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How are relying on religion and on science to make sense of the world associated with health-related resources and behaviors and well-being?

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ABSTRACT

Objective: Differences in the extent to which religious and scientific perspectives inform individuals' understanding of the world may affect their health and well-being. Yet minimal research has examined the influence of religious or scientific *beliefs* (or their relative influences) on health-related resources, behaviors, well-being, and stress responses, the focus of the current study.

Methods: A national sample of 289 U.S. adults (mean age 34.42, 62.1% female, 67.5% White) was recruited through an online platform. Participants completed baseline and 11 nightly self-report surveys.

Results: Higher reliance on religion was generally associated with greater psychological well-being (i.e. higher mindfulness, locus of control, positive affect; lower negative affect), while reliance on science was related to more COVID-19 distress. Contrary to hypotheses, scientific beliefs were not generally associated with a healthier lifestyle at the between-subject level, and higher reliance on both religion and science predicted *more* daily comfort food consumption. However, both belief systems buffered negative impacts of daily stress on physical activity at between-person (science) and within-person (religion) levels.

Conclusion: Results showed unique benefits and drawbacks of each meaning system on individuals' health behaviors and well-being. Future research is warranted to illuminate the intricate interplay between these two popular perspectives on the world.

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Religion; science beliefs; health behaviors; affect

Although sometimes portrayed as mutually exclusive, religious and scientific perspectives frequently co-exist; that is, people may rely to some extent on both religion and on science in making sense of their experiences but vary in their relative degree of reliance on each (Johnson et al., 2021). For example, individuals may base their beliefs on guidance from their religious leaders or sacred texts in conjunction with secular norms or information (Falade & Bauer, 2018; Park, 2013). Thus, one's lifestyle may be based on religious prescriptions and proscriptions but also reflect the latest guidance from scientists and public health organizations (e.g. Galang, 2021). In the present paper, we aimed to understand how relying on religion and on science to understand the world relates to health behaviors and well-being.

Importance of religious and scientific beliefs

Many aspects of religiousness have been shown to affect individuals' health and related behaviors (Hood et al., 2018), but little of this work has specifically investigated influences of religious *beliefs* or *reliance on religion for understanding the world* (Park, 2020). Yet theoretical accounts have posited that the belief or conviction aspect of religion might be uniquely related to health behaviors distinct from other aspects such as attitudes or service attendance because these beliefs form individuals' fundamental perceptions of reality (Park, 2017). Research on how reliance on scientific perspectives relates to health-related resources and behaviors is also sparse (Johnson et al., 2021). Individuals' understanding of reality is theorized to influence knowledge of and trust in sources of information (Jervis, 2006). In these ways, the degree to which one subscribes to religion- and science-based "accounts of the world" (O'Brien & Noy, 2020) is thought to influence many aspects of behavior, including health-related ones (Noy & O'Brien, 2018).

Such research into reliance on religion and on science may have implications for public health. As the diverse reactions to the COVID-19 pandemic amply illustrated (David et al., 2023; Olagoke et al., 2021; Rutjens et al., 2020), individuals' beliefs in religion and science can influence their attitudes toward health-related behaviors (Pivetti et al., 2021), suggesting that this area warrants greater attention. To illuminate the complex interplay between relying on religion and science as influencing health-related resources and behaviors, we examined relations between religious and scientific worldviews and a set of resources and behaviors related to physical and mental health.

Current knowledge about how beliefs in religion and in science are associated with health-related factors

Religiousness has been linked with physical health in myriad studies over many decades (for reviews, see Park & Slattery, in press; Park & Carney, 2019). However, most of this work assessed religiousness in terms of *behavior*, such as frequency of service attendance, and assessed health in terms of disease rather than health-related resources or behaviors. Few studies have focused on cognitive facets of religiousness, such as individuals' religious *beliefs* or *reliance on religion for understanding the world*, nor have studies linked these beliefs with health behaviors. The few such studies that do exist also mainly focused on assessing fairly circumscribed religious beliefs (e.g. belief in God, fatalism) rather than more encompassing reliance on religion to understand and navigate the world, which was the focus of the current study.

This handful of studies has produced mixed results: some reported favorable associations [(e.g. cross-sectionally associated with less alcohol use (Poulson et al., 1998) and better health behaviors; Benjamins et al., 2011)] but others found no relations (e.g. Park et al., 2018) or even inverse relations between religious beliefs and healthy behaviors (e.g. Franklin et al., 2007; see Park & Slattery, in press, for a review). Several recent studies suggested that some religious beliefs might decrease people's willingness to receive the COVID-19 vaccine (e.g. Garcia & Yap, 2021; Lahav et al., 2022).

Before the COVID-19 pandemic, research had just begun to examine associations between reliance on a scientific worldview and health. One study showed that university students with moderately high levels of both religious and scientific beliefs were less reactive to laboratory-induced stress than were those with high scientific beliefs alone (Farias & Newheiser, 2019). Recently, a flurry of research has linked beliefs in science with acceptance of vaccines (Rutjens et al., 2018), particularly the COVID-19 vaccine (e.g. Pivetti et al., 2021; Rutjens et al., 2022). However, studies of scientific beliefs and vaccines have generally focused on *attitudes toward* vaccines rather than actual receipt. Aside from these studies, research directly linking scientific beliefs with health and well-being is virtually nonexistent. Further, no research on how reliance on religion and science are conjointly associated with health-related behaviors or well-being has yet been conducted.

Current study: specific research questions and hypotheses-forming literature

Given this apparent need to better understand the mutual influences of religious and scientific perspectives on people's actual performance of health behaviors and well-being, we aimed to examine this issue in a national sample of adults. Because so little research is available on this topic, we conceptualized health broadly as including health-related personal resources, health behaviors, and stress responses. We considered two resources well-established in prior research to be related to many indices of physical health: mindfulness and internal locus of control. Mindfulness—paying attention to the present moment with non-judgment and acceptance (Feldman et al., 2007)—has been related to many health behaviors, including diet and physical activity (e.g. Fanning et al., 2018; Gilbert & Waltz, 2010). Internal locus of control—the extent to which people feel that events that happen to them are contingent on their own behavior (Grotz et al., 2011)—has also been closely linked to health behaviors and well-being (Cobb-Clark et al., 2014; Hou et al., 2017). The few studies examining associations between general religiousness and mindfulness have suggested positive links (e.g. Albatnuni & Koszycki, 2020; Cobb et al., 2015), but studies specifically examining *beliefs* in religion or science and mindfulness have yet to be conducted. For internal locus of control, some recent research has linked internal locus of control with religiousness (e.g. Timmins & Martin, 2019) but again, none specifically investigated religious beliefs or scientific beliefs and locus of control.

We considered three specific health behaviors on both the average (aggregate) and daily levels: alcohol consumption, comfort food consumption, and physical activity (PA). We also considered reliance on religion and on science in the context of the adverse effects of stress on health behaviors (Stults-Kolehmainen & Sinha, 2014), following the suggestion that reliance on religion might buffer the effects of stress on health behaviors (Ellison et al., 2019; Farias & Newheiser, 2019), while reliance on science appears not to (Farias & Newheiser, 2019). We assessed stress both in terms of COVID-19-related distress, given that we conducted this study during the pandemic, as well as average daily hassles (both individual's average experience with stress relative to others (i.e. between-subject) and their own day-to-day fluctuation in stress (within-subject)). We examined the extent to which both reliance on

religion and reliance on science buffered the impact of stress on health behaviors and positive/negative affect on a daily basis. Specifically, in the present study, we addressed the following research questions and made the following hypotheses: (1) How does reliance on religion and on science predict individuals' health-related psychosocial resources (i.e. mindfulness, locus of control)? Based on the small amount of research on this topic, we tentatively hypothesized that greater reliance on religion would be related to higher levels of mindfulness. Also, we hypothesized that religion would be associated with higher levels of internal locus of control (e.g. Timmins & Martin, 2019). Given the lack of prior research regarding reliance on science, we did not make hypotheses. (2) How does reliance on religion and on science predict individuals' average levels of health behaviors (i.e. alcohol, comfort food, physical activity) and their average affective well-being (i.e. COVID-19 distress, positive affect, and negative affect)? We hypothesized that individuals who rely more strongly on science may have more information regarding health-related disease risks, and thus may experience higher COVID-19 distress but also engage in better health behaviors due to having more information about staying healthy. We did not have reason to believe reliance on science would relate to affect. Given the mixed but generally favorable relations between religiousness and health and well-being (Peteet et al., 2023), we hypothesized that greater reliance on religion to make sense of the world would be associated with greater mental well-being and possibly more salutary engagement in health behaviors. (3) How does reliance on religion and on science *moderate* (buffer) the relationship between daily stress and daily health behaviors/affect? Based on the small amount of research on the stress-buffering effects of beliefs in religion and in science (e.g. Farias & Newheiser, 2019), we hypothesized that reliance on science would not buffer daily stress but reliance on religion would (e.g. Tix & Frazier, 2005). However, we still hypothesized that reliance on religion, overall, should be associated with better daily mental well-being, and reliance on science, overall, should be associated with better daily health behaviors.

Methods

Participants

A national sample was recruited from the Prolific platform between May and June 2021 for the present study. Prolific is an online research platform that provides recruitment and management of participants for online research. To participate, individuals were required to be U.S. residents aged 18 or older. Participants had to reside in the Eastern or Central time zone to ensure they were receiving the nightly surveys at the end of the day. After providing online consent, participants completed questionnaires using Qualtrics online survey software. Participants completed a baseline survey (approximately 25-30 min). Then, for 11 consecutive evenings, shorter (5-7 min) surveys were sent to participants *via* Prolific at 8pm EST, and participants were asked to complete them "between now (8pm) and 2 am, right before you go to sleep." Responses completed after 2 am were excluded. Consistent with prior daily diary studies assessing health behaviors (e.g. Riley et al., 2019), an 11-day window was chosen to ensure two weekends were captured, during which activities and health

behaviors may vary more. Participants received \$4 for completing the baseline survey and \$1.50 per nightly survey, as well as a bonus of \$1.50 for the completion of all surveys. The study was approved by the University of Connecticut Institutional Review Board (IRB). The study was not preregistered.

Measures

Baseline Measures: Reliance on Religion was assessed with the 5-item Reliance on Science and Faith Scale (SFS): Faith subscale (Kitchens & Phillips III, 2021), which measured how much a participant relied on God for solutions and truth (e.g. God offers excellent explanations for reality). Items were rated from (1) *Strongly disagree* to (5) *Strongly agree* and the mean score was calculated. Cronbach's α in the present sample was 0.98. Reliance on Science was assessed with the SFS: Science subscale (Kitchens & Phillips III, 2021), nearly identical to the faith scale but now measured reliance on science for solutions and truth (e.g. Science offers excellent explanations for reality). Cronbach's α in the present sample was 0.89. Mindfulness was assessed with the revised Cognitive and Affective Mindfulness Scale (Feldman et al., 2007); 10 items rated from (0) *Never* to (5) *Always*. Cronbach's α in the present sample was 0.87. Internal Locus of Control was assessed with the 4-item personal mastery subscale of the MIDUS Sense of Control scale (Lachman & Weaver, 1998), which measured the degree to which participants perceived life as controllable. Items were rated from (1) *Strongly disagree* to (7) *Strongly agree*. Cronbach's α in the present sample was 0.87. COVID-19 Distress was assessed with an adapted version of the COVID-19 Stressors scale (Tambling et al., 2021), which measured how much stress the participant felt to each of seven COVID-19-related experiences over the past week (e.g. How stressful are changes to social routines?). Items were rated from (1) *Not stressful at all* to (5) *Extremely stressful*. Cronbach's α in the present sample was 0.87.

Daily Diary Measures assessed at the end of each day for 11 days included the following: Daily Stress was assessed by asking participants to rate the perceived stressfulness experienced in each of 10 stressor categories (e.g. family, work, health) from (0) *Did not occur* to (5) *Occurred and caused me to panic* (adapted from DeLongis et al., 1988; Brantley et al., 1987). Total daily stress was then calculated after summing up scores of the 10 stressor categories for each day (possible range 0 to 50). The intraclass correlation coefficient (ICC) for daily stress in the present sample was 0.74. Daily Alcohol Consumption was assessed by asking participants to report the number of alcoholic drinks (defined as a 12-ounce can of beer, a 4-ounce glass of wine, a 12-ounce bottle of wine coolers, or a shot of liquor) they had during the past 24 h. ICC in the present sample was 0.61. Daily Comfort Food Consumption was assessed by asking participants to report their sweet and salty snack food intake over the past day on an adapted version of the National Cancer Institute Dietary Screener Questionnaire (DSQ; National Cancer Institute, n.d.). Participants reported their intake of seven food categories: (1) chocolate and other candy, (2) cookies/cake/pie/brownies, (3) doughnuts/sweet rolls/Danish/muffins/pan dulce/Pop-Tarts, (4) ice cream or other sugary frozen desserts, (5) salty snacks such as

popcorn/potato or corn chips/pretzels/Cheetos, (6) pizza/pasta/mac and cheese/casserole, (7) fast food such as McDonald's/Taco Bell. Response options for each item ranged from 0 to 6+ times. Responses to the seven items were totaled to create a total count of comfort food consumption each day. ICC for daily comfort food consumption in the present sample was 0.57. Daily Minutes of Physical Activity (PA) was assessed with an adapted version of the Godin Leisure-Time Exercise Questionnaire (Godin & Shephard, 1985) modified for daily use. Participants were asked how many total minutes they spent doing mild (e.g. light walking and yoga), moderate (e.g. brisk walking and regular swimming), and vigorous (e.g. running and fast swimming) physical activities "solely for recreation, exercise, sport, or leisure"; total time spent engaging in each category during the past 24h were combined. Daily Minutes of Moderate/Vigorous Physical Activity was computed by summing the minutes spent doing only moderate and vigorous activities. ICCs for daily total minutes of physical activity and daily minutes of moderate/vigorous physical activity were 0.49 and 0.48, respectively. Positive Affect and Negative Affect were assessed by asking participants to report how much they were experiencing 12 different emotions/feelings in that given moment, from (1) *Very slightly or not at all* to (5) *Extremely* (Scale of Positive and Negative Experience; Diener et al., 2009). Six emotions were considered positive (e.g. good, joyful) and the other six were considered negative (e.g. bad, angry). For each day, the six positive emotion scores were summed, representing positive affect, and the six negative emotion scores were summed, representing negative affect; possible scores ranged from 6 to 30 for each. ICCs for positive affect and negative affect were 0.67 and 0.55, respectively.

Data analysis plan

Missing data

340 participants completed the baseline survey. The 309 participants who cleared initial validity checks and completed at least one daily diary completed 8.3 out of 11 daily surveys, with less than 36% of the data missing for any single item. Given our aim to examine between- and within-subject daily stress on health behaviors/affect, and that one daily diary was insufficient for modeling within-subject variability, we determined a minimum number of completed days required for a participant to be included in our final sample. This cutoff was selected to balance the need for enough within-subject variability, while also having a sufficiently large sample size. Our sample had a noticeable drop-off between two and three days of daily data. Thus, we used three days as our cut-off (i.e. the minimum number of completed daily surveys to be included); 289 participants completed at least three daily surveys (mean = 8.8 out of 11 days completed), with less than 32% of the data missing for any single item. This subsample ($N=289$) was then used for all analyses, a sample size expected to be sufficiently powered for the proposed analyses based on both previous daily diary studies of similar outcomes (e.g. Riley et al., 2019) as well as simulation studies given expected intraclass correlation coefficients (ICCs) and cross-level interactions (Arend & Schäfer, 2019).

Data analysis approach

First, for Aim 1, two separate linear regressions were conducted to assess reliance on religion and reliance on science as predictors of baseline mindfulness and internal locus of control. For each regression model, participants' age, gender, race, income, education, and marital status were included as covariates. For Aim 2, daily health behaviors and measures of psychological well-being were first averaged over the 11-day study. These averages represented the between-subject component of the daily health behaviors and affect. Separate linear regression models were conducted for each of the between-subject health behaviors (alcohol, comfort food, and PA) and affect (COVID-19 distress, positive affect, and negative affect) outcomes. Reliance on religion and reliance on science were included as predictors, and age, gender, race, income, education, and marital status were included as covariates.

To test Aim 3, we conducted multilevel moderation analyses using the lme4 package in R (Bates et al., 2015). These models tested whether reliance on religion or science predicted daily health behaviors and affect as well as any moderating effects on the links between daily stress and daily health behaviors/affect. We first disaggregated daily stress into its between-subject and within-subject components to determine whether religion and science moderated an individual's average experience with stress relative to others (between-subject) and/or their own day-to-day experience with stress (within-subject). As is common with health behavior data (e.g. Baldwin et al., 2016), each of the health behaviors (alcohol, comfort food, and PA) were right-skewed with a high portion of zero values. To best accommodate the distribution of the outcome variables, several model distributions were tested to find the best fit for the data using the glmmTMB package in R (Brooks et al., 2017). After examining model fit criteria such as Akaike information criterion (AIC) and Bayesian information criterion (BIC) and factoring in model parsimony, Poisson models were used for alcohol and comfort food consumption, negative binomial models were used for total PA and moderate/vigorous PA, and a linear model was used for positive affect.

The distribution for negative affect was heavily right-skewed, where a vast majority of the daily entries were the lowest possible score, six. To account for this skewness, we utilized a two-part hurdle gamma model, which involved using logistic regression to predict whether a participant experienced the lowest negative affect score on a given day vs. anything higher and then using a gamma model to predict all the other scores that are higher than the lowest negative affect score. For this model, we subtracted all values by six so that the lowest negative affect score was zero to fit a hurdle model.

All multilevel models included the between-subject and within-subject components of daily stress, the reliance on religion and science scores, and the four interaction effects between reliance on religion and science separately on the between-subject and within-subject daily stress components. The day of each response was also included in all models as a fixed effect to control for any inadvertent intervention effects that might have been caused by participating in this observational study, and all fixed effects were grand-mean centered to aid in interpretation. Lastly, to account for the nested nature of the data, participant IDs were included as random intercepts for all models, and the within-subject component of daily stress was included as a random slope for most models except for PA due to model convergence issues (See Table 1).

Table 1. Unstandardized estimates of multilevel models predicting daily health behaviors and affect.

Predictors	Alcohol*			Comfort Food*			PA ^a			Moderate/Vigorous PA*			Positive Affect			Negative Affect (Gamma)*			Negative Affect (Hurdle/Logistic)*			
	B	S.E.	p	B	S.E.	p	B	S.E.	p	B	S.E.	p	B	S.E.	p	B	S.E.	p	B	S.E.	p	
(Intercept)	0.06	0.01	<0.001	2.11	0.08	<0.001	26.02	2.09	<0.001	8.76	1.00	<0.001	16.29	0.31	<0.001	3.74	0.13	<0.001	0.49	0.07	<0.001	
Daily Stress (Between)	1.09	0.04	0.046	1.05	0.01	<0.001	1.01	0.02	0.713	1.02	0.03	0.488	-0.39	0.08	<0.001	1.08	0.01	<0.001	0.55	0.03	<0.001	
Daily Stress (Within)	1.01	0.04	0.729	1.01	0.01	0.052	1.01	0.01	0.402	1.04	0.02	0.038	-0.56	0.05	<0.001	1.08	0.01	<0.001	0.70	0.03	<0.001	
Science	1.05	0.24	0.829	1.18	0.06	0.003	1.04	0.11	0.717	1.18	0.18	0.253	0.93	0.43	0.031	1.03	0.05	0.523	1.25	0.25	0.266	
Religion	0.92	0.14	0.575	1.15	0.04	<0.001	1.03	0.07	0.640	1.08	0.10	0.390	1.14	0.27	<0.001	0.95	0.03	0.086	1.51	0.19	0.001	
Time	0.99	0.01	0.175	0.97	0.00	<0.001	0.99	0.01	0.065	0.97	0.01	<0.001	-0.20	0.02	<0.001	1.01	0.01	0.090	1.03	0.02	0.144	
Daily Stress (B) × Science	1.11	0.08	0.145	1.02	0.02	0.298	1.09	0.04	0.012	1.07	0.05	0.110	0.01	0.13	0.911	0.99	0.01	0.288	1.13	0.08	0.090	
Daily Stress (B) × Religion	1.05	0.05	0.292	1.01	0.01	0.211	1.04	0.02	0.052	1.02	0.03	0.393	0.02	0.08	0.782	1.00	0.01	0.723	1.11	0.05	0.023	
Daily Stress (W) × Science	0.99	0.02	0.497	1.00	0.01	0.802	1.01	0.01	0.484	1.01	0.02	0.537	0.00	0.07	0.977	1.00	0.01	0.750	1.07	0.06	0.193	
Daily Stress (W) × Religion	1.01	0.01	0.439	1.00	0.01	0.779	1.01	0.01	0.063	1.02	0.01	0.033	-0.02	0.04	0.627	0.99	0.01	0.350	1.01	0.03	0.779	
Random Effects																						
σ ²		2.91			0.39			1.01			2.00			12.36						12.36		
τ ₀₀		5.55 _{id}			0.36 _{id}			1.58 _{id}			2.76 _{id}			26.21 _{id}						26.21 _{id}		
τ ₁₁		0.00 _{id, DailyStressW}			0.00 _{id, DailyStressW}			0.00 _{id, DailyStressW}			0.00 _{id, DailyStressW}			0.22 _{id, DailyStressW}						0.22 _{id, DailyStressW}		
ρ ₀₁		-0.35 _{id}			-0.03 _{id}			-0.60 _{id}			-0.60 _{id}			-0.14 _{id}						-0.14 _{id}		
Observations		2531			2530			2533			2534			2531						2531		

Note: *Estimates for Alcohol, Comfort Food, PA, Moderate/Vigorous PA, and Negative Affect have been exponentiated and therefore represent odds ratios.

^aPA analysis was conducted without random slopes due to model convergence issues.

^bBolded values indicate $p < .05$.

Results

Sample characteristics

The mean age of participants was 34.42 years ($SD=13.1$). Participants' gender was recoded into male ($n=97$, 33.6%), female ($n=177$, 61.2%), and other ($n=15$, 5.2%), a category that included non-binary, trans men and trans women, and others. Race was recoded as White participants ($n=195$, 67.5%) and non-White participants ($n=89$, 30.8%), which included 15.2% who identified as African American, 1% Native American or Alaskan Native, 8.7% Asian, and 5.9% multiracial). Five participants did not disclose their race (1.7%). Income was recoded as under \$40,000 ($n=94$, 32.5%), between \$40,000 and \$80,000 ($n=112$, 38.8%), over \$80,000 ($n=79$, 27.3%), and those who did not disclose their income ($n=4$, 1.4%). Education was recoded as less than a college degree ($n=134$, 46.4%), a college degree ($n=88$, 30.4%), and greater than a college degree ($n=67$, 23.2%). Marital status was recoded as those living together, which included married and cohabiting/long-term relationships ($n=123$, 42.6%), and those living alone, which included single, divorced, separated, and widowed ($n=166$, 57.4%).

Variable descriptive and bivariate correlations

Pearson bivariate correlations were calculated to examine associations among baseline and averaged study variables (see Supplemental Table 1). Of note, reliance on science was not significantly correlated with any of the other variables except for reliance on religion, to which it was negatively correlated ($p<0.01$). In contrast, reliance on religion was positively correlated with mindfulness, internal locus of control, average comfort food consumption, and average positive affect (all $ps < 0.05$).

Analyses for AIM 1. Reliance on religion and science as predictors of baseline psychosocial resources

Trait mindfulness

Reliance on religion was significantly positively associated with individuals' trait-level mindfulness ($B=0.77$, $SE = 0.30$, $p<0.01$) but reliance on science was not ($B=0.74$, $SE = 0.48$, $p=0.12$).

Internal locus of control

Reliance on religion was significantly positively associated with internal locus of control ($B=1.01$, $SE = 0.30$, $p<0.01$), while reliance on science was not ($B=0.59$, $SE = 0.47$, $p=0.21$).

Analyses for AIM 2. Reliance on religion and science as predictors of average health behaviors and psychological Well-Being

Average alcohol consumption

Neither reliance on religion ($B=-0.03$, $SE = 0.05$, $p=0.50$) nor reliance on science ($B=-0.04$, $SE = 0.08$, $p=0.59$) predicted average daily alcohol consumption.

Average comfort food consumption

Reliance on religion significantly predicted greater average daily consumption of comfort food ($B=0.35$, $SE = 0.10$, $p < 0.01$), while reliance on science was not predictive ($B=0.22$, $SE = 0.16$, $p=0.18$).

Average PA

Neither reliance on religion ($B=2.22$, $SE = 2.81$, $p=0.43$) nor reliance on science ($B=-0.48$, $SE = 4.5$, $p=0.92$) were significantly associated with the average total amount of minutes spent on PA.

Average moderate/vigorous PA

Neither reliance on religion ($B=2.38$, $SE = 1.60$, $p=0.14$) nor reliance on science ($B=1.93$, $SE = 2.56$, $p=0.45$) were significantly associated with the average amount of minutes spent on moderate/vigorous PA.

COVID-19 distress

Reliance on science predicted higher baseline COVID-19 distress ($B=1.05$, $SE = 0.53$, $p=0.049$), while reliance on religion did not reach statistical significance at the $p < 0.05$ level ($B=0.38$, $SE = 0.33$, $p=0.26$).

Average positive affect and negative affect

Reliance on religion predicted higher average daily positive affect ($B=0.95$, $SE = 0.28$, $p < 0.01$), while reliance on science did not ($B=0.57$, $SE = 0.45$, $p=0.21$). Neither reliance on religion ($B=-0.22$, $SE = 0.17$, $p=0.21$) nor reliance on science ($B=0.14$, $SE = 0.28$, $p=0.63$) predicted average daily negative affect.

Analyses for AIM 3. Reliance on religion and science as moderators of the relationship between daily stress and daily health behaviors/affect

Daily alcohol consumption

No main effects were observed for any predictors on daily alcohol consumption other than daily stress at the between-subject level ($B=0.08$, $SE = 0.04$, $p=0.046$). No significant moderating effects emerged between any daily stress component and reliance on religion or science on daily alcohol consumption.

Daily comfort food consumption

Significant positive main effects were evident for both reliance on religion ($B=0.14$, $SE = 0.03$, $p < 0.01$) and reliance on science ($B=0.16$, $SE = 0.05$, $p=0.003$) on daily comfort food consumption such that a one-unit increase in average reliance on religion and a one-unit increase in average science were associated with a 14.6% increase ($e^{0.137} = 1.146$) and a 17.5% increase ($e^{0.161} = 1.175$) in comfort food consumption,

respectively. Also, daily stress at the between-subject level was significantly positively associated with comfort eating ($B=0.05$, $SE = 0.01$, $p < 0.01$), while time, or the day at which the responses were recorded, was significantly negatively associated with daily comfort food consumption. However, no moderating effects were observed between any daily stress component and reliance on religion or science.

Daily total PA

No main effects were significant for stress, reliance on religion, or reliance on science. However, a significant interaction effect between daily stress at the between-subject level and reliance on science ($B=0.08$, $SE = 0.03$, $p=0.012$) on total minutes of daily PA was observed. To better visualize this interaction, we plotted the relationship of daily stress at the between-subject level, reliance on science, and daily PA by probing -1 SD and $+1$ SD values for both daily stress (between) and reliance on science (See Figure 1). Individuals lower in reliance on science tended, on average, to engage in less PA when they experienced more overall stress, while individuals who relied more on science to make sense of the world tended to engage in more PA, on average, when they experienced more overall stress.

Daily moderate/vigorous PA

There was a significant positive main effect for daily stress at the within-subject level ($B=0.04$, $SE = 0.02$, $p=0.038$) and a significant negative effect for time on daily moderate/vigorous PA. There were no significant main effects for religion or science but there was a significant interaction observed demonstrating a moderating effect for daily stress at the within-subject level and reliance on religion ($B=0.02$, $SE = 0.001$, $p=0.033$) on total minutes of moderate/vigorous PA. We also plotted the relationship of daily stress at the within-subject level, reliance on religion, and daily moderate/vigorous PA by probing -1 SD and $+1$ SD values for both daily stress (within) and reliance on religion (See Figure 2). Individuals who relied more on religion to make

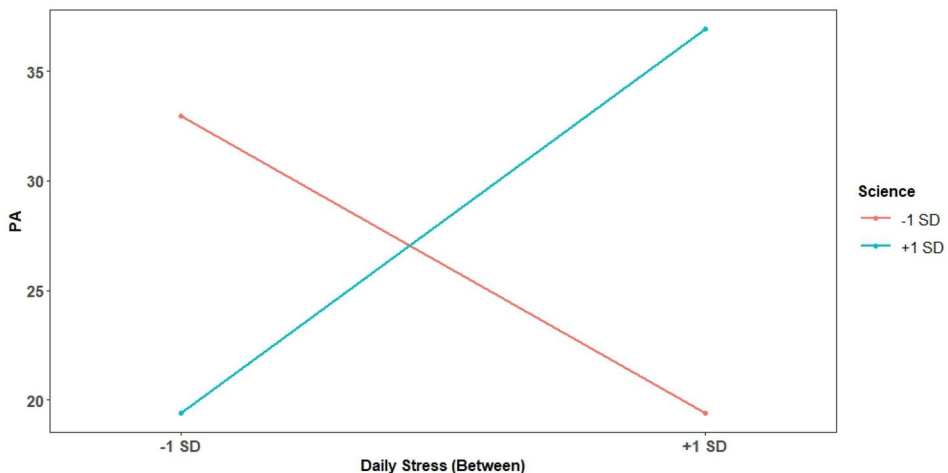


Figure 1. Interaction between reliance on science and daily stress (between-subject) on daily PA.

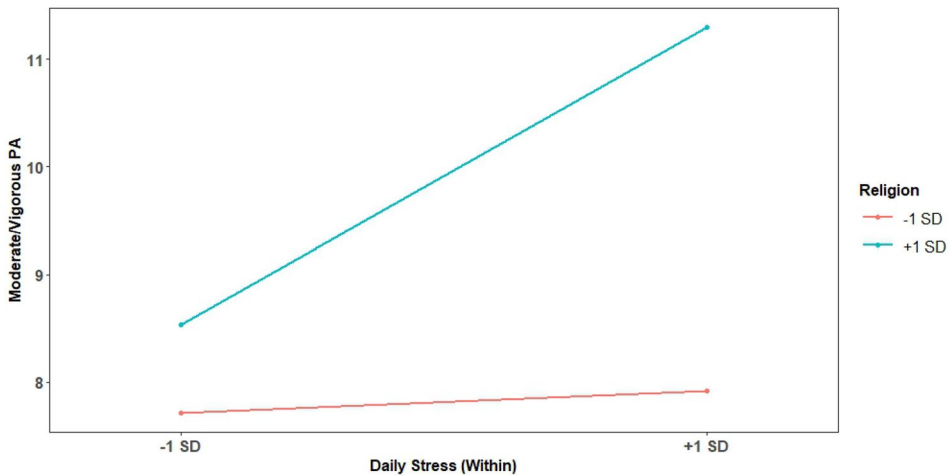


Figure 2. Interaction between reliance on religion and daily stress (within-subject) on daily moderate/vigorous PA.

sense of the world tended to engage in more moderate/vigorous PA on days higher in stress than they normally experience relative to those who relied less on religion. For individuals lower in reliance on religion, moderate/vigorous PA remained relatively constant *regardless* of how much stress they felt on a given day.

Daily positive affect

There were significant positive main effects for reliance on religion ($B=1.14$, $SE = 0.27$, $p < 0.01$) and reliance on science ($B=0.93$, $SE = 0.43$, $p=0.03$) on daily positive affect. Also, time and daily stress at the between-subject ($B=-0.39$, $SE = 0.08$, $p < 0.01$) and within-subject ($B=-0.57$, $SE = 0.05$, $p < 0.01$) levels were significantly negatively associated with daily positive affect. However, there were no significant moderating effects between daily stress and reliance on religion/science on daily positive affect.

Daily negative affect

For the logistic regression part of the model, there were significant negative effects for daily stress at the between-subject ($B=-0.59$, $SE = 0.06$, $p < 0.01$) and within-subject ($B=-0.36$, $SE = 0.04$, $p < 0.01$) levels. These results mean that a one-unit increase in daily stress (between) and daily stress (within) were associated with a 45% decrease ($e^{-0.594} = 0.55$) and a 30% decrease ($e^{-0.359} = 0.7$), respectively, in the odds of experiencing the lowest negative affect possible vs. anything greater for a given day. There was also a significant positive effect for reliance on religion ($B=0.41$, $SE = 0.13$, $p=0.001$) such that a one-unit increase in average religion was associated with a 51% increase ($e^{0.412} = 1.51$) in the odds of experiencing the lowest negative affect possible vs. anything greater for a given day. Lastly, there was a significant interaction effect between daily stress at the between-subject level and reliance on religion ($B=0.12$, $SE = 0.05$, $p=0.02$). We plotted this relationship of daily stress at the between-subject level, reliance on religion, and the probability of experiencing the lowest negative affect by probing -1 SD and $+1$ SD values for both daily stress (between) and reliance

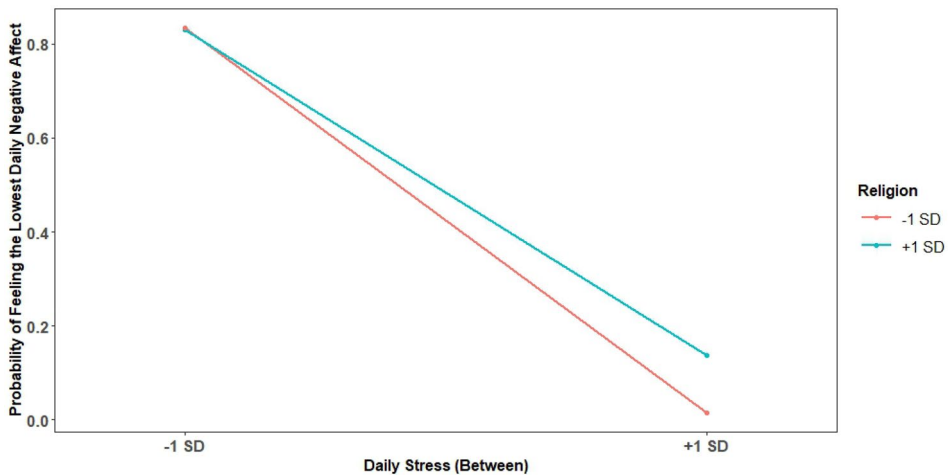


Figure 3. Interaction between reliance on religion and daily stress (between-subject) on the probability of experiencing the lowest daily negative affect possible.

on religion (See Figure 3). At higher levels of average daily stress, individuals who relied more on religion had an increased likelihood of experiencing the lowest negative affect possible relative to those who relied less on religion. Those who tended to experience low levels of stress on average had very similar high probabilities (~80%) of experiencing the lowest negative affect possible vs. experiencing anything higher regardless of their reliance on religion.

For the gamma model (i.e. within individuals who experienced *some* negative affect), daily stress had significant positive effects at the between-subject ($B=0.08$, $SE = 0.01$, $p < 0.01$) and within-subject ($B=0.08$, $SE = 0.01$, $p < 0.01$) levels such that higher between- and within-subject daily stress were associated with higher daily negative affect scores. However, there were no other significant effects for the gamma part of our model.

Discussion

The COVID-19 pandemic and other recent events have highlighted the divergent ways that individuals make sense of their worlds and the impact that these different ways of sense-making have on their behavior. In this study, we aimed to specifically examine the conjoint influences of relying on religion and on science to make sense of the world in one important domain: individuals' health-related resources, health behaviors, and emotional well-being and their interplay in the context of stress. Because so little research has compared the effects of different belief systems, our questions were exploratory. Our results generally indicated that relying on religion and on science to make sense of the world helped explain individuals' health-related resources and behaviors.

In considering the observed associations, it is important to note that although religious and scientific views of the world tend to be moderately strongly inversely associated (e.g. Farias & Newheiser, 2019), they were not mutually exclusive in terms

of their predictive value on health behaviors and well-being. Because, in the present study, scores of reliance on religion and on science were based on items that exactly mirrored each other with just one word swapped (“God” and “science”), we expected a large inverse association between religion and science, but it was only moderate in strength. Further, as we review below, in no instances were effects opposite for reliance on religion and on science; instead, they seemed to be differentially relevant for different aspects of health.

As expected, reliance on religion to make sense of the world was positively associated with both of the health-related resources measured, mindfulness and internal locus of control, while reliance on science was unrelated. The latter findings were somewhat unexpected, given that a scientific understanding of the world might be expected to provide at least some sense of secondary control (Bruckermann et al., 2021). Both psychosocial resources are generally associated with greater health and engagement in healthy behaviors (e.g. Fanning et al., 2018; Hou et al., 2017). Thus, these resources represent one potential pathway through which reliance on religion to make sense of the world may influence downstream health (Park & Carney, 2019).

Further, a scientific worldview, but not a religious one, was related to higher levels of COVID-19 distress, perhaps because scientific perspectives indicated legitimate reasons for concern with the virus and its consequences and thus induced more stress on these individuals (David et al., 2023).

Interestingly, in further support of the nuanced relationship between reliance on religion and science to make sense of the world, we also found instances where both related to the performance of health behaviors *in the same direction*. Specifically, both were related to greater daily consumption (and average consumption for religion only) of unhealthy “comfort foods”, regardless of stress levels. Perhaps those more religiously oriented were less concerned about eating unhealthy comfort foods due to divine protection or fatalism (Park & Slattery, in press). We expected high reliance on science to be negatively associated with daily comfort food consumption, or, at the least, to be unassociated. Yet, we found the opposite at the daily level, a finding that might reflect the lack of connection between factual knowledge and the ability to resist the lure of comfort food eating, especially when under stress (e.g. Pool et al., 2015).

As for PA, neither relying on religion nor on science to make sense of the world were generally related to one’s average level of PA engagement. These findings were somewhat contrary to our initial hypotheses, in that we expected higher reliance on science, in general, would be related to more PA engagement. Similar to comfort food findings, results suggest that despite increased awareness of the empirically supported health benefits of PA associated with a more scientific worldview, individuals generally may still lack the regulatory capacity or self-efficacy to follow through with the *behavior* of PA engagement (e.g. Rimal et al., 2000).

However, when accounting for stress, our daily models provided a much more nuanced understanding of the nature of the relationship between worldviews, stress, and daily PA engagement. Individuals with less reliance on a scientific worldview experienced a greater negative impact of stress on daily PA; in other words, greater reliance on science buffered the impact of average stress on total PA levels. These

findings suggest that although they may not engage in greater PA on average, more scientific individuals may be more likely to translate knowledge that PA can be beneficial for stress reduction into actual health behavior. Stated another way, a higher reliance on scientific beliefs may make individuals less prone to the negative impact of daily stressors on PA (e.g. Englert & Rummel, 2016).

Further, on higher stress days (compared to individuals' own average stress levels), having a more religious perspective resulted in greater moderate/vigorous PA engagement compared to having a less religious worldview. So, a higher reliance on religion may also protect against the otherwise negative effect of particularly stressful days on daily moderate/vigorous PA. This may be attributed to the fact that a religious outlook can frame the influence of daily stressors as less challenging or threatening and therefore reduce its effects (Ellison et al., 2019).

No relationships between alcohol consumption and either way of making sense of the world were observed. However, nearly 80% of reported daily alcohol intake observations in the present study were zero. This limited variance in alcohol use hindered our ability to draw conclusions about associations with alcohol and thus warrants future exploration.

For positive and negative affect, relying on religion to make sense of the world was favorably associated with both average and daily levels of positive affect, as expected based on previous research (Petee et al., 2023). However, interestingly, higher reliance on science was also positively associated with positive affect on a daily level. One possible explanation for this similarity is that individuals who are strongly confident in or have a strong reliance on either worldview may feel more at peace and content with the world compared to those who are not as sure about their foundational outlooks on life. Also consistent with our hypotheses, a more religious worldview, in general, was associated with a higher chance of experiencing the lowest negative affect possible for a given day. Also, reliance on religion to make sense of the world buffered the effect of overall stress on the probability of experiencing a negative affect higher than the lowest. Together, these findings further supported our initial hypothesis on the effects of religion on emotional well-being. However, the significant direct effects and stress-buffering effects of religion did not predict the severity of negative affect (i.e. when examining negative affect beyond the lowest possible score). Thus, religion may help individuals in experiencing minimal negative affect, but once a person does experience negative affect, reliance on religion does not seem to provide any further benefit. Another noteworthy nuance is that this effect only occurred in negative affect, but not positive affect, which suggests that a religious perspective plays a role in helping individuals be more "resilient" against stress (Farias & Newheiser, 2019) but may not necessarily promote feeling more "pleasant" emotions in the face of it.

Study limitations

Study limitations must be noted. First, as mentioned previously, the alcohol variable lacked variation to adequately examine associations with worldviews. Further, we did not incorporate participants' level of health information or motivations (e.g. how aware they were of the health benefits/risks of the health behaviors). This information should

be assessed in future research to better understand how religious and scientific perspectives of the world manifest in health behaviors and outcomes. The negative affect distribution was also heavily skewed, perhaps due to the questions assessing the construct. Although our affect measure is a validated scale, instructions were modified to assess how individuals felt *at that moment right before they went to sleep* to determine the “final result” of one’s day. This modification might have inadvertently captured the relatively positive and calm moments before sleep. Also, given the novelty of this research and the exploratory nature of our analyses, we did not statistically correct for the multiple tests conducted. Although these findings provided important preliminary evidence related to our research questions, future studies are needed to replicate these findings using rigorous methods. We did not investigate how the reliance on religion and on science might relate to or differ by specific religious affiliation, denomination, race/ethnicity, gender, or other demographic variables; investigation of differences by demographic or other variables is a promising direction for future research. Finally, since our study was observational, we could not establish causal effects.

Study implications

Despite these limitations, our findings have implications for understanding the relationship between religious and scientific perspectives and their influence on individuals’ health and well-being. Specifically, our results provided key insights into the relationship between religious and scientific worldviews on a person’s psychosocial health-related resources, health behaviors (both generally and as influenced by daily stress), and affective well-being. Many of the findings supported our initial hypotheses. For example, our findings suggested that reliance on religion may have some protective benefits for psychological well-being. However, holding a more scientific perspective was not predictive of greater health behavior engagement as we had predicted, suggesting that reliance on science to make sense of the world does not necessarily equate to a healthier life.

Our multilevel results also revealed the impact of religious and scientific worldviews on individuals’ day-to-day behaviors and well-being in the context of daily stress. Both reliance on religion and on science to make sense were associated with more daily comfort food consumption and higher daily positive affect. Reliance on religion also buffered the impact of stress on daily negative affect, while both worldviews buffered the impact of stress on daily PA, suggesting that they may be protective for maintaining healthy behaviors during times of stress.

Overall, these findings highlighted the complex and dynamic interplay between religious and scientific beliefs and their influence on health-related resources, behaviors, well-being, and stress responses. The interplay of religious and scientific beliefs on health behaviors during the COVID-19 pandemic highlighted the urgency of better understanding the roles of these beliefs vis-à-vis health and well-being (David et al., 2023; Rutjens et al., 2022). Future research is needed to identify potential strategies for promoting health and well-being among individuals with different belief systems and to develop ways to capitalize on these belief systems to promote better health behaviors and well-being. This work might fruitfully explore how individuals reconcile

conflicting beliefs (O'Brien & Noy, 2020). This research also highlighted the need for healthcare professionals to consider the influence of an individual's religious and scientific beliefs when assessing their health-related behaviors and well-being and perhaps usefully support individuals with different belief systems.

Overall, given the relatively limited research on the conjoint influences of religious and scientific beliefs, this study laid a foundation for future research to better understand how religion and science play their own respective as well as joint roles in affecting a person's health and well-being.

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Data availability statement

Data available on request from the authors—The data that support the findings of this study are available from the corresponding author, K. G., upon reasonable request.

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