Article

Love thy Aged? A State-Level Analysis of Religiosity and Mobility in Aging Populations During the Novel Coronavirus (COVID-19) Pandemic

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Abstract

Objectives: We test whether the association between state religiosity and distance traveled is moderated by population age during the novel coronavirus (COVID-19) pandemic. **Methods:** Mobility is operationalized as the state-level average median distance traveled from February 24 to May 4 across the contiguous United States. Shelter-in-place rates are operationalized as the state-level percentage of users staying home. State religiosity is measured with an index of aggregated religious identities, beliefs, and practices. Population age is indicated by the state percentage of adults aged 65 years and older. We model population mobility using regression with state clustered robust *SE*s. **Results:** We observe that religious states tend to travel more during the early stages of the pandemic. However, the behavioral risks associated with state religiosity are less pronounced in states with larger older populations. **Discussion:** We contribute to our understanding of the social patterning of pandemic mobility in aging populations.

Keywords

religion/spirituality, mobility, aging populations, coronavirus, COVID-19

Introduction

After spreading around the world in a matter of months, the novel coronavirus (SARS-CoV-2/COVID-19) has become a leading cause of death in the United States. According to the Coronavirus Resource Center at Johns Hopkins University (2020), over 230,000 Americans have already died from COVID-19. According to the Centers for Disease Control and Prevention (CDC) (2020a), adults aged 65 years and older are disproportionately affected by the pandemic, accounting for roughly 80% of all reported COVID-19 deaths. Although the CDC (2020b) has proposed several potential mitigation strategies, staying home and avoiding close contact with people are among the best ways to prevent exposure to the coronavirus. As the official website of the Hopi Tribe (2020) explains, "the virus does not move, people move it…if people stop moving, the virus stops moving and dies." Because limiting movement is so important for slowing the spread of the coronavirus, we must begin to consider the social patterning of mobility (behavior related to traveling and sheltering-in-place). The fundamental question is whether certain populations are more or less mobile than others during the pandemic.

In this study, we test whether the association between state religiosity and pandemic mobility is moderated by population age. In the pages that follow, we explore relevant research from the sociology of religion and recent religious rhetoric concerning the coronavirus pandemic. We also consider the moderating role of aging populations from the perspectives of gerontology, public health, and social psychology. In our main analysis, we model state mobility scores and shelter-in-place rates as a function of state religiosity, population age, and covariates. After summarizing our key results, we discuss the contributions and limitations of our study. We end with important directions for future research on social-structural variations and age-related contingencies in pandemic behavior.

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The Role of Religion in the Pandemic

Our first argument is that more religious populations may be especially resistant to public health recommendations like social distancing and staying at home because they tend to hold more negative views of science and some unique beliefs regarding the pandemic itself. Several studies show that more religious populations tend to report less trust in science as a social institution and more anti-science attitudes (Evans, 2013; Gauchat, 2008, 2012). Of course, these positions are not representative of all religious groups. There is at least some evidence to suggest that conservative Protestant denominations, including evangelical Protestants, may be less literate in science and expressly critical of the scientific community and the potential benefits of scientific progress (Ellison & Musick, 1995; Evans, 2013; Gauchat, 2008; Sherkat, 2011, 2017). For example, studies show that conservative Protestants are often less concerned with environmental degradation, less trusting of the findings of climate scientists, and more likely to endorse "a polluting creed" (Sherkat & Ellison, 2007; Smiley, 2019).

Many conservative Protestant denominations see the Bible as the ultimate source of authority and direction in the experience of personal life and world events (Boone, 1989; Ellison et al., 1996). In contrast to the positivist logic implied by the scientific method, so-called biblical literalists assess the legitimacy of scientific information by its apparent compatibility with scripture (Ellison & Musick, 1995). Religious conservatives, guided by pastors and other religious elites, often draw on religious scripture to oppose scientific recommendations that are perceived as immoral or defined as encroaching on religious liberty or the will or grace of God. Moreover, tensions between religion and science are often rooted in fears regarding the profane influence of science on society (Evans, 2013) and a "social conflict between institutions struggling for power" (Evans & Evans, 2008: 97).

Along these lines, we argue that religious belief systems are likely to serve as an ideological basis for resisting public health recommendations and initiatives during the pandemic (Baker et al., 2020; Hill et al., 2020; Perry et al., 2020). The core concerns of (1) denying health information from health scientists (mistrust of science), (2) accepting health misinformation from religious and political leaders (religious authority), and (3) rejecting restrictions on in-person religious services (religious liberty) are clearly and regularly represented in the media.

Pastor Andrew of the USA Christian Church in California tells us that "our safety is at stake since national disobedience of God's laws brings danger and diseases, such as coronavirus, but obeying God brings covenant protection. God protects the United States of America from danger as the country repents of LGBT, false gods, abortion, and other sins" (Rosen, 2020).

Reverend Curtis of Havre Assembly of God Church in Montana refers to COVID-19 as an acronym for "Christ Over Viruses and Infectious Diseases" (Curtis, 2020). He also directs us to "Joshua 1:9—Be strong and courageous. Do not be frightened, and do not be dismayed, for the Lord your God is with you wherever you go." Based on this passage, he asks, "Shall we deal with fright and dismay with the strength and courage that God prescribes? Shall we face an uncertain future, knowing that God is with us no matter what?"

Reverend Spell of the Life Tabernacle Church in Louisiana is convinced that the virus is "not a concern" because it is "politically motivated" (Slisco, 2020). Reverend Spell also expresses faith in the healing powers of his church: "Our church is a hospital where the sick can come and get healing. Cancers are healed here, people are healed of HIV in these services, and we believe that tonight, we are also going to pass out anointed handkerchiefs to people who may have fear, who may have a sickness, and we believe that when those anointed handkerchiefs go, then that healing virtue is going to go on them as well."

Pastor Howard-Browne of The River at Tampa Bay Church in Florida describes people who are concerned about the coronavirus as "pansies" and insists he would only close his church "when the rapture is taking place" (Stewart 2020). Days after making these comments, the pastor was arrested by the sheriff of Hillsborough County because "his reckless disregard for human life put hundreds of people in his congregation at risk and thousands of residents who may interact with them this week in danger" (Mazzei, 2020).

Bishop Glenn of New Deliverance Evangelistic Church in Virginia told his congregation that "God is larger than this dreaded virus" and that "people are healed" in his church (Brown, 2020). A few weeks later, the pastor died after being diagnosed with the coronavirus.

Even President Trump has attempted to connect with religious rhetoric to push his precarious economic timelines, suggesting that "pews should be filled on Easter," knowing that "his base will revel in the symbolism of resurrection" (Wise, 2020). The general concern of health professionals is that churches may become "coronavirus hotspots" because such "meetings are counter to the prescribed public health policy of groups of people coming together" (Gattis, 2020). Scholars in public health echo these sentiments, noting "the way people interact in churches, synagogues, mosques, and other religious facilities—shaking hands, hugging, singing—appear conducive to what epidemiologists call 'superspreading events'" (Collier et al., 2020). Emboldened by religious leaders and the President, some churchgoers in Missouri have defied social distancing warnings with claims that they are protected from the coronavirus because they are "covered in Jesus' blood" (Edwards, 2020).

These anecdotal accounts are generally consistent with recent population research on religion and risky pandemic lifestyles (Hill et al., 2020; Perry et al., 2020). Perry et al.'s (2020: 2) analysis of national survey data showed that Christian nationalism, "an ideology that idealizes and advocates a fusion of American civic life with a particular type

of Christian identity and culture" (e.g., believing that "the federal government should advocate Christian values") was *positively* associated with eating inside restaurants, attending large gatherings, visiting family or friends in person, and shopping for nonessential items. Christian nationalism was also *inversely* associated with washing hands more often, avoiding touching one's face, and having worn a mask. Impressively, these associations persisted with a wide range of covariates, including political affiliation and political orientation. Perry et al. (2020: 3) speculate that these patterns could be explained by "Christian nationalism's relationship to faith in God's divine protection, distrust of science and (likely) news media, and commitment to Trump."

Hill et al.'s (2020) state-level analysis showed that more religious states tend to exhibit *higher* average mobility scores (geo-behavioral changes in the average median distance traveled) and *slower* average declines in mobility over an 8 -week study period. The study also found that state stay-at-home orders had a weaker impact on mobility in more religious states. These patterns also persisted with adjustments for governor's political party, baseline mobility levels, and several sociodemographic characteristics. The authors concluded that, during the early stages of the pandemic, more religious states tended to travel more and were more resistant to changing their movement patterns than less religious states.

The Moderating Role of Population Age

Our second argument is that the behavioral risks associated with state religiosity may be less pronounced in states with larger older populations. From the beginning of the pandemic, public health officials and the media have noted the disproportionate impact of COVID-19 on older populations. Across the United States, residents have been encouraged to shelter-in-place and to avoid nonessential trips to "protect the most vulnerable members of society" (Gillick, 2020; Hafner, 2020). These messages clearly dovetail with religious doctrine relating to the welfare of society in general and older people in particular. For example, Pope Francis has supported social distancing measures as being in service of "the common good" (Vatican News, 2020). Peterson and Raltson (2017: 734) explain that "we can find in all major world religions an emphasis on reverence for tradition, a respect for human life, and a custom for elder respect" (see also Tan & Barber, 2020). Indeed, passages from scripture explicitly direct followers to respect and to care for older people as a form of reverence to God. In the Old Testament, the book of Leviticus (19:32; NIV) encourages followers to stand "in the presence of the aged…" and to "…show respect for the older people." In the New Testament, Peter (5:5; NIV) advises younger people to "submit" themselves to their "elders" as a sign of "humility" to God.

While religious populations may be more resistant to public health recommendations in general, this resistance could be mitigated in the context of older populations. Deeply held religious beliefs about the common good and respect for older adults could be activated or reinforced by two complementary mechanisms: proximity and priming. The proximity process, following the contact hypothesis, suggests that greater contact with the older people can reduce age-related anxiety and promote positive attitudes toward older adults (Allan & Johnson, 2008; Bousfield & Hutchison, 2010; Caspi, 1984; Drury et al., 2016; Knox et al., 1986; Meshel & MCGlynn, 2004; Schwartz & Simmons, 2001). The priming process begins with exposure to widespread messages that devalue older people. While government officials advocate for the exclusive isolation of older adults and the sacrifice of older people for the sake of the economy (Armitrage & Nellums, 2020; Becket, 2020), social media and protest signs spread concepts like "boomer remover" and "sacrifice the weak" (Newberry, 2020; Whalen, 2020). Theoretically, these messages could prime religious people to engage self-control and prosocial behavior by forcing them to confront latent religious cognitive frameworks or schemas concerning older adults (McCullough & Willoughby, 2009; Pichon et al., 2007; Preston et al., 2010; Rounding et al., 2012; Sasaki et al., 2013; Shariff & Norenzayan, 2007; Willard et al., 2016).

Hypotheses

In accordance with these arguments, we developed two hypotheses to guide our analyses. Our first hypothesis (H1) is that more religious states will tend to travel *more* than less religious states during the pandemic. This hypothesis will be tested through the direct effects of state religiosity on state mobility scores and shelter-in-place rates. Our second hypothesis (H2) is that the behavioral risks associated with religiosity will be *attenuated* in states with larger percentages of adults aged 65 years and older. This hypothesis will be tested through the interaction of state religiosity and population age.

Methods

Data

We use 11 weeks (February 24, 2020 to May 4, 2020) of state mobility scores and shelter-in-place rates from *Cuebiq* (2020). We employ religion data from the 2010 *US Religion Census: Religious Congregations and Membership Study* (Grammich et al. 2018) and the 2014 *Religious Landscape Study* (Pew Research Center, 2015), demographic characteristics from the 2018 *American Community Survey: 5-Year Estimates* (American Community Survey, 2018) and the 2020 *Bureau of Labor Statistics* (Bureau of Labor Statistics 2020), state stay-at-home orders from the *New York Times* (Mervosh et al., 2020), and political data from public state records. Data are limited to the contiguous United States because mobility estimates exclude Alaska and Hawaii. The District of Columbia is also omitted due to missing data on

governor's political party. All variables are state-level. Mobility scores, shelter-in-place rates, unemployment rates, and the number of days with a state stay-at-home order vary over the study period. Data for the percentage of votes cast for Donald Trump in the 2016 Presidential election, governor's political party, percentage Black, population density, and baseline mobility/shelter-in-place are repeated for each week. Our final analytic sample is 528 (48 states*11 weeks).

Measures

State Mobility and Sheltering-in-Place. Our outcome variables are state mobility scores and shelter-in-place rates. *Cuebiq* (2020), an offline intelligence and measurement marketing company, partners with 86 apps to collect first-party location data to understand population behavior during the coronavirus pandemic via software development kit (SDK) technology. SDK technology improves accuracy and precision in location data collection by linking with cell phone operating systems, global positioning systems, and Wi-Fi signals. Anonymous and privacy compliant geo-behavioral data are collected for opted in users, including movement and stops to determine dwell time and visit frequency at locations. Each day, always-on data collection accumulates, on average, 100 data points for approximately 15,000,000 cell phone users. Mobility scores measure the average median distance traveled by all devices for the weeks of February 24–May 4 for each state. Shelter-in-place rates, defined by *Cuebiq* (2020), represent the percent of users staying home (moving less than 330 feet from home) for the weeks of February 24–May 4 for each state. This time frame was selected because it marks the first period of national coronavirus awareness and changing mobility across the United States. In preliminary analyses, we assessed the construct validity of our outcomes by testing associations with the number of days with a state stay-at-home order. We observed an inverse association with mobility scores ($r = -.55$, $p < .001$) and a positive association with shelter-in-place rates ($r = .70$, $p < .001$). In other words, states with longer periods of stay-at-home orders tend to exhibit *lower* mobility scores and *higher* shelter-in-place rates.

Religiosity. Our focal predictor variable, religiosity, is measured as a mean index of six variables ($\alpha = .98$), including (1) percent evangelical or conservative Protestant, (2) percent who report attending worship services at least weekly, (3) percent who identify as highly religious, (4) percent who say religion is very important in their lives, (5) percent who say they pray daily, and (6) the percent who say they believe in God with absolute certainty. This index assesses how religious a state is by assessing self-reported religious identities, beliefs, and practices. Percent evangelical was collected through the 2010 *US Religion Census: Religious Congregations and Membership Study*. The remaining variables were collected through the 2014 *Religious Landscape Study.*

Population Age. Our moderator variable is population age. We measure population age as the percentage of adults aged 65 years and older. This estimate is based on 5-year estimates from the 2018 *American Community Survey.* States with larger percentages of adults aged 65 years and older are interpreted as older states.

Background variables. Our analyses include a range of state-level background variables that are at least theoretically related to mobility and religiosity (Hill et al., 2020; Hill et al., in press), including (1) percentage of votes cast for Donald Trump in the 2016 presidential election, (2) governor's political party, (3) percentage Black, (4) 1-month lagged unemployment rate (January, February, and March), (5) population density, (6) number of days with a state stay-at-home order for each measurement period, and (7) baseline mobility (mean mobility scores for the first 2 weeks of the study period) or baseline shelter-in-place (mean percentage shelter-in-place for the first 2 weeks of the study period). Political data were obtained from public voting records. Percent Black and population density are based on 5-year estimates from the 2018 *American Community Survey.* The monthly unemployment rates for January, February, and March were obtained from the 2020 *Bureau of Labor Statistics*. Data on state stay-at-home orders as of April 14, 2020 were collected by the *New York Times*.

Statistical Procedures

Our analytic strategy proceeds in three steps. In Table 1, we present descriptive statistics for all study variables, including variable ranges, means, and *SD*s. We then model state mobility scores (Table 2) and shelter-in-place rates (Table 3) using ordinary least squares regression with state clustered robust *SE*s to account for serial correlation and heteroskedasticity (Robitzsch and Grund, 2020). To aid in the interpretation of our results, we standardized all of the continuous predictor variables and outcome variables in Tables 2 and 3. These standardized regression coefficients represent effect sizes and are interpreted as the expected *SD* change in Y for each one *SD* change in X. Following Rosenthal and Rosnow (1991), we consider effect sizes between .10 and .30 small, between .30 and .50 moderate, and greater than .50 large. Tables 2 and 3 follow the same modeling logic. Model 1 tests whether state religiosity and population age are associated with state mobility scores and shelter-in-place rates net of controls for percentage Black, lagged unemployment rate, population density, number of days with a state stay-at-home order for each measurement period, baseline mobility or shelter-in-place, and weekly variations in travel. The percentage Black and the unemployment rate indicate the race and socioeconomic structures of states. Population density and baseline mobility scores and shelter-in-place rates assess the concentration of populations and the average median distance traveled for the

Table 1. Descriptive Statistics for Selected Study Variables.

	Variable Range	Variable Mean	*SD*
Mobility scores	.84 to 4.12	3.02	.72
Shelter-in-place rates	.16 to .59	.35	.10
Religiosity (2010/2014)	−1.92 to 2.14	.04	.96
Percent ≥65 (2018)	.11 to .20	.16	.02
Percent Trump votes (2016)	.30 to .69	.50	.10
Republican governor (2020)	0 to 1	.52	.50
Percent black (2018)	.004 to .38	.11	.09
Lagged unemployment (2020)	2.20 to 28.20	4.60	3.09
Population density (2018)	5.99 to 1207	204	266
Home order days (2/24 to 5/04)	0 to 7	3.29	3.40
Baseline mobility average (2/24 to 3/2)	.16 to .26	.21	.02
Baseline shelter rate average (2/24 to 3/2)	3.17 to 4.11	3.83	.21

Notes: n = 528. State-level estimates.

Table 2. State-level Clustered Robust Regression of Mobility Scores.

	Model 1		Model 2		Model 3	
Religiosity (2010/2014)	.157 (.036)	***	.052 (.069)		.112 (.065)	+
Percent ≥65 (years) (2018)	.084 (.040)	*	.059 (.040)		.067 (.032)	*
Religiosity*percent ≥65					−.100 (.026)	***
Percent Trump votes (2016)			.122 (.062)	+	.131 (.056)	*
Republican governor (2020)			−.001 (.064)		−.008 (.062)	
Percent Black (2018)	.048 (.036)		.099 (.048)	*	.084 (.043)	*
Lagged unemployment (2020)	−.143 (.053)	**	−.130 (.058)	*	−.121 (.054)	*
Population density (2018)	−.101 (.036)	**	−.080 (.041)	+	−.047 (.047)	
Home order days (2/24 to 5/04)	−.218 (.046)	***	−.194 (.036)	***	−.179 (.035)	***
Baseline mobility average (2/24 to 3/2)	.383 (.056)	***	.373 (.048)	***	.334 (.043)	***
Week (3/2)	.015 (.005)	**	.016 (.005)		.016 (.005)	***
Week (3/9)	−.064 (.008)	***	−.063 (.007)	***	−.063 (.007)	***
Week (3/16)	−.949 (.033)	***	−.950 (.034)	***	−.951 (.034)	***
Week (3/23)	−1.864 (.077)	***	−1.883 (.080)	***	−1.895 (.081)	***
Week (3/30)	−1.610 (.070)	***	−1.644 (.070)	***	−1.665 (.072)	***
Week (4/6)	−.819 (.075)	***	−.863 (.067)	***	−.890 (.066)	***
Week (4/13)	−1.756 (.093)	***	−1.799 (.092)	***	−1.826 (.094)	***
Week (4/20)	−1.096 (.076)	***	−1.139 (.073)	***	−1.166 (.072)	***
Week (4/27)	−.909 (.074)	***	−.953 (.069)	***	−.979 (.068)	***
Week (5/04)	−.325 (.166)	+	−.399 (.184)	*	−.450 (.166)	**

Notes: n = 528. +p < .10; *p < .05; **p < .01; ***p < .001. Shown are standardized coefficients with standard errors in parentheses. Reference week is 2/24.

first 2 weeks of the study period. State stay-at-home orders measure the pandemic policy of states. We use dummy variables for week to model thresholds in mobility and shelter-in-place trends. Model 2 adds percentage Trump vote and governor's political party to assess state political orientation. Model 3 includes the focal interaction term (state religiosity*population age) to test whether the effects of state religiosity on state mobility scores and shelter-in-place rates vary by population age. The question here is whether the association between religiosity and movement varies across states depending on the size of the older adult population. Figures 1 and 2 provide graphical illustrations of these moderation patterns.

Results

Descriptive Statistics

Table 1 shows an average state mobility score (median distance traveled) of 3020 m (3.02*1000 m) or just over 3 km (nearly 2 miles). We also observe that approximately 35% of cell phone users sheltered-in-place (moved less than 330 feet

Table 3. State-level Clustered Robust Regression of Shelter-in-Place Rates.

	Model 1		Model 2		Model 3	
Religiosity (2010/2014)	−.121 (.023)	***	−.094 (.032)	**	−.122 (.033)	***
Percent ≥65 (years) (2018)	−.053 (.018)	**	−.045 (.019)	*	−.042 (.017)	*
Religiosity*percent ≥65					.038 (.014)	**
Percent Trump votes (2016)			−.031 (.026)		−.035 (.025)	
Republican governor (2020)			−.018 (.034)		−.013 (.034)	
Percent Black (2018)	−.029 (.021)		−.042 (.024)	+	−.030 (.022)	
Lagged unemployment (2020)	.057 (.042)		.051 (.044)		.051 (.043)	
Population density (2018)	.170 (.018)	***	.163 (.019)	***	.147 (.023)	***
Home order days (2/24 to 5/04)	.116 (.025)	***	.107 (.024)	***	.105 (.024)	***
Baseline shelter rate average (2/24 to 3/2)	.202 (.025)	***	.197 (.025)	***	.184 (.027)	***
Week (3/2)	−.028 (.010)	**	−.028 (.010)	**	−.028 (.010)	**
Week (3/9)	.197 (.014)	***	.197 (.014)	***	.197 (.014)	***
Week (3/16)	1.600 (.047)	***	1.600 (.047)	***	1.600 (.047)	***
Week (3/23)	1.835 (.060)	***	1.841 (.062)	***	1.843 (.062)	***
Week (3/30)	1.893 (.054)	***	1.906 (.055)	***	1.909 (.056)	***
Week (4/6)	1.786 (.053)	***	1.801 (.055)	***	1.806 (.055)	***
Week (4/13)	1.645 (.059)	***	1.661 (.060)	***	1.665 (.060)	***
Week (4/20)	2.203 (.055)	***	2.219 (.057)	***	2.223 (.058)	***
Week (4/27)	2.004 (.050)	***	2.020 (.052)	***	2.024 (.052)	***
Week (5/04)	1.707 (.126)	***	1.738 (.135)	***	1.742 (.131)	***

Notes: n = 528. +p < .10; *p < .05; **p < .01; ***p < .001. Shown are standardized coefficients with standard errors in parentheses. Reference week is 2/24.

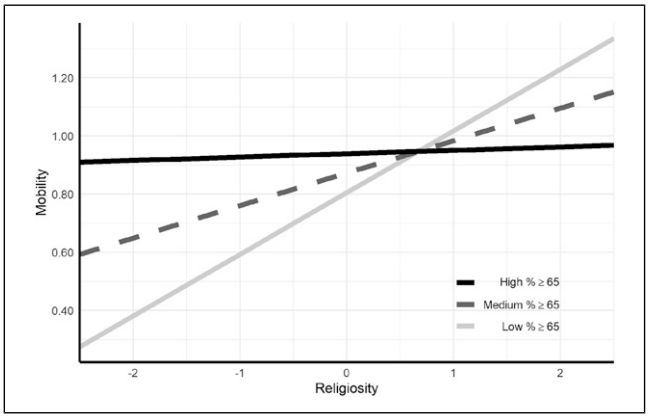

Figure 1. Association of Religiosity and Mobility Scores by Population Age.

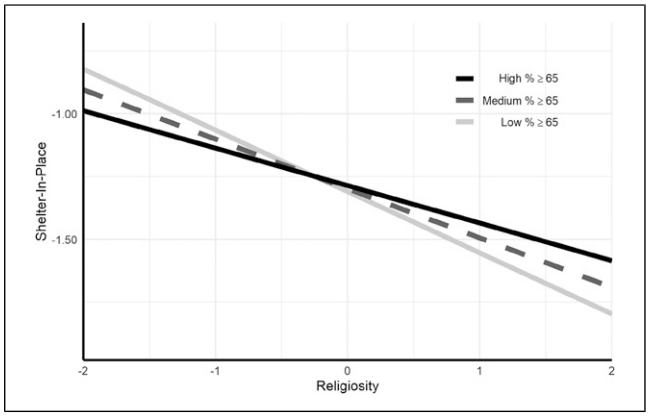

Figure 2. Association of Religiosity and Shelter-in-Place Rates by Population Age.

from their home) for the weeks of February 24–May 4. On average, states exhibited moderate levels of religiosity. In terms of state population age, the percentage of adults aged 65 years and over ranged from 11% to 20%. Finally, state political variables indicate that Trump won, on average, 50% of the votes in the 48 contiguous states included in our study, and half of the governors included in our analyses are affiliated with the Republican Party.

Direct Effects

Model 1 of Table 2 shows that more religious states and states with larger percentages of adults aged 65 years and older tend to exhibit *higher* state mobility scores than less religious states and states with smaller older populations, net of controls for percentage Black, lagged unemployment rate, population density, number of days with a state stay-at-home order, baseline mobility, and weekly variations in travel. More specifically, a one *SD* increase in religiosity is associated with a .16 *SD* increase in mobility. And a one *SD* increase in the percentage of adults aged 65 years and older is associated with a .08 *SD* increase in mobility. In Model 2, we note that these associations are attenuated to non-significance when percentage Trump vote and governor's political party are added to the regression equation. In this model, states with larger percentages of Trump voters tend to exhibit *higher*

mobility scores. Governor's political party is unrelated to mobility scores. In other words, mobility scores are *comparable* in states governed by Republicans and Democrats. Among our statistically significant predictor variables, we observe a moderate effect size for baseline mobility (.38) and small effect sizes for stay-at-home order (.21), religiosity (.15), lagged unemployment (.14), percent Trump vote (.12), population density (.10), and the percentage of adults aged 65 years and older (.08).

According to Table 3, more religious states and states with larger percentages of adults aged 65 years and older also tend to exhibit *lower* state shelter-in-place rates than less religious states and states with smaller older populations. More specifically, a one *SD* increase in religiosity is associated with a .12 *SD* decrease in shelter-in-place rates. A one *SD* increase in the percentage of adults aged 65 years and older is also associated with a .05 *SD* decrease in shelter-in-place rates. These associations persisted across models, even with adjustments for political variables. Model 2 of Table 3 shows that percentage Trump vote and governor's political party are unrelated to shelter-in-place rates. In other words, behavior related to sheltering-in-place is *comparable* across levels of support for Trump and in states governed by Republicans and Democrats. Among our statistically significant predictor variables, we observe only small effect sizes for baseline shelter-in-place (.20), population density (.17), religiosity (.12), stay-at-home order (.11), and the percentage of adults aged 65 years and older (.05).

Moderating Effects

In Tables 2 and 3, interaction terms (religiosity*percent ≥65) are added in Model 3. In Table 2, the interaction term is statistically significant and inverse. This suggests that the positive association between state religiosity and state mobility is *attenuated* in states with larger percentages of adults aged 65 years and older. In Table 3, the interaction term is statistically significant and positive. This suggests that the inverse association between state religiosity and state shelter-in-place rates is also *mitigated* in states with larger percentages of adults aged 65 years and older. Figure 1 provides a graphical illustration of the interaction in Model 3 of Table 2. Specifically, we show the association between state religiosity and mobility scores at three levels of population age: high (the top third of the age distribution), medium (the middle third of the age distribution), and low (the bottom third of the age distribution). According to this representation, the positive association between state religiosity and mobility scores is increasingly *attenuated* in states with larger percentages of adults aged 65 years and older. Figure 2 provides a graphical illustration of the interaction in Model 3 of Table 3. This image shows that the inverse association between state religiosity and shelter-in-place rates is also gradually *attenuated* in states with larger percentages of adults aged 65 years and older. Overall, the behavioral risks associated with state religiosity are progressively mitigated in states with larger older populations.

Supplemental Analyses

In supplemental analyses, we estimated our regression models using robust regression with the M estimator and iterated re-weighted least squares (IWLS) to down-weight the influence of any outliers (Jorgenson, 2007; Venables and Ripley, 2002). These results were substantively identical to our focal regression models with state clustered robust *SE*s. We also replicated our focal analyses using a religiosity index that omitted percent evangelical. In other sensitivity analyses, we controlled for coronavirus infection rates and death rates per 100,000. Again, these analyses failed to alter any of our substantive conclusions.

Discussion

In this study, we tested whether the association between state religiosity and pandemic mobility varies by population age. Our first hypothesis (H1) indicated that more religious states would tend to travel *more* than less religious states during the pandemic. This hypothesis received consistent support. More religious states exhibited *higher* mobility scores and *lower* shelter-in-place rates. These patterns are noteworthy for three reasons. First, they confirm recent work on Christian nationalism and risky pandemic health-related behavior at the individual level (Perry et al., 2020). Second, they extend previous research on state-level religiosity and mobility to a new indicator of movement: shelter-in-place rates (Hill et al., 2020). Finally, the cumulative evidence across these studies clearly dovetails with the so-called "dark side" of religion (Hill et al., 2011). The consistent message is that more religious populations tend to exhibit riskier pandemic lifestyles.

Our second hypothesis (H2) predicted that the behavioral risks associated with religiosity would be *attenuated* in states with larger percentages of adults aged 65 years and older. This hypothesis also received consistent support. State religiosity had a weaker impact on state mobility scores and shelter-in-place rates in populations with larger percentages of adults aged 65 years and older. To our knowledge, this is the first empirical study of population age variations in state religiosity and pandemic mobility. Our findings are noteworthy because they demonstrate that the behavioral risks associated with state religiosity may in fact depend on the age structure of populations. While more religious states *and* states with larger percentages of older adults are moving around more during the pandemic, the interaction of these effects demonstrates a pattern of attenuation and not of amplification. These findings are generally consistent with our theory of proximity and ageism. The behavioral risks associated with living in a more religious state may be counteracted by greater exposure to older populations

through complementary processes related to the contact hypothesis and the priming of anti-ageist cognitive frameworks that emphasize the common good and respect for older adults. From a theological perspective, biblical principles that emphasize "love of neighbor" may be fulfilled by making temporary sacrifices of limiting nonessential travel and communal religious gatherings, in the process showing a profound respect for the lives of older people and the most vulnerable (VanderWeele, 2020).

Although we were primarily interested in the moderating influence of population age, several other patterns are also worthy of discussion. We note that the effect of state religiosity was fully mediated in the case of mobility scores and partially mediated in the case of shelter-in-place rates by state political ideology. This evidence suggests that one reason why religious states tend to travel more during the pandemic is because these states also tend to follow the leadership of President Trump. The religious orientation of these states was established long before Trump ran for political office. More religious populations voted for Trump in 2016 to support various Christian agendas (Gorski, 2019). Later, during the pandemic, evangelical states were exposed to President Trump's ideological resistance to public health mitigation strategies like staying home (Hill et al., in press). There is a lot of speculation about why religious populations tend to exhibit riskier pandemic lifestyles. Although previous research tends to emphasize religious explanations (e.g., faith in divine protection and mistrust of science), we are reminded that distinct political processes may also underly the association between religiosity and pandemic behavior.

We were surprised to find that states with larger percentages of adults aged 65 years and older tend to exhibit *higher* mobility and *lower* shelter-in-place rates than states with smaller older populations. This finding is disturbing when considered in the context of the elevated mortality risk of older adults. Given the nature of our state-level data, it is unclear who might be driving this association. Like the effect of state religiosity, the effect of population age was fully mediated in the case of mobility scores and partially mediated in the case of shelter-in-place rates by state political conservatism. This makes sense because older voters tend to be politically conservative. They also clearly supported Donald Trump over Hillary Clinton in 2016 (Pew Research Center, 2018). Nevertheless, several questions remain. Are older people in older states moving around more during the pandemic (e.g., for political reasons or to maintain their routines and ritualized patterns of day-to-day activities)? Are younger populations moving around more (e.g., to assist the older people with grocery shopping and other tasks)? Whatever the reason, older populations will inevitably face a greater burden of infection and death.

We acknowledge that our analyses are limited in three key respects. Although our data suggest that more religious states and older populations tend to travel more during the coronavirus pandemic, we cannot conclude that religious individuals or older individuals are traveling more without individual-level data. Because we are still in the early stages of the pandemic, we are unable to assess concurrent changes in our state-level predictors across years. Finally, our mobility data are also limited because they are based on opted-in users, not probability samples in states. We are nevertheless encouraged by the fact that both of our mobility outcomes are predictably associated with a range of variables, including, time (week), religiosity, percent Trump vote, population density, and stay-at-home orders.

Conclusion

Despite these limitations, we provided the first empirical study of intersection of state religiosity, population age, and mobility during the coronavirus (COVID-19) pandemic. Our analyses consistently showed that, in the early weeks of the pandemic, religious states tend to travel more. We also observed that the behavioral risks associated with state religiosity are less pronounced in states with larger older populations. Our analyses contribute to our understanding of the social patterning of pandemic mobility in aging populations, which is ultimately relevant to slowing the spread of the coronavirus. More research is needed to replicate our findings using longer longitudinal designs and data collected at the individual level. As more valid and reliable epidemiological data become available, we will need to assess whether infection and mortality rates also vary according to state religiosity and population age. Future work should continue to consider the social patterning of pandemic mobility more broadly. Given the enhanced vulnerability of racial minorities to infection and eventual death from COVID-19, understanding the role of race and ethnicity is perhaps most pressing (Garcia et al., in press). Research along these lines would clearly advance our understanding of social-structural variations and age-related contingencies in pandemic behavior.

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