (0.86)^{T}	–	−1.61 (0.94)^{T}
Marital status, married	2.28 (0.67)***	–	3.33 (0.71)****
Mental health			
Global assessment of function	0.09 (0.03)***	–	0.10 (0.03)***
Social support	0.18 (0.06)***	0.08 (0.01)****	0.27 (0.06)****
Physical health			
Physical function	0.17 (0.06)**	–	–
Cognitive function		0.11 (0.05)*	–
Months receiving dialysis	0.02 (0.01)***	–	0.02 (0.01)**
Smoking, yes	−3.38 (0.81)****	–	−2.56 (0.86)**
Model *R*-square (*n*)	0.34 (249)****	0.12 (308)****	0.31 (251)****

^{T} $.05 < p \leq 0.10$; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$; **** $p < 0.0001$

B unstandardized coefficient, *SE* standard error

"–" Indicates *p* value for association >0.10

characteristics (Table 3), religious practices, intrinsic beliefs, and overall religiosity all remained associated with social support ($b = 0.18$, $b = 0.08$, and $b = 0.26$, respectively, $p < 0.001$), and religious practices and overall religiosity to overall psychological functioning based on GAF scores ($b = 0.09$ and $b = 0.11$, respectively, $p < 0.001$).

Physical Health

Religiosity was also related to a host of physical health measures.

Bivariate Analyses

Religious practices were associated with better physical functioning ($r = 0.17$, $p = 0.002$), despite the fact that severity of overall medical illness (CIRS) tended to be worse ($r = 0.10$, $p = 0.07$). Frequency of religious practices was also associated with number of months on dialysis ($r = 0.16$, $p = 0.006$) and tended to be more frequent among those who did not smoke cigarettes ($t = 1.9$, $p = 0.05$). Intrinsic religious beliefs were associated with better cognitive functioning, but not with other indicators of physical health. Finally, overall religiosity was related to better physical functioning ($r = 0.18$, $p < 0.01$) and better cognitive functioning ($r = 0.13$, $p < 0.05$), again despite being positively related to severity of medical illness ($r = 0.12$, $p = 0.04$) and length of time on dialysis ($r = 0.15$, $p < 0.01$).

Multivariate Analyses

Adjusting only for other correlates of physical health, religious practices remained significantly associated with better physical functioning ($b = 0.21$, $p = 0.0001$), worse

overall medical illness ($b = 0.18$, $p = 0.04$), longer time on dialysis ($b = 0.02$, $p = 0.003$), and less cigarette smoking ($b = -2.30$, $p = 0.004$); intrinsic religious beliefs remained associated with better cognitive functioning ($b = 0.16$, $p = 0.002$); and overall religiosity remained correlated with better physical functioning ($b = 0.20$, $p = 0.0005$), more severe overall medical illness ($b = 0.22$, $p = 0.02$), and greater time on dialysis ($b = 0.02$, $p = 0.007$), but the association with cognition weakened ($b = 0.34$, $p = 0.055$). When also controlling for demographic and mental health factors, religious practices remained associated with better physical functioning ($b = 0.17$, $p < 0.01$), greater time on dialysis ($\beta = 0.02$, $p < 0.001$), and especially less cigarette smoking ($b = -3.38$, $p < 0.0001$); intrinsic beliefs remained correlated with better cognitive function ($b = 0.11$, $p < 0.05$); and overall religiosity continued to be associated with to a longer time on dialysis ($b = 0.02$, $p < 0.01$) and less cigarette smoking ($b = -2.56$, $p < 0.01$).

Discussion

This is the largest study to our knowledge of dialysis patients (or patients with any specific medical condition) in KSA that has examined the prevalence of religious beliefs and practices and their relationship to mental and physical health. Given the importance of religion to the lives of people in this region, failure to study religion's role in the lives of people with chronic kidney disease in KSA and the Middle East more generally is a serious oversight. Findings from research on religiosity in Western countries cannot be generalized to those with chronic illness living in this part of the world. Even correlations between religiosity and demographic characteristics in the present sample showed differences from those reported in Western countries. A consistent finding by the Gallup polls over the past 50 years in the USA, Canada, and Europe has been that those who are most religious are women, minorities, the uneducated, and the poor (Koenig et al. 2001, 2012) (consider Karl Marx's aphorism, "religion is the opiate of the masses"). In contrast, those who were more religious in the present sample tended to be men, those of Saudi nationality (not minority immigrants), better educated, and with higher incomes.

As expected, we found religious practices and intrinsic religious beliefs widely prevalent among dialysis patients in this sample, despite the fact that Jeddah is a relatively cosmopolitan city because of its position as a major port on the Red Sea serving countries from all over the world. This is evident from the fact that dialysis patients from Mecca recruited into the study were more religious than those recruited from hospital in Jeddah. To what extent religious practices are more prevalent among patients here compared to healthy people living in the general population of the region is unknown, since community surveys of religious beliefs and practices using a religiosity measure similar to ours have not been done. Based on Gallup World Surveys conducted during the past 10 years, however, 94.5 % of those in KSA say that religion is important, and 15 of the 40 most religious countries in the world are Muslim-majority countries (most in the Middle East) (Author 2009). Given the role that religion plays in Muslims' coping with illness (Eapen and Revesz 2003; Scholte et al. 2004; Taleghani et al. 2006), there is little doubt that one function that religion likely served for dialysis patients in this study was to help them deal with the challenges of chronic kidney disease.

Most importantly, we found that religious beliefs and practices were related to better mental and physical health. Dialysis patients who were more religious were rated by clinician interviewers as having better overall psychological functioning. This strong and

consistent finding is particularly relevant given that the primary purpose of the study was not to examine religiosity, but rather to determine the prevalence of and treatments for depression. Religious involvement was only one of many characteristics that were assessed here, so was unlikely to bias interviewer ratings. The association between religiosity and better mental health, however, is consistent with reports from other parts of the world. A recent systematic review found that among studies examining religious involvement and mental health that were published in top psychiatry and neurology journals over the past 20 years, 72 % reported a positive association (Bonelli and Koenig 2013).

We are aware of only one other study from the Middle East that has examined the relationship between religiosity and mental health in Muslims undergoing dialysis. Saffari and colleagues examined 362 hemodialysis patients at three general hospitals in Tehran, Iran (Saffari et al. 2013). Mental health was assessed in terms of quality of life (QOL) and was measured using the EQ-5DL-3L. Religiosity was measured by the 5-item Duke Religion Index translated into Farsi, which measures attendance at religious services, private religious activities, such as prayer, and intrinsic religious beliefs (as in the present study). QOL and health status were both significantly and positively associated with each aspect of religiosity, especially attendance at group prayer and worship services.

Part of the mechanism by which religious activity might influence mental health in dialysis patients is by increasing social support. Family and social connections are very important aspects of life in the Middle East, which is much more collectivistic than the individualism seen in the West, and is strongly influenced by Islamic beliefs and cultural traditions. Those who have strong family and social networks have others to rely on during times of need, especially during chronic illness. We found a strong relationship between religiosity and social support in the present study, which is consistent with nearly 80 % of the research that has examined this relationship in non-Muslim populations (Koenig et al. 2012). What was interesting here, however, is that the relationship between overall psychological functioning and religiosity was independent of social support, which means that social factors may partially explain this relationship but not all of it. Other mechanisms, presently are not well understood, may also be at work.

One somewhat surprising finding here was the link between religiosity and physical health. Despite having more severe medical illness (perhaps prompting many to turn to religion for comfort), those who were more religious reported better physical and cognitive function than those who were less religious. A number of prior studies in Christian populations have reported that religious involvement may alter perceptions of how sick people feel and what they are capable of doing (Idler 1995; Idler and Kasl 1997). Given strong relationships between religiosity, meaning and purpose in life, and optimism and hope, such positive attitudes may enhance motivation to care for self and prevent serious illness from limiting activities (in contrast to those with little purpose or meaning who may be easily discouraged from self-care activities because of chronic debilitating medical illness) (Koenig 2012; Koenig et al. 2014). Consistent with these findings are reported that religious involvement may delay the onset of physical disability (Idler and Kasl 1997; Benjamins et al. 2003; Reyes-Ortiz et al. 2006; Hybels et al. 2012) and cognitive decline (Van Ness and Kasl 2003; Hill et al. 2006) with increasing age and poor physical health [including research in Muslims (Inzelberg et al. 2013)].

Also of note was the positive relationship between religiosity and number of months on dialysis. Poor mental health and lack of social support are well-known factor related to the discontinuation of dialysis, as patients give up the will to live and the efforts needed to continue with a treatment that promises no cure for the disease (McDade-Montez et al. 2006; Cohen and Germain 2005). However, the association between religiosity and length

of time on dialysis found here was independent of both overall psychological functioning and social support. Again, psychosocial factors likely explain only part of this relationship, and other factors related to religious belief and practice may confer resilience and maintain hope in these patients. As indicated earlier, at least one other study has reported that religiosity was inversely related to decisions to discontinue dialysis (Pruchno et al. 2006).

Finally, the inverse relationship between religiosity and cigarette smoking is worth discussing, given the impact of smoking on the progression of cardiovascular disease predisposing to CKD as well as on the progression of CKD itself (Orth et al. 1998; Regalado et al. 2000; Hallan and Orth 2011). This association may be due to a "fatwa" that now places a ban on cigarette smoking in Muslims and is part of Islamic law (sharia) (Ghouri et al. 2006; Muhamad and Mizerski 2013).

Limitations

Because the present study involved a convenience sample of dialysis patients, results cannot be generalized across Saudi Arabia. Statistical tests are difficult to interpret when they are applied to non-probability data. The internal reliability of the religious practices subscale of our religiosity measure was also relatively low (Cronbach's alpha = 0.64), perhaps due in part to translation issues. Furthermore, the cross-sectional design does not allow determinations of causality, particularly with regard to the associations between religiosity and health outcomes identified here. However, the study also has a number of strengths, including the relatively large size, selection of patients from several different dialysis settings, and the use of standard measures of mental and physical health. Careful control of demographic and other psychosocial and health factors in multivariate models is another strength.

Conclusions

Religious involvement is widespread among patients on dialysis in KSA, at least the region in and around Jeddah on the east coast near the Red Sea. Religious beliefs and practices may be particularly helpful in coping with the life changes brought on by CKD and a treatment that maintains life, but is not curative. We found that religiosity was related to better overall mental health, greater social support, better physical and cognitive function (despite more severe overall illness), a longer time being on dialysis (suggesting that it may also be related to discontinuation of dialysis), and less cigarette smoking (known to adversely affect the course of renal disease). This is the first study to examine the relationship between religiosity and health among dialysis patients in Saudi Arabia, and it is one of the few studies done so far among dialysis patients in the Middle East or a Muslim-majority population. Prospective and experimental studies are needed to determine whether religious involvement actually leads to better social, psychological, and physical health, or vice versa. If the former, then clinicians should be aware of the role that religion plays in the lives of dialysis patients in this region of the world and its relationship to health outcomes.

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Appendix: Muslim Religiosity Scale

(1) How often do you attend group religious services for worship and prayer at Mosque or in small group at work or in your home (obligatory prayers) (Fard)?

1. 5 times/day
2. 1–4 times/day
3. Several times/week
4. Several times/month
5. Never

(2) How often do you pray alone in private (Nawafl)?

1. Never
2. Rarely
3. Occasionally
4. Often
5. Very often

(3) Are you regular in prayer or do you sometimes sum 2 or more of your obligatory prayers (Fard) with each other or skip?

1. Always skip prayers
2. Often skip
3. Sometimes skip
4. Occasionally skip
5. Never skip (Regular)

(4) How often do you read or recite the Qur'an or other religious literature (magazines, papers, books) in your home?

1. Not at all or rarely
2. During Ramadan only
3. Occasionally, besides Ramadan, but less than several times per week
4. Occasionally, besides Ramadan, but less than several times per week
5. Once a day or more

(5) How often do you listen to or watch religious programs on radio or TV?

1. Not at all or rarely
2. During Ramadan only
3. Occasionally, besides Ramadan, but less than several times per week
4. Several times/wk
5. Once a day or more

(6) Do you give Zakat to poor each year?

1. Never
2. Rarely
3. Occasionally
4. Often
5. Very often

(7) Do you give money to poor as a free gift (not obligatory like Zakat)?

1. Never
2. Rarely
3. Occasionally
4. Often
5. Very often

(8) How often do you fast from food/water (Sawm)?

1. Never
2. During Ramadan (part of month)
3. During Ramadan (all of month)
4. During Ramadan (all of month) + occasionally other times (Nawafl)
5. During Ramadan (all of month) + many other times (Nawafl)

(9) How often do you make Hajj?

1. Never
2. Once
3. Twice
4. Several times, but not yearly
5. Yearly

(10) How often do you make Umrah?

1. Never
2. Once
3. Several times
4. Every year
5. Several times per year

(11) In my life, I experience the presence of Allah/God

1. Definitely true of me
2. Tends to be true
3. Unsure
4. Tends *not* to be true
5. Definitely *not* true

(12) My religious beliefs are what really lie behind my whole approach to life

1. Definitely true of me
2. Tends to be true
3. Unsure
4. Tends *not* to be true
5. Definitely *not* true

(13) I try hard to carry my religion over into all my other dealings in life

1. Definitely true of me
2. Tends to be true
3. Unsure

4. Tends not to be true
5. Definitely not true

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