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Smoking in the temple of the holy spirit? Geographic location matters☆

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ABSTRACT

Smoking at a young age poses significant risks to one's health and is linked with a wide range of deviant conducts. While prior research has looked into the ways in which individual religious characteristics may influence smoking, much less is known about how the overall religious context in which individuals are embedded may affect smoking during adolescence and early adulthood. In this study, multilevel regression analyses were used on nationally representative panel data to explore this understudied area. The results suggest that when a county has higher population share of conservative Protestants, youth living there are more likely to smoke. A similar robust relationship is also found for county-level mainline Protestant population share and smoking. By simultaneously examining both the individual and contextual religious effects on smoking, this study contributes to a renewed, more comprehensive understanding of an important public health and youth deviance issue.

1. Introduction

Smoking at a young age poses significant risks to one's well-being. According to studies conducted by the Centers for Disease Control and Prevention (Elders et al., 1994), smoking during adolescence and early adulthood may delay lung growth, increase the risk of having lung cancer, and is associated with other high risk behaviors, such as using cocaine and engaging in unprotected sex. What is even more troubling is the long-term, societal toll of youth smoking—a recent report from the U.S. Department of Health and Human Services warns that if current youth smoking rate holds, 5.6 million American minors, or about 1 out of every 13 Americans aged 17 or younger, will die prematurely due to smoking-related illnesses (U.S. Department of Health and Human Services, 2014).

Historically, tobacco smoking has never been fully detached from a myriad of religious factors. However, outside the hodgepodge of historical archives with differing records about the relationship between religion and tobacco smoking, little is known by social and health scientists about the role(s) that religion plays in smoking. As a major social institution, religion has the capabilities of efficiently promoting moral values on substances and implementing the resulting behavioral norms among followers (e.g., Adamczyk and Palmer, 2008; Desmond et al., 2011).

To better understand the relationship between religion and smoking, one needs to realize that there is no single, definite answer as religious views on smoking may vary significantly between different religious groups. For instance, while the American indigenous peoples smoke through ceremonial pipes for religious purposes, the Mormons completely abstain from any form of tobacco use (Brigham, 2002). Striking a balance in between are the Catholics whose church leaders may frown upon the excessive use of tobacco, while voicing less concern towards the moderate use (e.g., The Catechism, 1992).

Besides the existing vacancy in the study of religion and smoking, what prior research has not adequately discussed is the contextual impact of those religious views on individual smoking behaviors. In other words, when a religious group constitutes a large share of the population in a geographic area, to what extent would the religious values and norms on smoking from that religion influence the smoking behaviors of residents in the whole community? Perhaps more importantly, what may happen to residents whose religious identity and values on smoking differ from the major religious group in the local area? Would their smoking behavior eventually resemble that of the dominant religious group?

As we will discuss in more detail in the literature review section below, the civic community theory suggests that while some religious denominations, such as the Catholics and mainline Protestants, encourage social engagement and community investment, other religious denominations, such as the conservative Protestants, focus more on

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religious, other-worldly matters (Beyerlein and Hipp, 2005). Consequently, areas with a significant presence of those more socially minded denominations tend to develop more positive social environment leading to more desirable outcomes including better health and lower crime rates. In contrast, perhaps due to a lack of social investment, areas with more presence of conservative Protestants tend to have run-down environment associated with less desirable individual and socioeconomic outcomes (e.g., Blanchard et al., 2008). Will such patterns between religious contexts and behavioral outcomes also hold for youth smoking? And will adolescents and young adults living in conservative Protestant counties be more likely to smoke compared to peers living elsewhere?

These questions echo what the founders in sociology have highlighted in their classic works—religious values on important issues, such as social integration and work ethics, are far from being random individual thoughts and practices. Rather, as a large group of people who endorse those values interact with each other over time, those values become collectively meaningful, socially significant, and may even systematically predict important social outcomes, such as suicide rates and economic prosperity, for the entire community (Durkheim, 1897; Weber, 1904). When it comes to smoking, it might be possible that when a religion has a large presence in a local area, its members are more likely to be seen and heard in daily social interactions in that community. Residents from other (non)religious groups are more likely to come into contact with followers from that large religious group through going to the same school, working in the same place, living in the same neighborhood, or even sharing the same relatives. Eventually, the attitudes and behaviors regarding smoking may spread from the focal religious group to other (non)religious groups and become the prevailing norms and values in the broader community.

Nevertheless, the paucity of research on macro-level religious context has kept us from fully understanding the religious contextual impacts on smoking—one of the health behaviors that bears long term impacts on a variety of life outcomes, especially for the youth. To fill in this gap left by prior research, this study employs multilevel modeling on merged data from nationally representative samples to comprehensively assess the relationship between religious context and smoking among adolescents and young adults. Doing so contributes to bridging classic sociological perspectives on religion with some of the most pressing public health issues.

2. Literature review

2.1. Religion and smoking

Most prior research agrees that stronger individual religiosity may protect adolescents and young adults from substance use behaviors through a variety of channels, such as establishing positive role models, subjecting one to more effective social control, and promoting religious values which discourage substance use (e.g., Adamczyk and Palmer, 2008; Desmond et al., 2011). Specifically when it comes to smoking tobacco, past studies suggest that various aspects of individual religiosity exert robust and inhibitive effects on smoking even after controlling for important covariates, such as attitudes toward substance use, psychological well-being, and peer characteristics (e.g., Alexander et al., 2016; Ford and Hill, 2012; Good and Willoughby, 2014; Nonnemaker et al., 2006).

Compared to research at the individual level, much less research has been conducted to study how the overall religious context of a geographical area may influence youth smoking behaviors. Measuring religious context as aggregated school-level religiosity, Wallace et al. (2007) find that higher school-level religiosity is initially associated with less frequent smoking among high school seniors. However, this religious contextual effect is explained when individual-level religiosity is considered. Using the same religious contextual measure but expanding samples to adolescents from more age categories, Bahr and Hoffmann (2008) find a robust and inhibitive religious contextual effect on smoking frequency in a nationally representative sample and a sample of Utah adolescents. Differing from the prior research, Mellor and Freeborn (2011) measure religious context as religious density, i.e., the percentage of residents in a county who share the same religious identity with the survey respondent. Despite the fact that a negative relationship between individual-level religiosity and smoking exists as expected, no robust effect can be established between religious density and smoking.

Although prior research has contributed to our understanding of the multilevel effects of religion on smoking, several problems have emerged. First of all, prior research on religious context and smoking has yet to fully assess the *multilevel* nature of religious context. For instance, in Wallace et al. (2007)'s as well as Bahr and Hoffmann (2008)'s studies, religious context is only measured as school-level religiosity. Nevertheless, whereas schools are small aggregate units that are limited in structural impact, macro-level religious context, such as the overall religiosity or population share of different religious groups at county, state, or national level, may create a broader religious moral community reinforcing or weakening individual religious effects on important behavioral outcomes (Stark, 1996). What's more, macro-level religious context may also affect the ways social capital is organized leading to lower or higher collective efficacy in a community (Beyerlein and Hipp, 2005; Putnam, 2000). Prior research measuring religious context at the macro level has demonstrated that macro-level religious context may influence various important life outcomes, such as youth delinquency (Regnerus, 2003), gambling problems (Eitle, 2011), and mortality rates (Blanchard et al., 2008).

On the other hand, for the few research on smoking that measures religious context at the macro-level (e.g., Mellor and Freeborn, 2011), *micro-level* religious context, such as the religious characteristics of one's social network, which may indicate the extent to which one is integrated into a religious moral community, is not taken into consideration. However, prior research has shown that the interpersonal aspect of religious context matters as individuals living in highly religious areas may be socially isolated diminishing the contextual influence from religion (Rivera et al., 2018). By contrast, individuals living in less religious areas may still find ways to actively interact with their co-religionists forming a “lonely” yet cohesive religious moral community at the micro level (Olson, 2008; Tittle and Welch, 1983).

In addition to not being able to fully assess the multilevel nature of religious context, prior studies also tend to neglect the fact that religious context is *heterogeneous* and it is thus important to examine what kind of religion occupies a given religious context. One may expect that besides religious differences, when it comes to mundane matters, such as social integration, individualism, and work ethics, one religious group, such as the Protestants, may hold quite different values from another religious group, for instance the Catholics (Durkheim, 1897; Weber, 1904). When a religious group with those unique values accounts for a large share of local population, is it possible that those values would spread from this religious group to influence the broader community? However, because of measuring religious context as aggregated religiosity, such as mean religious service attendance frequency, prior research (e.g., Bahr and Hoffmann, 2008; Wallace et al., 2007) is unable to capture the cultural variations between religious contexts and the resulting social implications.

2.2. Religion, civic community, and smoking

One of the theories that looks into the contextual effects of religion is the civic community theory. According to the civic community theory, different religious groups may produce different communal outcomes due to various cultural values they hold toward important issues, such as civic engagement and intergroup relations (Beyerlein and Hipp, 2005). The conservative Protestants tend to believe that social ills are primarily personal ills which warrants religious redemptions

rather than social, secular interventions. Consistent with such a cultural value, in conservative Protestant communities more efforts are made to increase personal religious devotions for other-worldly bliss, while less investment are made in social infrastructures and resources for this-worldly betterment.

When it comes to smoking, one may expect that when conservative Protestant cultural values that prioritize individual religiosity over this-worldly betterment dominate a community, the community may develop less desirable environmental characteristics conducive to smoking. For instance, there would be less funding to support community-level anti-smoking efforts, there might be fewer public health professionals actively involved in anti-smoking campaigns, and possibly a resulting lower level of public awareness of the dangers of smoking, or perhaps the overall socioeconomic environment might be more impoverished which tends to be associated with higher smoking rates. Therefore, we hypothesize that:

Hypothesis 1. There is a *positive* relationship between *county-level conservative Protestant population share* and tobacco smoking.

The above hypothetical prediction of the relationship between conservative Protestant religious context and smoking is not without empirical support. Prior research using the civic community theory has found empirical evidence supporting the above theoretical rationale—areas with higher population share of conservative Protestants tend to fare worse on mortality rates (Blanchard et al., 2008) and violent crime rates (Desmond et al., 2010). These study results may suggest that communities with a significant presence of conservative Protestants might have less desirable social infrastructures and development contributing to a variety of negative outcomes.

In contrast, according to the civic community theory, Catholics and mainline Protestants tend to perceive social ills as social rather than personal moral problems. Thus, more social instead of religious interventions should be made to find the solutions. For instance, in his encyclical, Pope John Paul II emphasized the importance of effective social interventions, such as equitable economic development, in alleviating the sufferings of the poor and vulnerable (Pope John Paul II, 1991). Resulting from such a cultural focus on this-worldly interests and civic engagement, Catholics and mainline Protestants also highly value bridging social capital—a form of social capital that unites rather than divides a community (Beyerlein and Hipp, 2005; Putnam, 2000). As a result, when social problems emerge, communities with more bridging capital are more efficient in producing collaborations between different groups to collectively resolve those problems, which leads to better outcomes for community residents.

When it comes to smoking, one may expect that when a community is suffused with cultural values promoting social investment and community collaborations—the kind of values endorsed by the Catholics and mainline Protestants, more public spending may go to social programs aiming to prevent and treat smoking, more collaborations might be established between societal actors to collectively combat smoking, and possibly a resulting higher level of public awareness of the dangers of smoking. Therefore, we hypothesize that:

Hypothesis 2. There is a *negative* relationship between *county-level mainline Protestant population share* and tobacco smoking.

Hypothesis 3. There is a *negative* relationship between *county-level Catholic population share* and tobacco smoking.

Prior studies have found empirical evidence suggesting a positive social influence of Catholic or mainline Protestant religious context on a variety of social outcomes. For instance, areas with a higher population share of Catholics or mainline Protestants tend to have lower mortality rates (Beyerlein and Hipp, 2005) and lower violent crime rates (Ulmer and Harris, 2013). These results may suggest that areas with higher population share of Catholics or mainline Protestants tend to develop more positive social environment conducive to desirable individual and communal outcomes.

3. Methodology

3.1. Data

The datasets used for this study come from wave 2 and wave 3 of the National Study of Youth and Religion (NSYR). The major purpose of the NSYR is to explore the religious and spiritual life of America's youth as well as their political, social, and cultural attitudes as they transition from adolescence into adulthood (Smith, 2008; Smith and Pearce, 2003, 2005). We omitted the wave 1 of NSYR because wave 1 was conducted in 2003, when the respondents were aged 13–17, an age cohort for whom the sale of tobacco is prohibited. Wave 2 of NSYR followed the same respondents in 2005 when respondents aged between 16 and 20, and wave 3 repeated the follow-up between 2007 and 2008 when respondents aged between 17 and 24.

The NSYR is a nationally representative telephone survey of 3,290 youth across 50 states, including Alaska and Hawaii. To maximize representativeness, the random-digit-dial (RDD) sampling method was employed, which produced random household telephone numbers representing all 50 U.S. states and the District of Columbia. Those telephone numbers are composed of listed, unlisted, and not-yet-listed numbers. To randomize responses, youth who had the most recent birthday and had been living in the household for at least six months of the year were selected to answer survey questions. Compared to the traditional school-based survey method, the RDD sampling method may further improve the representativeness of youth by allowing the researchers to reach out to youth who were home-schooled, drop-outs, or frequently absent from school (Smith, 2008; Smith and Pearce, 2003, 2005).

With the permission of the principal investigators of NSYR, the NSYR's individual-level data were merged with county-level U.S. Census 2000 and the county-level data in the Religious Congregations and Membership Study (RCMS) 2000 to enable hierarchical modeling. The RCMS contains data on most religious denominations providing us with important religious contextual measures, such as rates of adherence per 1,000 population in a county for all denominations (Grammich et al., 2012). The US Census contains important demographic and socioeconomic measurements for all counties where the respondents of NSYR reside.

3.2. Measurement

The dependent variable, frequency of tobacco smoking, is asked in the wave 2 and 3 of the NSYR by a question: “in the last year, how often, if at all, do you smoke cigarettes”. Respondents chose from seven options including “never, a few times a year, about once a month, a few times a month, about once a week, a few times a week, and once a day or more”. Due to a large proportion of respondents who had never smoked—71.36% in wave 2 and 66.56% in wave 3, we have recoded frequency of smoking into a binary variable with 1 = ever smoked and 0 = otherwise.

Our key independent variables come from the RCMS 2000 and are matched with the individual-level NSYR. These independent variables measure the rates of adherence per 1,000 county population for three major religious denominations—conservative Protestant, mainline Protestant, and Catholic. We choose these three religious denominations based on the civic community theory and prior literature which suggests that these three religious denominations are often associated with a variety of important individual and social outcomes, such as gambling problems, family formation, and self-rated health (Eitle, 2011; Huijts and Kraaykamp, 2011).

A host of variables at both individual- and county-level are adopted as control variables. We control for basic demographic characteristics: gender, race (white or non-white), age, years of education, and region

of residence (the South, Midwest, Northeast, and West). For individual-level religious characteristics, we control for the youth respondents' religious service attendance frequency, frequency of reading religious scriptures alone, frequency of praying alone, and importance of religion. The question for religious service attendance frequency is "about how often do you usually attend religious services?" The response categories are 0 = never, 1 = a few times a year, 2 = many times a year, 3 = once a month, 4 = 2–3 times a month, 5 = once a week, 6 = more than once a week. The question for the frequency of reading religious scriptures alone is "how often, if ever, do you read from the scriptures to yourself alone?" The response categories range from 1 = never to 7 = many times a day. The question for frequency of praying alone is "how often, if ever, do you pray by yourself alone?" The response categories are coded in the same way as reading scripture alone. The question for importance of religion (salience) is "how important or unimportant is religious faith in shaping how you live your daily life?" The response categories are 1 = not important at all, 2 = not very important, 3 = somewhat important, 4 = very important, and 5 = extremely important.

Controlling for religious affiliations is critical for multilevel analyses that try to infer about the impact of religious compositions. For example, say that we find people from counties with a greater population share of conservative Protestants are more likely to smoke. This may be caused by two distinct mechanisms: contextual religious influence works on individuals' smoking behavior—a phenomenon we are motivated to discover; or, it is more likely to find a conservative Protestant in places with a greater population share of conservative Protestants. If being a conservative Protestant is associated with more smoking (an individual-level phenomenon), then the seemingly direct impact of religious context is only a proxy for the aggregated individual religious identity effect. To avoid this problem, we use dichotomous variables to control for the following individual religious affiliations: conservative Protestant, mainline Protestant, Black Protestant, Catholic, Jewish, Mormon, other religions, indeterminate, and not religious.

Prior research has shown that peer groups play an important role in youth health and health behaviors (West, 1997). Considering the importance of peers during adolescence and early adulthood, we control for peer characteristics that may influence youth smoking behavior. These variables include the number of friends with similar religious beliefs as the respondent, the number of friends from the same religious group as the respondent, number of irreligious friends, and number of friends doing drugs. In addition to peers, we also control for a host of parent variables to better capture the unique life stage that our research subjects went through which include parent respondent income, marital status of the parent respondent, and mother-child closeness (1 = not close at all … 6 = extremely close).

Finally, informed by various theories on the relationship between social context and behavioral outcomes (Leventhal et al., 2009), we take county-level variables into consideration. These county-level control variables include proportion of adults 25 and above with a four-year college degree, median household income, poverty rates, proportion of single mother household, residential stability (proportion of residents who have not moved in 5 years), urbanization, proportion male, proportion African Americans, and proportion of the adult males employed in six major industries (service, retailing, farming, construction, manufacturing, and professional). These county-level variables are taken from the U.S. Census 2000 and merged with the individual-level NSYR data.

Because a large quantity of the covariates invites the "curse of dimensionality", we conducted principal component analysis to extract the first principal components that together account for over 70% of the variance as the proxy for these covariates in the main analyses. Principal component analysis and its extracted components were done for religiosity variables, peer characteristics, and county-level socioeconomic environment because these variables have shown a high level of post-hoc internal reliability to satisfy the reduction of dimensions by few indicators.

3.3. Statistical analysis

We employ multilevel modeling to fit the data under the proposed theoretical framework. One significant feature of research on religion's cultural influence on individual behaviors is that the magnitude and direction of such influence may differ across different religious denominations, regional units, or broader cultural environments. Thus, individuals may form clusters with auto-correlated characteristics among themselves. In such scenario, an important assumption of ordinary least-square regression—independent and identical distribution—is violated. Fortunately, multilevel models allow parameters at individual-level to freely vary and cluster at a higher measurement-level which effectively corrects the inflated standard errors.

The second advantage pertains to the model's capability of eliminating endogeneity that occurs due to heterogeneous individual background. One can theoretically contend that some people are more likely to be affected by county-level religious population share and smoke more simply because it is part of their "nature" to be addicted. With wave indicator included in the model where individuals' smoking intercepts vary across counties, we can be more confident to claim that this change in smoking is not caused by a heterogeneous between-person difference in the proclivities for smoking. For *i*th individual residing in *j*th county nested in the *k* region during the *t*th wave, a full multilevel model is:

$$link(\pi_{tijr}) = \beta_0 + \boldsymbol{\beta}_1 \boldsymbol{X}_{tijk} + \beta_2 pop.\ share_{jk} + \boldsymbol{\beta}_3 \boldsymbol{\Lambda}_{jk} + u_{.ijk} + u_{.jk} + u_{.k} \quad (1)$$

In equation (1), X is a vector of individual-level covariates, while capital Lambda represents a vector of county-level covariates. The errors of the model are decomposed into three components as a result of randomizing the intercepts at each analytic level (Nakagawa and Schielzeth, 2013). The lowest level (i.e., survey wave) residual is not shown because it has the distribution-specific variance of the logit function, which is π^2/3. u_(.ijk) is the variance at respondent-level, u_(.jk) is the variance at county-level, and u_(.k) represents the region-level variance.

Before performing the main analyses, multiple imputation was conducted to handle the missing data by creating five additional samples for a completed dataset based on the chained multiple imputation method, which is preferred in large sample with missing values across several variables of different types (Azur et al., 2011). To be cautious, we intentionally avoided imputing several variables that we consider as must have only one rigid value instead of an estimated value, such as gender, race, and any county-level information. Analyses were conducted in the R environment with "mice" package for multiple imputation (Buuren and Groothius-Oudshoorn, 2011) and "lme4" package for generalized logistic hierarchical modeling (Bates et al., 2015).

4. Results

Table 1 provides the descriptive statistics of all variables. Between-subject standard deviation describes the variation of an indicator among all respondents. Since the vast majority of the respondents had never smoked, we combine categories in the smoking variable into a dichotomy of "never smoked" and "smoked" for logistic regression. The average logged county population share of conservative Protestants is 4.69. Between-subject standard deviation of conservative Protestant population share is 0.90. For the logged county population share of mainline Protestants, the mean is 4.39 and standard deviation is 0.66. In the formal analyses, we categorize most continuous variables including county-level religious population share and the principal components into four ordinal quartiles (cut off by 25th percentile, median, and the 75th percentile) as an effort to preserve the potential non-linear trend in distribution.

Table 1
Descriptive statistics.

	N	Mean (%)	S.D. between subjects	Range
Dependent variable				
Smoking frequency	5108			1,7
Never		69%		
A few times a year		5%		
Once a month		1.5%		
A few times a month		2.6%		
Once a week		1.5%		
A few times a week		3.8%		
Once a day or more		16.7%		
Key independent variables (logged)				
Conservative Prot. per 1,000 county population	5063	4.69	.90	.32, 6.88
Mainline Prot. per 1,000 county population	5065	4.39	.66	.43, 6.41
Catholics per 1,000 county population	5039	4.85	1.12	−1.12, 6.79
Individual-level religious characteristics				
Religious service attendance	5125	2.28	2.00	0,6
Importance of religion	5122	3.23	1.18	1,5
Reading scriptures alone	5097	2.24	1.48	1, 7
Praying alone	5101	3.92	1.92	1, 7
Conservative Protestant	5128	27%	.41	0, 1
Mainline Protestant	5128	9%	.25	0, 1
Black Protestant	5128	7%	.24	0, 1
Catholic	5182	18%	.36	0, 1
Jewish	5128	3%	.18	0, 1
Mormon	5128	2%	.14	0, 1
Not religious	5128	21%	.37	0, 1
Other religion	5128	2.5%	.14	0, 1
Individual-level demographic characteristics				
Female	6740	49.5%	.50	0, 1
White	6740	66%	.47	0, 1
Age	5136	18.8	1.5	16,24
Years of education	5105	13.1	2.55	0,19
Number of friends with similar religious beliefs	4899	2.95	1.42	0, 5
Number of friends from the same religious group	5004	.90	1.26	0, 5
Number of friends not religious	4908	1.28	1.35	0, 5
Number of friends doing drugs	5008	1.76	1.54	0, 5
Parent income	6328	5.91	2.93	1, 11
Parent married	5125	.68	.47	0, 1
Mother closeness	4866	2.06	.92	1, 6
County-level characteristics (logged)				
Prop. age 25 + adults with a college degree	5066	−1.93	.38	-.36, −1.0
Median household income	5065	10.64	.23	9.71, 11.33
Poverty rates	5065	−2.18	.43	−3.85, −6.76
Prop. single mother household	5065	.07	.02	.02, .19
Residential stability	5065	-.64	.13	−1.17, −.29
Urbanization	5065	-.31	.41	-.41, 0
Prop. male	5065	-.71	.02	-.85, −.50
Prop. black	5065	−2.84	1.47	−8.88, −.17
Prop. adult male in service	5065	−3.5	.19	−4.54, −2.65
Prop. adult male in retailing	5065	−3.16	.24	−4.36, −2.63
Prop. adult male in farming	5065	−6.64	1.13	−9.36, −2.77
Prop. adult male in construction	5065	−3.18	.24	−4.54, −2.19
Prop. adult male in manufacturing	5065	−3.02	.32	−4.15, −2.08
Prop. adult male in professional fields	5065	−2.63	.26	−3.85, −1.64

Table 2 below summarizes the factor loadings of each batch of the indicators on its corresponding component extracted from the principal component analysis. The first component of religiosity is generated by negative coefficients on all religiosity indicators, while the second component of religiosity scores positively on the religious service attendance indicator. The contrast between the two religiosity components suggests that the first component captures lower religiosity and the second component captures the "practicing but not spiritual" religious people. For peer characteristics, the first component represents irreligious friends while the second represents friends who are religious but more likely to use drugs. The numerous county SES indicators make it difficult to interpret the subjective meaning of all the loadings in each single component, but it is reasonable to say that the first component approximately depicts a place with higher income, lower poverty, and more urbanization, which is in contrast to the second component which scores higher on poverty rates but scores lower on rates of college education and median income.

Model 1 in Table 3 presents a baseline model with only wave indicator and county conservative Protestant population share included. At this stage, we do not have a clear statistical trend showing the association between county-level conservative Protestant population share and smoking, but the respondents are more likely to smoke in the last wave of the survey (0.84, $p < .001$). When individual-level covariates are added in model 2, we start to see a clear statistical trend that county-level conservative Protestant population share is positively associated with higher risk of smoking: compared to the 1st quartile of county conservative Protestant population share, the third quartile (0.46, $p < .05$) and fourth quartile (0.79, $p < .001$) have a significant and incremental change in the likelihood of smoking. Interestingly, after accounting for individual-level covariates, the sign of the coefficient of wave flips to be negative (-0.34, $p < .05$). Here wave is a fixed effect that does vary across individuals, its altered sign of coefficient suggests that respondents who began smoking in the latter wave did so due to changes in their background information on demographic basics, religiosity, and parent and peer characteristics. It also implies that smoking in the subsequent wave is not due to a period effect of survey wave, rather the increase is more likely to be a result of the age effect, which is itself a significant predictor (0.44, $p < .001$). Moreover, net of the effects of individual characteristics, there is no statistical evidence showing a differential smoking risk between people following different religious denominations. We find that whites (0.68. $p < .001$) tend to smoke, while those who have better grades (-0.19, $p < .001$) and are female (-0.41, $p < .01$) tend not to smoke.

One may suspect that county-level conservative Protestant population share is a mere reflection of the county's underlying socioeconomic structure, which may also be responsible for the higher smoking rate among people living in those places. Therefore, we add the two principal components extracted from a batch of county-level variables measuring the social, economic, and demographic structure of counties. A more important concern is about the regional distribution of counties which makes certain region, such as the South, have a greater concentration of conservative Protestants. Such a condition may lead to the counterargument that our "conservative Protestant effect" reflects little more than the geographic distribution of smokers—the U.S. South tends to have higher rates of smokers as well as conservative Protestants (Centers for Disease Control and Prevention, 2017; Pew Research Center, 2014). To address this concern, model 3 treats the coefficient of conservative Protestant population share as a random slope that varies across the four regions of the U.S.—South, Midwest, Northeast, and West.

Model 3 reveals that even after controlling for county-level covariates, county-level conservative Protestant population share is still positively associated with smoking in the manner that individuals living in counties with the highest (0.89, $p < .001$) and second highest quartile (0.59, $p < .01$) in terms of conservative Protestant population share are significantly more likely to smoke. When translating coefficients to odds ratio, the 4th quartile of conservative Protestant population share is associated with a 2.4 times increased likelihood of smoking and the 3rd quartile of conservative Protestant share is associated with 1.8

Table 2
Loadings on principal components for three groups of indicators: Religiosity, peer characteristics, and county SES.

	Religiosity 1	Religiosity 2		Friend 1	Friend 2		County 1	County 2
Attendance	-.62	.73	Not religious	.48	.05	Prop. college degree	.08	-.22
Read scripture	-.58	-.68	Same group	-.48	.20	Median household income	.02	-.14
Faith	-.41	-.06	Same belief	-.48	.66	Poverty rates	-.84	.52
Pray alone	-.33	-.10	Drug use	.55	.72	Prop. single mom	-.13	-.19
						Residential stability	.01	.01
						Urbanization	.005	.001
						Prop. male	.01	.01
						Prop. black	-.10	.10
						Prop. service	.03	-.03
						Prop. retailing	.51	.75
						Prop. farming	.07	.07
						Prop.construction	.07	.09
						Prop. manufacture	.04	-.22
Cumulative proportion of variance	.70	.86		.40	.69		.63	.87

times greater likelihood of smoking, after controlling for personal religiosity, peer deviance, county-level SES, and demographic background factors. The variance of the random effect of county-level conservative Protestant population share is 0.54 for the 4th quartile category and 0.06 for the 3rd quartile category. Compared to the default variance at county- and region-level, the effect of conservative Protestant population share does vary across regions. However, such random effect variance is not strong enough to override the significant main effect of conservative Protestant population share. Based on the results in Table 3, our Hypothesis 1 is supported.

Models in Table 4 replicate the same model specifications as in Table 3 but replace county-level conservative Protestant population share with county-level mainline Protestant population share. We find in model 1 that county-level mainline Protestant population share is positively associated with smoking, with individuals from counties of the 3rd and 4th quartile of the mainline Protestant population share more likely to smoke. Compared to the first quartile, people in the 3rd quartile of mainline Protestant population share are 1.82 times (=exp (0.60)) more likely to smoke and the odds ratio is 2.51 times (=exp (0.92)) higher for the 4th quartile. The association between mainline Protestant population share and smoking, however, disappears in model 2 with religious identity, religiosity, individual demographic covariates, and peer characteristics controlled. Nevertheless, when further controlling for county-level SES, the 4th quartile of mainline Protestant population share is significantly associated with smoking when compared to the first quartile (0.42, $p < .05$). We also notice that the coefficient magnitude of the mainline Protestant population share categories sequentially increases from 0.13 to 0.42, suggesting that greater mainline Protestant population share does gradually elevate the risk of smoking compared to the first quartile until the contrast becomes significant at 95% confidence level. Therefore, our empirical results oppose Hypothesis 2.

In addition to studying the conservative Protestant and mainline Protestant contextual effects on smoking, we also look into whether or not a Catholic contextual effect exists. However, our data analyses find no significant main effect of Catholic population share on smoking. Thus, Hypothesis 3 cannot be supported. To save space, the statistical results for Catholic population share is not reported because this county-level variable is the only parameter that differs substantially from the other two tables.

5. Discussion and conclusions

In this study, multilevel analyses were conducted on nationally representative samples to explore the relationship between macro-level religious context and smoking among adolescents and young adults. At the contextual level, consistent with what the civic community theory has predicted about the conservative Protestant religious context, when a county has a higher population share of conservative Protestants, youth living there tend to smoke. This conservative Protestant religious context effect remains robust even after controlling for various individual and county-level socioeconomic variables. When it comes to the mainline Protestant religious context, higher population share of mainline Protestants in a county is also positively associated with smoking among the youth, which is inconsistent with the civic community theory.

What might explain the robust, boosting religious contextual effects on smoking? Prior research on religious context and crime rates suggests that areas with a higher adherence rate of mainline Protestants are associated with higher property crime rates, such as vehicle theft, commercial burglary, and larceny. When it comes to the conservative Protestant context, both violent and property crime rates are positively associated with conservative Protestant adherence rate (Desmond et al., 2010). Thus, it seems that when it comes to social control for the larger community, something is missing in a predominantly conservative or mainline Protestant social environment. Possibly, due to those missing elements on social control, a predominantly conservative or mainline Protestant environment is associated with higher crime rates and perhaps more smoking.

Such a speculation on social control may gain empirical support from a recent study in the Netherlands where Timmermans et al. (2018) find that higher level of neighborhood safety is negatively associated with heavy smoking and nicotine dependence. Another study conducted in Scotland also finds a similar neighborhood effect on smoking: one's perception of neighborhood problems is positively associated with more smoking (Ellaway and Macintyre, 2009). Therefore, it might be possible that the relatively less safe environment in a predominantly conservative or mainline Protestant environment contributes to more smoking. However, what is missing in these two religious contexts that translates into less effective social control on crime, deviance, and ultimately smoking?

One of the speculations we have is based on the denominational variations in moral judgments. Prior research suggests that when it comes to moral judgments, the conservative Protestants tend to employ the Ethic of Divinity emphasizing divine authority and spiritual purity (Jensen and McKenzie, 2016; Shweder, 1990; Shweder et al., 1997). As a result, it might be possible that in a predominantly conservative Protestant cultural environment, individual autonomy is surrendered to religious authorities which leads to less personal control and efficacy. When it comes to smoking, one who struggles with smoking problems might invest too much hope in the Higher Powers and church leaders, while neglecting the importance of self who, ultimately, should be the one making the difference.

In contrast, prior research shows that mainline Protestants are much less likely to adopt the Ethics of Divinity moral approach (Jensen and McKenzie, 2016; Shweder, 1990; Shweder et al., 1997). Although it

Table 3
Multilevel regression results predicting smoking on county-level conservative protestant population share.

Smoking likelihood	Model 1		Model 2		Model 3	
	Coef.	s.e.	Coef.	s.e.	Coef.	s.e.
County conservative Prot. population share						
2nd *quartile*	.36	.27	.26	.19	.36	.21
3rd *quartile*	.61[a]	.25	.46[a]	.20	.59**	.22
4th *quartile*	.50	.34	.79***	.20	.89***	.25
Wave	.84***	.14	-.34[a]	.17	-.27	.17
Individual-level control variables						
Conservative Prot.			.03	.18	-.03	.19
Mainline Prot.			-.06	.25	-.06	.25
Black Prot.			-.72[a]	.31	-.64[a]	.30
Catholic			.07	.19	.01	.19
Jew			-.66	.43	-.84[a]	.40
Mormon			.38	.26	.44	.26
Other			.35	.19	.35	.19
Not religious (ref.)						
Female			-.41**	.15	-.44**	.15
White			.68***	.19	.86***	.20
Age			.44***	.07	.44***	.06
Grade			-.19***	.03	-.19***	.03
Religiosity component 1						
2nd *quartile*			.72***	.18	.72***	.21
3rd *quartile*			1.15***	.19	1.16***	.25
4th *quartile*			1.35***	.21	1.31***	.29
Religiosity component 2						
2nd *quartile*			-.37[a]	.17	-.36[a]	.18
3rd *quartile*			-.47[a]	.19	-.40[a]	.18
4th *quartile*			-.73***	.18	-.69***	.18
Parent income			-.07[a]	.03	-.10***	.03
Parent married			-.45	.37	-.31	.36
Mother closeness			-.15[a]	.06	-.18**	.06
Friend component 1						
2nd *quartile*			.31	.22	.50**	.19
3rd *quartile*			.93***	.24	1.13***	.22
4th *quartile*			1.84***	.24	2.07***	.25
Friend component 2						
2nd *quartile*			.34[a]	.19	.50**	.16
3rd *quartile*			.28	.21	.47**	1.8
4th *quartile*			1.14***	.22	1.33***	.19
County-level control variables						
County component 1						
2nd *quartile*					.01	.18
3rd *quartile*					-.35	.22
4th *quartile*					-.47[a]	.21
County component 2						
2nd *quartile*					.05	.19
3rd *quartile*					.02	.20
4th *quartile*					-.13	.21
τ_{00} (var. individual)	154.9		5.52		5.81	
τ_{01} (var. county)	0		.012		.002	
τ_{02} (var. region)	.93		.009		.005	
τ_{12}(var. β_{12_2})					.09	
τ_{12}(var. β_{12_3})					.06	
τ_{12}(var. β_{12_4})					.54	

[a] p < .05; **p < .01; ***p < .001 (two-tailed).

Table 4
Multilevel regression results predicting smoking on county-level mainline protestant population share.

Smoking frequency	Model 1		Model 2		Model 3	
	Coef.	s.e.	Coef.	s.e.	Coef.	s.e.
County Mainline Prot. population share						
2nd *quartile*	.53	.31	-.02	.22	.13	.20
3rd *quartile*	.60*	.27	.28	.18	.25	.18
4th *quartile*	.92**	.30	.34	.21	.42*	.19
Wave	.93***	.11	-.36*	.14	-.22	.15
Individual-level control variables						
Conservative Prot.			.15	.17	.15	.18
Mainline Prot.			-.01	.25	.04	.23
Black Prot.			-.59	.35	-.59*	.29
Catholic			-.21	.28	.03	.19
Jew			-.83	.48	-.70	.38
Mormon			.38	.26	.44	.26
Other			.35	.19	.35	.19
Not religious (ref.)						
Female			-.44**	.21	-.40**	.14
White			.70***	.19	.83**	.27
Age			.47***	.05	.43***	.06
Grade			-.20**	.03	-.20***	.03
Religiosity component 1						
2nd *quartile*			.70***	.20	.64***	.18
3rd *quartile*			1.11***	.21	1.09***	.19
4th *quartile*			1.31***	.29	1.26	.22
Religiosity component 2						
2nd *quartile*			-.36*	.17	-.35*	.17
3rd *quartile*			-.44*	.18	-.39*	.18
4th *quartile*			-.70***	.18	-.67***	.17
Parent income			-.08**	.03	-.10*	.04
Parent married			.50	.34	-.30	.54
Mother closeness			-.16*	.06	-.19**	.06
Friend component 1						
2nd *quartile*			.36	.21	.59**	.18
3rd *quartile*			.95***	.20	1.27***	.19
4th *quartile*			1.83***	.20	2.16***	.20
Friend component 2						
2nd *quartile*			.38*	.16	.54***	.16
3rd *quartile*			.33	.18	.54**	1.7
4th *quartile*			1.19***	.21	1.46***	.17
County-level control variables						
County component 1						
2nd *quartile*					-.03	.18
3rd *quartile*					-.31	.21
4th *quartile*					-.53**	.20
County component 2						
2nd *quartile*					.11	.18
3rd *quartile*					.17	.20
4th *quartile*					.30	.19
τ_{00} (var. individual)	158		6.44		5.37	
τ_{01} (var. county)	.00		.00		.002	
τ_{02} (var. region)	.18		.01		.01	
τ_{12}(var. β_{12_2})					.14	
τ_{12}(var. β_{12_3})					.08	
τ_{12}(var. β_{12_4})					.06	

*p < .05; **p < .01; ***p < .001 (two-tailed).

seems that such a difference from the conservative Protestants might introduce more personal efficacy to the battle against smoking, it might also be that the social control function of religious institutions and authorities are much weakened. Therefore, one who lives in a predominantly mainline Protestant environment might fear less about the divine punishments for smoking or perhaps pay little attention to the anti-smoking messages from religious authorities. Future research could include more variables on individual moral perceptions to better understand how different religious contexts may foster different moral approaches to and outcomes in smoking.

In addition, future research may want to expand the scope of investigation beyond young adulthood. Prior research shows that smoking is most prevalent among adults aged 25–44 (Centers for Disease Control and Prevention, 2018), which leads one to ask what roles religion at different levels may play in terms of inhibiting or boosting the smoking behaviors of formal adults. Besides an expansion in time, future research may also want to expand scopes in space as prior research has shown that neighborhood safety and well-being are tied with smoking (Ellaway and Macintyre, 2009; Timmermans et al., 2018).

Despite these limitations, distinguished from prior research on religion and smoking, this study is one of the few that has measured religious contextual effects at both micro and macro level. More importantly, differing from prior research which tends to be confined by aggregated religiosity, this study is able to grasp the diverse religious socio-cultural influences on smoking. Doing so not only contributes to a

renewed, more comprehensive way of understanding the religious covariates of smoking; but also connects classic theoretical frameworks in the sociology of religion with an important issue in public health, deviance, and youth development. On the practical side, this research suggests that in addition to collecting individual-level information, public health and social service professionals may also want to take the local religious cultural context into consideration when addressing youth smoking problems. However, we also realize that our study alone may not be able to fully assess the practical, policy implications of religious context on smoking. Therefore, data based on more diverse cultures, societies, and age groups will be needed to further explore the religious contextual mechanism behind smoking and the resulting practical implications for social policies.

Declaration of interest

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