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Multidimensional religious involvement and tobacco smoking patterns over 9–10 years: A prospective study of middle-aged adults in the United States

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ABSTRACT

This study examined the relationship between multiple dimensions of religious involvement and transitions of tobacco smoking abstinence, persistence, cessation and relapse over 9–10 years of follow-up in a national sample of adults in the United States. Using data provided at baseline and follow-up, participants were categorized as non-smokers, persistent smokers, ex-smokers, and relapsed smokers. Religious involvement over the two time points were categorized into combinations of "high" and "low" involvement within the domains of (a) religious attendance, (b) religious importance, (c) spiritual importance, (d) religious/spiritual comfort seeking, and (e) religious/spiritual decision-making. High levels of religious involvement across five dimensions (religious attendance, religious importance, spiritual importance, religious/spiritual comfort-seeking, and religious/spiritual decision-making) were associated with lower odds of being a persistent smoker or ex-smoker. Religious involvement was not associated with smoking cessation among smokers at baseline. Interventions to increase smoking abstinence may be more effective if they draw on ties to religious and spiritual organizations and beliefs. Meanwhile, religious involvement is unlikely to affect smoking cessation effectiveness.

Tobacco smoking has emerged in the last 50 years as one of the leading causes of morbidity and mortality both in the United States and globally. With the recognition of the effects of smoking on disease processes, the proportion of smokers has declined in the United States since the mid-1950s; the prevalence of adults who were current smokers decreased more than 50 percent since 1965, from 43% to 18% (Holford et al., 2014). During this period, tobacco control efforts in the form of taxation, smoke-free air laws, and public health education have resulted an increased mean life span of approximately 19–20 years and 8 million premature deaths prevented (Holford et al., 2014).

Evidence suggests that religious involvement may provide individuals additional resilience against stressors resulting in lower levels of cigarette smoking (Kinney et al., 2003; Whooley et al., 2002). Using the Alameda County Study data, Strawbridge et al. showed that weekly religious involvement was associated with greater odds of smoking cessation by 1994, among those who reported being smokers in 1965, and drastically lower odds of smoking initiation among those who reported being nonsmokers in 1965 (Strawbridge et al., 2001). In an analysis of data from young adults aged 20–32 years who participated in the Coronary Artery Risk Development in Young Adults (CARDIA) study (1987/1988), those who attended religious services less than once a month or never at baseline, were at 50 percent increased odds of reporting current smoking, compared to those who attended religious services at least once a month (Whooley et al., 2002). Furthermore, nonsmokers who reported lower levels of religious attendance were at an increased odds of smoking initiation at three-year follow-up (Whooley et al., 2002).

However, one limitation of the existing research is the operationalization of religious involvement as solely religious attendance, although the social science literature demonstrates multidimensionality of religiosity (Cruz et al., 2009; Gillum and Holt, 2010; Nicholson et al., 2010; Roth et al., 2011). Religious

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involvement has been categorized in various ways, including "religious beliefs" (the beliefs in the presence of God, one's relationship with God, praying for healing, and frequent praying) as well as the more salient "religious behaviors" (attending services, attending activities, religious readings, religious television, and talking about faith) (Roth et al., 2011). Previous research has indicated that religiosity and spirituality is complex and its dimensions do not necessarily track together (Davison and Jhangri, 2010; Hill and Pargament, 2008; Maselko et al., 2009). For instance, Maselko et al. note that the three dimensions of religious involvement that they used were all associated with the risk of major depressive episodes (MDE); however, religious attendance and existential well-being were protective against MDE, while religious well-being was harmful (Maselko et al., 2009). Different dimensions of religious involvement might influence health differentially. Moreover, existing research has focused on a static view of religious involvement at one time-point that could dilute or misrepresent the relationships between dimensions of religious involvement and health over time.

Thus we examined the relationship between changes in multiple dimensions of religious involvement and transitions in smoking status (i.e., smoking abstinence, persistence, cessation and relapse) over 9–10 years of follow-up in a national sample of adults in the United States. We hypothesized that religious attendance as well as other dimensions of religious involvement would be associated with decreased odds of persistent cigarette smoking.

1. Methods

1.1. Sample

Data from the Midlife in the United States (MIDUS) study, a national multistage probability survey of non-institutionalized, adults sampled at two time points was used. MIDUS I collected data in 1995–6, from 7112 adults aged 20 and 79 years old who recruited either through random digit dialing (RDD) [the general sample], were siblings of some RDD participants, or a part of oversamples of certain metropolitan areas (Brim et al., 2004). MIDUS II was collected 9–10 years later in 2004–5 and comprised of 4974 adults aged 28–84 years old (70% retention rate, adjusted for mortality) (Brim et al., 2004). Detailed information regarding study design, recruitment, enrollment, and longitudinal retention has been previously described (Brim et al., 2004; Radler and Ryff, 2010). There were 25 "new smokers" who started smoking for the first time between baseline and follow-up; these individuals were excluded from the analysis due to this small sample size. Furthermore, we excluded another 453 who were missing information regarding key variables (smoking, age, income, education, race/ethnicity, marital status, employment status). Thus, our analytic sample includes 4496 individuals who answered the smoking behavior questions on the survey at both baseline and follow-up (2035 from general sample, 679 from sibling sample, 1345 from twin sample, 437 from city over-sample).

1.2. Measures

1.2.1. Smoking status

At baseline and follow-up, respondents were asked, "Do you smoke regularly now?" (Response = yes = current smoker at that time point). For this analysis, respondents were categorized into one of four groups: (a) persistent smokers (smokers at baseline and follow-up), (b) ex-smokers (smokers at baseline and non-smokers at follow-up), (c) relapsed smokers (ex-smokers at baseline and smokers at follow-up), and (d) non-smokers (non-smokers/former smokers at baseline and follow-up). Additionally, smokers at baseline were also asked whether they tried to quit smoking between baseline and the follow-up survey administration. Based on a combination of reported regular smoking at baseline and follow-up as well as reported cessation efforts, respondents were categorized as "successful" or "unsuccessful" quitters. These categorizations have been used previously in a study using the MIDUS data (Slopen et al., 2013).

1.2.2. Religious involvement

There were five domains of religious involvement that were asked at both MIDUS I and MIDUS II: (1) religious attendance, (2) religious importance, (3) spiritual importance, (4) religious/spiritual comfort seeking, and (5) religious/spiritual decision-making. Response to each domain were on a 4-point Likert-style response ("National Survey of Midlife Development in the United States (MIDUS I), 1995–1996 – Scales", 2011). To assess religious attendance, respondents were asked, "How often do you usually attend religious or spiritual services?"; response options ranged from "more than once a week" to "never." Religious and spiritual importance were assessed with the questions: "How important is religion in your life?" and "How important is spirituality in your life?"; response options ranged from "very" to "not at all." Religious comfort-seeking was assessed with the question: "When you have problems or difficulties in your family, work, or personal life, how often do you seek comfort through religious or spiritual means, such as praying, meditating, attending a religious or spiritual service, or talking to a religious or spiritual advisor?"; response options ranged from "often" to "never". Finally, religious decision-making was operationalized through a question asking, "When you have decisions to make in your daily life, how often do you ask yourself what your religious or spiritual beliefs suggest you should do?"; response options range from "often" to "never".

Using these individual responses over the two time points, religious involvement variables were created for dimension of religious involvement. First, responses were dichotomized into "high" or "low" categories. Respondents who reported attending religious or spiritual services at least monthly were categorized as having high religious involvement. Those responding to "very" or "somewhat" to the religious importance or spiritual importance question were categorized as placing high levels of importance to religion or spirituality, respectively. Likewise, "often" or "sometimes" responses to the religious/spiritual comfort seeking and religious/spiritual decision-making questions were categorized as high. Then, four-category variables were created for each dimension representing respondents' religious involvement over 9–10 year follow-up: (1) high at baseline and follow-up, (2) high at baseline and low at follow-up, (3) low at baseline and high at follow-up, and (4) low at baseline and follow-up.

1.2.3. Socio-demographic characteristics

Socio-demographic information including age (years, 4 categories:<=34, 35–44, 45–54, 55+), gender (male/female), educational attainment, race/ethnicity (4 categories: non-Hispanic White, non-Hispanic Black, Hispanic, Other), household income (4 categories: <=$25,000, $25,000–44,999, $45,000–69,999, $70,000+), and parental status at baseline (yes/no) was also collected. In addition, combined information relating to employment and partner status (yes/no at each time point) was also collected.

1.2.4. Statistical analyses

Chi-square tests were conducted to evaluate the bivariate relationships between key socio-demographic variables and progression of religious involvement, and patterns in smoking from MIDUS I to MIDUS II. Multinomial logistic regression models

evaluated the relationship between the progression of multiple dimensions of religious involvement and patterns in smoking behavior controlling for socio-demographic characteristics (Reference group = non-smokers). Effect modification by gender and race/ethnicity was examined. Finally, subgroup analyses according to smoking status at baseline were performed. All analyses were conducted using SAS version 9.3 statistical software (SAS Institute Inc., Cary, NC).

2. Results

Table 1 shows socio-demographic characteristics of the study population by smoking category. Persistent smokers, ex-smokers, relapsed smokers and non-smokers were 12.8%, 6.6%, 2%, and 78.7% of the study population respectively. Patterns of smoking status were significantly associated with age, income, education, marital status and employment status (chi-square p-values<0.05). Persistent smokers are more likely to be younger, have lower household income, and have lower levels of education. Smoking status was not associated with gender or race/ethnicity.

Table 2 shows the distribution of religious involvement progression in five domains by smoking status. Smoking behavior patterns were significantly associated with religious attendance, religious importance, religious/spiritual comfort seeking, and religious/spiritual decision-making. However, spiritual importance not associated with smoking behavior (chi-square p-values <0.05). Persistent smokers were significantly less likely to report high religious attendance at baseline (high–high and high–low) but consistently reported high (high–high) religious importance, religious/spiritual comfort seeking and religious/spiritual decision-making. There are no consistent patterns for ex-smokers and relapsed smokers.

Table 3 shows the results of the independent multinomial logistic regression models with odds ratios representing the independent effects of each dimension of religious involvement on smoking patterns across baseline and follow-up periods. For all of the dimensions of religious involvement, high religious involvement was associated with decreased odds of being a persistent smoker compared to a non-smoker, including religious attendance ($OR_{high-high}$ = 0.30, 95% CI: 0.22, 0.41; $OR_{high-low}$ = 0.59, 95% CI: 0.41, 0.85), religious importance ($OR_{high-high}$ = 0.61, 95% CI: 0.47, 0.82), spiritual importance ($OR_{high-high}$ = 0.61, 95% CI: 0.45, 0.82; $OR_{low-high}$ = 0.58, 95% CI: 0.38, 0.88), religious/spiritual comfort seeking ($OR_{high-high}$ = 0.59, 95% CI: 0.46, 0.75), and religious/

Table 1
Demographic characteristics of full sample, and by smoking pattern between baseline and follow-up.

	Analytical sample	Stratified by smoking status				
		Persistent smoker (M1 & M2)	Ex-smoker (smoker M1, non-smoker M2)	Relapsed smoker (ex-smoker M1, smoker M2)	Non-smoker (non-smoker at M1 & M2)	Chi-square
	% (N)	% (N)	% (N)	% (N)	% (N)	*P* value
Sample size (N)	100 (4496)	12.79 (575)	6.61 (297)	1.96 (88)	78.65 (3536)	
Gender[a]						
Female	53.38 (2400)	13.67 (328)	6.29 (151)	1.09 (49)	78.00 (1872)	0.2279
Male	46.62 (2096)	11.78 (247)	6.97 (146)	1.86 (39)	79.39 (1664)	
Age (years)[a]						
<35	19.40 (872)	14.11 (123)	8.14 (71)	3.10 (27)	74.66 (651)	<0.0001
35–44	26.60 (1196)	15.55 (186)	5.85 (70)	2.51 (30)	76.09 (910)	
45–54	25.65 (1153)	14.48 (167)	7.46 (86)	1.65 (19)	76.41 (881)	
≥55	28.36 (1275)	7.76 (99)	5.49 (70)	0.94 (12)	85.80 (1094)	
Annual income ($)[a]						
<25,000	16.86 (758)	16.49 (125)	8.71 (66)	2.37 (18)	72.43 (549)	<0.0001
25,000–44,999	20.44 (919)	13.38 (123)	7.73 (71)	2.07 (19)	76.82 (706)	
45,000–69,999	22.00 (989)	14.46 (143)	6.67 (66)	2.02 (20)	76.85 (760)	
≥70,000	40.70 (1830)	10.05 (184)	5.14 (94)	1.69 (31)	83.11 (1521)	
Education[a]						
<=High school	34.12 (1534)	18.97 (291)	8.67 (133)	2.28 (35)	70.08 (1075)	<0.0001
Some college	30.29 (1362)	14.54 (198)	7.27 (99)	2.35 (32)	75.84 (1033)	
Bachelors degree +	35.59 (1600)	5.38 (86)	4.06 (65)	1.31 (21)	89.25 (1428)	
Race/Ethnicity						
White	91.79 (4127)	12.77 (527)	6.64 (274)	1.96 (81)	91.77 (3245)	0.9254
Black	3.94 (177)	10.73 (19)	6.78 (12)	1.13 (2)	81.36 (144)	
Hispanic	3.07 (138)	15.22 (21)	5.07 (7)	2.17 (3)	77.54 (107)	
Other	1.20 (54)	14.81 (8)	7.41 (4)	3.70 (2)	74.07 (40)	
Marital status[b]						
Married M1 and M2	67.79 (3048)	10.93 (333)	5.81 (177)	1.67 (51)	81.59 (2487)	<0.0001
Single M1 and M2	17.22 (774)	17.57 (136)	9.04 (70)	2.07 (16)	71.32 (552)	
Married M1, single M2	7.32 (329)	15.20 (50)	8.51 (28)	1.82 (6)	74.47 (245)	
Single M1, married M2	7.67 (345)	16.23 (56)	6.38 (22)	4.35 (15)	73.04 (252)	
Employment status[b]						
Working M1 and M2	62.46 (2808)	13.28 (373)	6.70 (188)	1.89 (53)	78.13 (2194)	0.0054
Working M1, not M2	16.24 (730)	13.70 (100)	8.22 (60)	2.47 (18)	75.62 (552)	
Not working M1, working M2	5.03 (226)	12.83 (29)	7.08 (16)	3.54 (8)	76.55 (173)	
Not working M1, not working M2	16.28 (732)	9.97 (73)	4.51 (33)	1.23 (9)	84.29 (617)	
Has 1+ child[a]						
Yes	82.03 (3688)	13.20 (487)	6.43 (237)	1.95 (72)	78.42 (2892)	0.2703
No	17.97 (808)	10.89 (88)	7.43 (60)	1.98 (16)	79.70 (644)	

Notes: Column percents are presented for the full sample; row percents are presented for stratified sample.
[a] Measured at baseline.
[b] M1 = baseline (MIDUS I); M2 = follow-up (MIDUS II).

Table 2
Distribution of religious involvement by smoking pattern.

	Analytical sample	Stratified by smoking status				
		Persistent smoker (M1 and M2)	Ex-smoker (quit between M1 & M2)	Relapsed smoker (ex-smoker M1, smoker M2)	Non-smoker (M1 and M2)[a]	Chi-square *P* value
	% (N)	% (N)	% (N)	% (N)	% (N)	
Religious attendance						
High–High	51.14 (1456)	5.49 (80)	3.98 (58)	1.17 (17)	89.35 (1301)	<0.0001
High–Low	17.32 (493)	10.14 (50)	5.88 (29)	2.64 (13)	81.34 (401)	
Low–High	6.71 (191)	17.28 (33)	8.90 (17)	1.05 (2)	72.77 (139)	
Low–Low	24.83 (707)	16.41 (116)	7.07 (50)	1.98 (14)	74.54 (527)	
Religious importance						
High–High	67.42 (2510)	11.16 (280)	5.90 (148)	1.79 (45)	81.16 (2037)	0.02
High–Low	7.74 (288)	14.93 (43)	8.33 (24)	1.04 (3)	75.69 (218)	
Low–High	6.26 (233)	15.45 (36)	7.30 (17)	2.58 (6)	74.68 (174)	
Low–Low	18.59 (692)	14.88 (103)	7.66 (53)	1.59 (11)	75.87 (525)	
Spiritual importance						
High–High	72.56 (2673)	11.67 (312)	6.62 (177)	1.76 (47)	79.95 (2137)	0.10
High–Low	5.27 (194)	14.95 (29)	8.76 (17)	0.00 (0)	76.29 (148)	
Low–High	10.42 (384)	12.24 (47)	5.99 (23)	2.34 (9)	79.43 (305)	
Low–Low	11.75 (433)	16.40 (71)	6.00 (26)	1.85 (8)	75.75 (328)	
Religious/spiritual comfort seeking						
High–High	54.96 (2046)	10.12 (207)	5.67 (116)	1.56 (32)	82.65 (1691)	<0.0001
High–Low	9.88 (368)	14.13 (52)	7.07 (26)	1.36 (5)	77.45 (285)	
Low–High	9.35 (348)	17.53 (61)	7.47 (26)	2.87 (10)	72.13 (251)	
Low–Low	25.81 (961)	14.78 (142)	7.70 (74)	1.98 (19)	75.55 (726)	
Religious/spiritual decision-making						
High–High	48.41 (1801)	9.94 (179)	5.33 (96)	1.44 (26)	83.29 (1500)	<0.0001
High–Low	10.46 (389)	14.40 (56)	9.25 (36)	2.06 (8)	74.29 (289)	
Low–High	10.81 (402)	13.68 (55)	7.46 (30)	1.99 (8)	76.87 (309)	
Low–Low	30.32 (1128)	15.43 (174)	7.00 (79)	2.13 (24)	75.44 (851)	

Notes: Column per cents are presented for the analytical sample; row per cents are presented for stratified sample.
[a] Non-smokers include both reported never smokers at both time points as well as those reporting smoking regularly prior to the beginning of the first wave of the study.

spiritual decision-making ($OR_{high-high} = 0.58$, 95% CI: 0.45, 0.74). In four of five religious dimensions, high religious involvement at both time points was associated with decreased odds of being an ex-smoker: religious attendance ($OR_{high-high} = 0.51$, 95% CI: 0.34, 0.76), religious importance ($OR_{high-high} = 0.66$, 95% CI: 0.47, 0.93), religious/spiritual comfort seeking ($OR_{high-high} = 0.67$, 95% CI: 0.48, 0.92), and religious/spiritual decision-making ($OR_{high-high} = 0.70$, 95% CI: 0.51, 0.97). There was no effect modification by gender or

Table 3
Multinomial regression models: religious involvement in relation to smoking pattern; adjustment for age, gender, race, education, and income.[a,†]

	Non-smoker	Persistent smoker	Ex-smoker	Relapsed ex-smoker	Wald chi-square
		OR (95% CI)	OR (95% CI)	OR (95% CI)	*P* value
Religious attendance					
High–High	1.00	**0.30 (0.22, 0.41)*****	**0.51 (0.34, 0.76)*****	0.54 (0.26, 1.11)	<0.0001
High–Low	1.00	**0.59 (0.41, 0.85)****	0.80 (0.49, 1.29)	1.23 (0.57, 2.67)	
Low–High	1.00	0.98 (0.63, 1.54)	1.23 (0.68, 2.23)	0.46 (0.10, 2.05)	
Low–Low	1.00	1.00	1.00	1.00	
Religious importance					
High–High	1.00	**0.61 (0.47, 0.79)*****	**0.66 (0.47, 0.93)***	1.03 (0.52, 2.04)	0.0052
High–Low	1.00	0.83 (0.56, 1.25)	0.98 (0.58, 1.63)	0.56 (0.15, 2.04)	
Low–High	1.00	0.91 (0.59, 1.40)	0.88 (0.49, 1.57)	1.45 (0.52, 4.03)	
Low–Low	1.00	1.00	1.00	1.00	
Spiritual importance					
High–High	1.00	**0.61 (0.45, 0.82)****	1.04 (0.67, 1.62)	0.87 (0.40, 1.90)	0.1086
High–Low	1.00	0.84 (0.51, 1.37)	1.38 (0.72, 2.64)	–	
Low–High	1.00	**0.58 (0.38, 0.88)***	0.85 (0.47, 1.54)	1.02 (0.38, 2.71)	
Low–Low	1.00	1.00	1.00	1.00	
Religious/spiritual comfort seeking					
High–High	1.00	**0.58 (0.45, 0.74)*****	**0.67 (0.48, 0.92)***	0.69 (0.38, 1.25)	0.0002
High–Low	1.00	0.93 (0.65, 1.33)	0.89 (0.55, 1.42)	0.68 (0.25, 1.86)	
Low–High	1.00	1.05 (0.74, 1.49)	0.94 (0.58, 1.51)	1.28 (0.58, 2.82)	
Low–Low	1.00	1.00	1.00	1.00	
Religious/spiritual decision-making					
High–High	1.00	**0.57 (0.45, 0.72)*****	**0.70 (0.51, 0.97)***	0.61 (0.34, 1.10)	<0.0001
High–Low	1.00	0.97 (0.69, 1.37)	1.38 (0.90, 2.10)	1.05 (0.46, 2.38)	
Low–High	1.00	0.71 (0.50, 1.00)	0.93 (0.59, 1.45)	0.75 (0.33, 1.70)	
Low–Low	1.00	1.00	1.00	1.00	

[†] $p = 0.05$; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.
[a] All models are adjusted for age (years, 4 categories:<=34, 35–44, 45–54, 55+); gender (male, female); race/ethnicity (4-category: White, Black, Hispanic, Other); income (4 categories, <=$25,000, $25,000–44,999, $45,000–69,999, $70,000+); education (3 categories: less than or equal to high school, some college, bachelor degree +).

Table 4
Multinomial regression model: religious involvement in relation to smoking pattern; adjustment for age, gender, race, education, and income, with simultaneous adjustment.[a,†]

	Non-smoker	Persistent smoker	Ex-smoker	Relapsed ex-smoker
		OR (95% CI)	OR (95% CI)	OR (95% CI)
Religious attendance				
High–High	1.00	**0.25 (0.17, 0.36)*****	**0.49 (0.30, 0.80)*****	0.67 (0.27, 1.65)
High–Low	1.00	**0.50 (0.34, 0.75)****	0.80 (0.48, 1.34)	1.54 (0.63, 3.74)
Low–High	1.00	0.96 (0.60, 1.55)	1.40 (0.75, 2.62)	0.42 (0.09, 1.97)
Low–Low	1.00	1.00	1.00	1.00
Religious importance				
High–High	1.00	1.32 (0.75, 2.31)	0.77 (0.40, 1.48)	2.14 (0.44, 10.43)
High–Low	1.00	0.94 (0.45, 1.98)	0.76 (0.32, 1.81)	1.52 (0.20, 11.43)
Low–High	1.00	1.06 (0.51, 2.17)	1.05 (0.46, 2.38)	4.17 (0.76, 22.78)
Low–Low	1.00	1.00	1.00	1.00
Spiritual importance				
High–High	1.00	0.81 (0.43, 1.54)	0.94 (0.43, 2.03)	1.31 (0.25, 6.81)
High–Low	1.00	0.84 (0.34, 2.03)	0.84 (0.29, 2.47)	–
Low–High	1.00	0.62 (0.30, 1.25)	0.44 (0.17, 1.11)	1.76 (0.33, 9.34)
Low–Low	1.00	1.00	1.00	1.00
Religious/spiritual comfort seeking				
High–High	1.00	0.96 (0.57, 1.61)	0.77 (0.40, 1.48)	0.43 (0.14, 1.27)
High–Low	1.00	1.14 (0.63, 2.07)	0.62 (0.28, 1.35)	0.35 (0.08, 1.47)
Low–High	1.00	1.62 (0.94, 2.79)	1.02 (0.50, 2.10)	0.79 (0.26, 2.47)
Low–Low	1.00	1.00	1.00	1.00
Religious/spiritual decision-making				
High–High	1.00	1.46 (0.91, 2.35)	1.41 (0.74, 2.66)	1.28 (0.44, 3.75)
High–Low	1.00	1.71 (0.99, 2.93)	**2.29 (1.18, 4.44)***	1.62 (0.48, 5.52)
Low–High	1.00	0.98 (0.58, 1.65)	1.07 (0.53, 2.17)	0.80 (0.25, 2.64)
Low–Low	1.00	1.00	1.00	1.00

†p = 0.05; *p < 0.05; **p < 0.01; ***p < 0.001.
[a] This model adjusted for age (years, 4 categories:<=34, 35–44, 45–54, 55+); gender (male, female); race/ethnicity (4-category: White, Black, Hispanic, Other); income (4 categories, <=$25,000, $25,000–44,999, $45,000–69,999, $70,000+); education (3 categories: less than or equal to high school, some college, bachelor degree +).

race/ethnicity.

Table 4 contains the same results as Table 3, but all the dimensions of religious involvement are included in the model simultaneously. Although results are not drastically different and confidence intervals widen considerably, only religious attendance among persistent smokers ($OR_{high-high}$ = 0.25, 95% CI: 0.18, 0.36; $OR_{high-low}$ = 0.49, 95% CI: 0.31, 0.80) and ex-smokers ($OR_{high-high}$ = 0.50, 95% CI: 0.34, 0.75) as well as religious decision-making among ex-smokers ($OR_{high-low}$ = 2.29, 95% CI: 1.18, 4.44) remained statistically significant.

Table 5 shows the relationship between changes of religious involvement and smoking cessation between baseline and follow-up for regular smokers at baseline who attempted to quit. There were no significant relationships between any of the five dimensions of religious involvement and smoking cessation (p-values > 0.05). Although the overall association was not significant, reporting consistently high levels of religious attendance tended to be associated with increased odds of an unsuccessful quit attempts ($OR_{high-high}$ = 1.75, 95% CI: 1.01, 3.03).

Table 6 contains similar results to Table 5, but with all five dimensions of religious involvement simultaneously controlled. Overall, there were no significant relationships between any of the five dimensions of religious involvement and smoking cessation (p-values > 0.05). Likewise, reporting consistently high levels of religious attendance tended to be associated with increased odds of an unsuccessful quit attempts ($OR_{high-high}$ = 1.90, 95% CI: 1.00, 3.58).

The results showed no indication of effect modification by gender or race/ethnicity and so are not shown. Sensitivity analyses considering 3-category religious involvement were conducted and did not differ drastically from the results presented. In subgroup analyses among those reporting smoking at each time point (current and ex-smokers at MIDUS I and MIDUS II), cigarette consumption is largely the same across levels of religious involvement.

3. Discussion

In this national probability sample of adults in the United States followed over 9–10 years, high levels of religious involvement across five dimensions (religious attendance, religious importance, spiritual importance, religious/spiritual comfort-seeking, and religious/spiritual decision-making) were associated with lower odds of being a persistent smoker or ex-smoker, even after adjusting for age, gender, race/ethnicity, education, and income. Meanwhile, those same dimensions of religious involvement were not associated with successful smoking cessation. These results indicate that people with higher levels of religious involvement are less likely to be smokers at all, including at the time of MIDUS I data collection.

These results are consistent with previous studies investigating the relationship between religiosity and tobacco smoking, although most studies evaluated religious involvement using one-dimensional measures. Previous studies have indicated that low levels of religious attendance was associated with increased odds of current smoking, adjusting for various potential confounders (Mowery et al., 2000; Whooley et al., 2002). Further, there is specific evidence of the association between religious involvement and lower prevalence of smoking initiation during adolescence, which would affect the distribution of individuals into baseline smoking categories (reported non-smokers vs. former/regular smokers at MIDUS I) (Ellickson et al., 2003; Salas-Wright et al., 2012; Wallace, 1998; Wallace and Forman, 1998; Wallace and Muroff, 2002; Wallace and Williams, 1997).

Adolescence and early adulthood has been identified as a sensitive period for the development of tobacco dependence/addiction (Baker et al., 2004; Mowery et al., 2000; Muthén and Muthén, 2000). If tobacco smoking has not been initiated by the end of adolescence, the likelihood of tobacco dependence is quite low. In cross-sectional data, the overwhelming majority (90 percent) of adults who smoke started by the time they turned 21 and 50

Table 5
Odds of unsuccessful smoking cessation among smokers who attempted to quit between baseline and follow-up: adjustment for age, gender, race, education, and income.[a]

	Quit between M1 and M2 (non-smoker at M2)[b] N = 297	Unsuccessful quit attempt between M1 and M2[b] N = 387	Wald chi-square *P* value
		OR (95% CI)	
Religious attendance			
High–High	1.00	**1.75 (1.01, 3.03)***	0.2519
High–Low	1.00	1.20 (0.65, 2.22)	
Low–High	1.00	1.21 (0.57, 2.54)	
Low–Low	1.00	1.00	
Religious importance			
High–High	1.00	1.02 (0.65, 1.60)	0.9998
High–Low	1.00	1.00 (0.52, 1.95)	
Low–High	1.00	1.02 (0.49, 2.13)	
Low–Low	1.00	1.00	
Spiritual importance			
High–High	1.00	1.52 (0.88, 2.63)	0.4668
High–Low	1.00	1.56 (0.62, 3.65)	
Low–High	1.00	1.26 (0.57, 2.65)	
Low–Low	1.00	1.00	
Religious/spiritual comfort seeking			
High–High	1.00	0.98 (0.64, 1.49)	0.8362
High–Low	1.00	0.82 (0.45, 1.50)	
Low–High	1.00	0.81 (0.45, 1.48)	
Low–Low	1.00	1.00	
Religious/spiritual decision-making			
High–High	1.00	1.23 (0.81, 1.86)	0.6286
High–Low	1.00	1.39 (0.79, 2.44)	
Low–High	1.00	1.25 (0.71, 2.22)	
Low–Low	1.00	1.00	

*p < 0.05; **p < 0.01; ***p < 0.001.
[a] All models are adjusted for age (years, 4 categories:<=34, 35–44, 45–54, 55+); gender (male, female); race/ethnicity (4-category: White, Black, Hispanic, Other); income (4 categories, <=$25,000, $25,000–44,999, $45,000–69,999, $70,000+); education (3 categories: less than or equal to high school, some college, bachelor degree +).
[b] M1 = baseline (MIDUS I); M2 = follow-up (MIDUS II).

Table 6
Odds of unsuccessful smoking cessation among smokers who attempted to quit between baseline and follow-up: adjustment for age, gender, race, education, and income, with simultaneous adjustment.[a]

	Quit between M1 and M2 (non-smoker at M2)[b] N = 297	Unsuccessful quit attempt between M1 and M2[b] N = 387
		OR (95% CI)
Religious attendance		
High–High	1.00	**1.90 (1.00, 3.58)***
High–Low	1.00	1.44 (0.72, 2.89)
Low–High	1.00	1.46 (0.65, 3.30)
Low–Low	1.00	1.00
Religious importance		
High–High	1.00	0.48 (0.20, 1.17)
High–Low	1.00	0.48 (0.13, 1.74)
Low–High	1.00	0.94 (0.30, 2.93)
Low–Low	1.00	1.00
Spiritual importance		
High–High	1.00	1.51 (0.88, 2.63)
High–Low	1.00	2.01 (0.39, 10.33)
Low–High	1.00	0.92 (0.27, 3.21)
Low–Low	1.00	1.00
Religious/spiritual comfort seeking		
High–High	1.00	0.64 (0.26, 1.58)
High–Low	1.00	0.42 (0.15, 1.19)
Low–High	1.00	0.50 (0.20, 1.30)
Low–Low	1.00	1.00
Religious/spiritual decision-making		
High–High	1.00	1.24 (0.54, 2.87)
High–Low	1.00	1.62 (0.68, 3.90)
Low–High	1.00	1.41 (0.56, 3.55)
Low–Low	1.00	1.00

*p < 0.05; **p < 0.01; ***p < 0.001.
[a] All models are adjusted for age (years, 4 categories:<=34, 35–44, 45–54, 55+); gender (male, female); race/ethnicity (4-category: White, Black, Hispanic, Other); income (4 categories, <=$25,000, $25,000–44,999, $45,000–69,999, $70,000+); education (3 categories: less than or equal to high school, some college, bachelor degree +).
[b] M1 = baseline (MIDUS I); M2 = follow-up (MIDUS II).

percent were regular smokers by the time they were 18 years old (Mowery et al., 2000). Looking at age-related trajectories of tobacco smoking behavior, individuals who start smoking earlier (at age 12–13) have a riskier smoking trajectory compared to that of those who started smoking after age 15; those who started smoking earlier experience a steep rise to heavy smoking, while those who started smoking later smoked much more moderately (Baker et al., 2004). Furthermore, findings in animal and human studies provide evidence that tobacco smoking during adolescence may fundamentally change the development of the central nervous system, potentially pointing at an etiologic, biological mechanism for tobacco dependence patterns (Baker et al., 2004; Levin et al., 2007; Levin et al., 2003).

If causal, religious involvement may be inversely associated with tobacco smoking by providing individuals with resilience against stress. Among adults, Ellison et al. showed that relationships between belief in eternal life and psychological wellbeing/distress were strengthened among those with health, financial, and work stressors, independent of church-based social support, family contact, self-esteem, or feelings of mastery (Ellison et al., 2001). Among young adults (18–25 years) coming out of the child welfare system, religious involvement (conceptualized as external resilience) was closely related to an internal resilience measure, the Connor-Davidson Resilience Scale (Connor and Davidson, 2003; Goldstein et al., 2013). High levels of internal resilience were inversely associated with current smoking and nicotine dependence. Moreover, they were also associated with reduced levels of depression at higher levels of sexual abuse and within the context of broad physical, sexual, and emotional abuse (Goldstein et al., 2013). Individuals, whether they are already smokers or not, may draw instrumental and/or emotional support from being religiously involved, increasing resilience to tobacco smoking triggers, which is reflected in smoking behavior (i.e., initiation, relapse, quitting).

Consequently, it is likely that religious involvement works through stress and resilience pathways to reduce likelihood tobacco smoking during adolescence and young adulthood, which translates to a lower likelihood of smoking and nicotine dependence throughout the life course. More specifically, it is likely that religious involvement at earlier time points is associated with the subsequent progression of religious involvement, such that those who have high levels of religious involvement at baseline and follow-up are more likely to have had higher levels of religious involvement during adolescence and young adulthood. This would reduce their likelihood of ever being a smoker in the first place, which is consistent with the results of this study among persistent smokers in this study. Moreover, individuals who have already started smoking regularly by early to middle adulthood ("smokers" or "ex-smokers" at MIDUS I baseline) may draw support from religious involvement, such that they may be more likely to transition to non-smoking.

At the same time, there may be some reverse causation at work; religious involvement during adolescence may prevent tobacco smoking initiation during sensitive periods, setting the general trajectory over time for both religious involvement and smoking. In

these data, this may explain why there is minimal association between religious involvement and successful quit behavior. In addition, we cannot rule out that common, prior factors may drive both religious involvement and tobacco smoking over time. For instance, individuals who grew up in more traditional, restrictive households may be more likely to have participated in religious activity through childhood and adolescence (increasing odds of being religiously involved in later life) as well as less likely to have opportunity to start smoking during adolescence and young adulthood (missing the sensitive period for tobacco addiction).

This sample was designed to study mid-life and restricted to aged 20–74 years at baseline, so information about behavior during adolescence and early adulthood is limited in this study. It cannot be assumed that the religion dimension-specific associations seen in this data set will be the same for younger samples, for instance, in the CARDIA study population. Furthermore, the samples of minority race/ethnicities were too small to detect potential effect modification by those groupings. In addition, there was no data collected in the 9–10 years between baseline (M1) and follow-up (M2) and time-varying confounders were not considered. For instance, there is no data on spousal smoking or religious involvement, which could have appreciable impact on participant involvement. In addition, with 70% retention rate, adjusted for mortality, those participants lost to follow-up may differ from significantly from the study population with regard to tobacco smoking behavior and/or religious involvement, potentially biasing results.

However, the present study was able to expand on the literature regarding the relationship between varying dimensions of religious involvement and health-protective behavior; the association between religiosity and health is robust, persisting across different dimensions of religious involvement. A one-dimensional conceptualization of religious involvement as religious attendance would neglect much of the story, perhaps entangling potential health-protective effects of congregational (social) participation with internal (psychological) mechanisms. Religiosity may take different forms, but the beneficial effects are likely to be a result of its relationship to internal resiliency. The longitudinal approach of this study allowed the investigation of longitudinal patterns of both religious involvement and of tobacco smoking, allowing the disentanglement between the potential influences of religious involvement prior to baseline from characteristics over the decade of follow-up, resulting in groups such as “persistent smokers” and “ex-smokers”.

This study is of particular relevance to public health program designers seeking to reduce tobacco smoking. These results would suggest that encouraging religious involvement later on in life is unlikely to have any effect on smoking cessation effectiveness. While religious involvement prior to or during sensitive periods for smoking initiation (i.e., adolescence/young adulthood) may increase the efficacy of short- and long-term smoking abstinence efforts, it is beyond the scope of this study. Further study is warranted to fully understand the relationship between religious involvement over time and smoking patterns, especially related to racial/ethnic differences.

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