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Article

Religiosity and health: A global comparative study

Zachary Zimmer[a,*], Florencia Rojo[b], Mary Beth Ofstedal[c], Chi-Tsun Chiu[d], Yasuhiko Saito[e], Carol Jagger[f]

[a] Department of Family Studies and Gerontology, Global Aging and Community Initiative, Mount Saint Vincent University, 166 Bedford Highway, McCain Centre Room 201C, Halifax, Nova Scotia, Canada B3M2J6
[b] Social and Behavioral Sciences University of California San Francisco, 3333 California Street, San Francisco, CA, United States
[c] Institute of Social Research, University of Michigan, 426 Thompson, Ann Arbor, MI, United States
[d] Institute of European and American Studies, Academia Sinica, No. 128, Section 2, Academia Rd., Nangang District, Taipei City, Taiwan
[e] Population Research Institute, Nihon University, 12-5 Goban-cho, Chiyoda-ku, Tokyo, Japan
[f] Institute of Aging, Newcastle University, Biogerontology Research Building, Camputs for Ageing and Vitality, Newcastel upon Tyne, United Kingdom

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ABSTRACT

The objective of this paper is to understand global connections between indicators of religiosity and health and how these differ cross-nationally. Data are from World Values Surveys (93 countries, N = 121,770). Health is based on a self-assessed question about overall health. First, country-specific regressions are examined to determine the association separately in each country. Next, country-level variables and cross-level interactions are added to multilevel models to assess whether and how context affects health and religiosity slopes. Results indicate enormous variation in associations between religiosity and health across countries and religiosity indicators. Significant positive associations between all religiosity measures and health exist in only three countries (Georgia, South Africa, and USA); negative associations in only two (Slovenia and Tunisia). Macro-level variables explain some of this divergence. Greater participation in religious activity relates to better health in countries characterized as being religiously diverse. The importance in god and pondering life's meaning is more likely associated with better health in countries with low levels of the Human Development Index. Pondering life's meaning more likely associates with better health in countries that place more stringent restrictions on religious practice. Religiosity is less likely to be related to good health in communist and former communist countries of Asia and Eastern Europe. In conclusion, the association between religiosity and health is complex, being partly shaped by geopolitical and macro psychosocial contexts.

Introduction

Religiosity is frequently referenced as a predictor of population health (e.g., Gillum, King, Obisesan, & Koenig, 2008; Headey, Hoehne, & Wagner, 2014; Hummer, Benjamins, Ellison, & Rogers, 2010; Levin, Chatters, & Taylor, 2011; Musick, House, & Williams, 2004; Sullivan, 2010; Thege, Pilling, Székely, & Kopp, 2013). A large body of research, summarized in a number of review articles, conducted over decades and employing a broad range of objective and subjective indicators of health has suggested that, while there are exceptions, religion is, on balance, salutary (Ellison & Levin, 1998; Koenig, 2012; Krause, 2011; Larson, Swyers, & McCullough, 1998; Lavretsky, 2010; Levin & Chatters, 2008; Moreira-Almeida, 2013; Seybold & Hill, 2001; Zimmer et al., 2016).

Much of the research has deemed the association to be a function of three broad inter-related mechanisms. The first is social support. Across diverse populations, from wealthy U.S. suburbs to Nairobi slums, religious activity has been found to link individuals to others with common values, interests and concerns, who provide friendship, emotional support, and practical assistance, thereby increasing size of social networks and improving quality of social interactions (Kodzi, Gyimah, Emina, & Ezeh, 2011; Koenig et al., 1997; Krause, 2006; Pirutinsky et al., 2011). Second, religious denominations may prescribe lifestyles that promote health. For instance, certain religions convey negative views about tobacco, alcohol use, and risky sexual behavior (Hill, Ellison, Burdette, & Musick, 2007; Strawbridge, Shema, Cohen, & Kaplan, 2001). A number of behaviors that have been shown to improve health outcomes are interwoven within religious doctrines. There is convincing evidence about benefits of meditation and mindfulness practice. While these are activities typically connected to several

* Corresponding author.
E-mail address: zachary.zimmer@msvu.ca (Z. Zimmer).

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Eastern religions, prayer in general, typical of all major religions, is likely to accrue similar benefits (Davidson et al., 2003). Third is a set of mechanisms referred to as psychosocial factors. At the forefront of these are reduction of stress and provision of coping mechanisms (Krause, Ellison, Shaw, Marcum, & Boardman, 2001; Pargament, Koenig, & Perez, 2000). Stress is affected in a number of ways. Prayer and meditation are recognized as stress reducers, triggering biological functions like blood pressure and cortisol production (Anderson, Liu, & Kryscio, 2008; Sudsuang, Chentanez, & Veluvan, 1991). By providing answers to some of life's biggest questions, religion not only can ease one's own existential anxieties over the propinquity of mortality, but can also play a function when dealing with adversity such as sickness and death of loved ones (McFadden, 1995; Pargament, 1997; Rogers, 1976). Further, there are a large number of difficult to categorize and measure psychosocial concepts thought to mediate the association between religion and health, such as forgiveness and gratitude (Krause & Hayward, 2014; Lawler-Row, 2010).

Despite this abundance of research pointing to health benefits of religion, a number of issues that threaten the validity of the association have been systematically overlooked. The current study addresses two of these. The first is the extent to which the association is globally contextual. The vast majority of research on religiosity and health has been conducted in the U.S. where Christian-based religions are dominant. Research has paid little attention to geopolitical and macro psychosocial contexts that may shape the way in which religion is perceived across national, cultural, and denominational parameters. The current study incorporates a perspective advanced by Inglehart (2010), which suggests that socioeconomic development brings with it greater income, higher levels of education, and personal independence. Hence, it supports freedom of choice in many aspects of life, including whether and how to engage in religious activity, and allows for the benefits of religiosity to take form. Therefore, in countries where there are higher levels of development and greater diversity of religious practices, individuals will tend to choose activities from which they derive satisfaction, either consciously or not. Conversely, religion is less helpful where practice of any religion or the pursuit of specific religions is not normative, there are hostilities toward religious groups, restrictions on practice, adverse social consequences for engaging in religion and little choice in what and how to practice. Within these environments, pressures to conform can be stressful, endowing negative health outcomes for adherents, while restriction in free-time activities disallows for personally satisfactory and salutary participation. Inglehart's (2010) research demonstrated that religion in and of itself is unrelated to several indicators of well-being on a national level until adjusting for economic development, after which the impact of religion becomes positive. He further showed that the correlation between religion and indicators of well-being is minimal or negative in current and former communist countries of Eastern Europe and Asia; a function of the long and systematic suppression of religion in countries with a history of communist governance. In these countries, religion has mostly attracted new recruits that are selectively unhappy, unsatisfied with life, and unhealthy.

The second unresolved issue addressed in this paper is one of indicators of religiosity. The largest volume of and most robust evidence for a beneficial influence of religion is based on frequency of practice and attendance (Hummer, Ellison, Rogers, Moulton, & Romero, 2004; Li, Stampfer, Williams, & VanderWeele, 2016; Strawbridge, Cohen, Shema, & Kaplan, 1997). Religiosity is a complex social phenomenon encompassing different dimensions, such as the distinction between participation and belief (Krause, 1993). While there is some overlap, these dimensions are not perfectly correlated. Participation is related to behaviors such as attending services, engaging in prayer, acting upon rituals, and volunteering for organizations. Belief, in contrast, is more personal, involving notions such as strength or importance of god and faith, ideology, and philosophies. Spirituality, arguably a component of religiosity, is an even more complicated construct which is often referred to in terms difficult to characterize, such as the search for or contemplation of a meaning of life (Zinnbauer et al., 1997).

Current study

To address issues of contextual and measurement distinctions in the association between religiosity and health, the current study uses data from 93 countries in the World Values Survey (WVS), and assesses the degree to which the relationship between three indicators of religiosity are related to health globally and the degree to which these associations are country specific. We refer to the indicators as *participation*, *importance*, and *meaning*. Religiosity is complex and our indicators may be crude, yet have face validity, providing information about the degree to which an individual conforms to three dimensions commonly thought to be part of religious behavior and thinking. Participation is based on a survey question about frequency of attendance at religious services. Importance is established by the answer to a survey question about the importance of god in one's life. Meaning is constructed from a survey question asking about the frequency with which an individual ponders the meaning and purpose of life. This last item is the least direct indicator and admittedly is capturing more than religiosity, but makes for an interesting comparison with the other two, especially since Joshanloo and Wijers (2014) note that an immense amount of data has yielded very few significant associations between this particular measure and indicators of well-being. The analysis explores *if religiosity is associated with better health in a consistent fashion across countries and indicators*.

A critical aspect of the current study is the introduction of country-level predictors in multilevel models. The country-level variables quantify the degree of within country religious diversity, religious restriction and socioeconomic development, and whether the country can or cannot be classified as a current or former communist state. Using these measures, the study also explores *the extent to which national level factors shape the association between religiosity and health*.

Data

WVS is a globally conducted nationally representative survey of adults 18 and older, covering topics related to beliefs, values and motivations of people (Inglehart et al., 2014; World Values Survey, 2017). Led by social scientists within countries, it is conducted in waves, with each wave covering a number of countries. The first wave was conducted between the years 1981 and 1984 and covered eight countries. The survey expanded over time such that Wave 6, conducted between 2010 and 2014, covered 60 countries. The number of observations per country per wave varies, but is generally in the 1000 to 2000 range. Not all survey questions are repeated in all countries, however for the most part core questions are consistent. While there have been 97 countries participating in the WVS over the years, there are 93 wherein all the survey questions needed for the current analysis were asked in at least one wave. Item 1 in Supplementary Materials includes the list of countries and their three letter abbreviation used in tables and charts in this paper. For countries that have participated in multiple WVSs, we use data from the most recent wave available. In this study 66% of the sample comes from wave 6, 20% from wave 5, 8% from wave 4 and 6% from wave 3. This means the majority of the data was collected since 2010, and all of the data was collected since 1995. The total sample across 93 countries is 121,770 individuals.

Measures

The single indicator of health available in the WVS is a ubiquitous self-assessed health question: "All in all, how would you describe your state of health these days? Would you say it is very good, good, fair, or poor?" While just a single general question, a large quantity of research has verified its validity as an inclusive indicator of health, a strong

predictor of mortality, and a highly interpretable item across languages (Idler & Benyami, 1997; Jylha, 2009). There may be differences across countries in the tendency of individuals to rate their health in the top or bottom category. The current study accounts for these variations in a multilevel approach, which allows focus on religiosity and self-assessed health across rather than on levels of health within countries.

Three survey questions are used as indicators of religiosity. *Participation*, is attendance at religious services 'apart from weddings and funerals', on a seven-point scale ranging from more than once a week to never. *Importance* is based on a question that asks individuals to rate the importance of god in their life on a scale from 1 to 10. *Meaning* is determined by a question about frequency with which one ponders the meaning and purpose of life, with responses ranging from never (coded 1) to often (coded 4). While these indicators are correlated, particularly participation and importance, correlations are not strong enough to suggest similar constructs. For analytical purposes, the items are normalized across the total sample so that each has a mean of zero and standard deviation of one. In addition to measures of religiosity, each model includes individual-level measures of age, which is continuous, sex, and an indicator of social class. The latter is based on a single item included in all WVS questionnaires that asks individuals to rank their social class into one of five categories from low/working class to high. The two highest and two lowest groups are collapsed such that we have responses of low, middle and high. In addition, 5% of respondents did not answer the question about social class resulting in a fair number of missing. These missing are coded as an additional category, resulting in a four-category variable. All multivariate models include an age-squared term because the association between age and self-assessed health is non-linear in a large number of countries.

The country-level measures that are included address the extent to which the association is globally contextual with respect to diversity, restriction, socioeconomic conditions and communist government as discussed in the introduction and in Inglehart (2010). They come from different sources. *Diversity* is an aggregate of religious denomination listed in the WVS constructed using the Simpson index of ecological diversity (Simpson, 1949). Ranging from 0 to 1, the index measures the inverse of the probability that two individuals selected randomly from the population will have the same religious denomination. Diversity will equal 0 if all persons in the sample have the same denomination and 1 if each person were to have their own denomination. *Restriction* is an index based on the degree to which government places restrictions on religious practice. This measure is obtained from the Pew Research Center's Global Religious Futures Project (Pew Research Center, 2015). It is a composite of 20 items gauging the ways in which national and local governments constrain religious expressions. The original scale ranges from 1 to 10, but we divide this by 10. Development is operationalized by using the *Human Development Index* (HDI) published each year by UNDP. It is a composite of life expectancy, education and per capita income, and ranges from 0 to 1 (UNDP, 2000). Item 2 in Supplementary Materials provides diversity, restriction, and HDI scores for each country. Finally C*ommunism* is a dichotomous measure coded as 1 for communist and former communist countries of Asia and Eastern Europe and zero otherwise. Given that the Soviet Union was dissolved by the early 1990s, all of the Eastern European countries would have left the Soviet Union and would have converted out of communism by the time of data collection. Table 1 shows summary statistics for study variables.

Table 1
Descriptive statistics for study variables (N = 121,770).

	Percent (N)	Mean (Std Dev)	Source
Individual-level data			
Age		41.49 (16.41)	
Sex			
Male	47.8 (58,207)		
Female	52.2 (63,563)		
Social class			WVS
High	38.9 (47,306)		
Middle	35.2 (42,894)		
Low	20.9 (25,470)		
Missing	5.0 (6100)		
Self-assessed health			
Very good	25.0 (30,472)		WVS
Good	44.2 (53,768)		
Fair	24.7 (30,118)		
Poor	6.1 (7412)		
Religiosity indicators			
Participation		0.000 (1.000)	WVS
Importance		0.000 (1.000)	WVS
Meaning		0.000 (1.000)	WVS
Country-level data			
Diversity		0.441 (0.250)	WVS
Restriction		0.390 (0.241)	Pew
HDI		0.725 (0.139)	UNDP
Communist country			CIA
Yes	27.2 (33,091)		
No	72.8 (88,679)		

Note: Percentage and N in parentheses for categorical variables. Mean and standard deviations in parentheses for continuous variables. Source refers to the source of the information as follows: WVS – World Values Survey; Pew – Based on the Pew Research Center report on *Latest Trends in Religious Restrictions and Hostilities*. UNDP – Based on various years of the *Human Development Report*; CIA - Based on information obtained from the CIA World Factbook.

Analysis

Two types of analyses are conducted. First, country-specific associations are examined using ordered logistic regression models fitted to determine the relationship between religiosity indicators and health separately for each country, controlling for sex, age, age-squared and social class. Results are shown as log-odds. Second, pooling data across countries, global associations are shown using multilevel models with random intercepts and slopes. These results assess the overarching association between religiosity and health, the extent to which this overarching association varies across countries, and the extent to which country-level variation is explained by country-level variables. Details on the form of these models is found in Supplementary Materials Item 3.

Country-specific associations

Associations between participation, importance and meaning and self-assessed health, controlling for age, age-squared, sex, and social class, in each country, with 95% confidence intervals, is shown graphically for all countries in Figs. 1 to 3. Results are in the form of the log odds, which center on zero such that coefficients below and above zero have opposite direction but are equal in magnitude if they have the same value. The ordered logit model is a proportional odds model. It is interpreted similar to a binary logit model, except that the log odds associated with an independent variable indicates how a one-unit change in that variable associates with a move up or down the ordered scale of the dependent variable regardless of what categories of the dependent variable are references, or how the variable is 'cut': very good versus good, fair, poor; very good or good versus fair or poor; or very good versus good, fair or poor. A positive coefficient can therefore be interpreted as increasing the chances of being in a higher or better self-assessed health category, and a negative coefficient as increasing the chances of being in a lower or less favorable self-assessed health category. Figures are organized from the largest negative to the largest positive coefficient for within-country associations. Countries are indicated by three letter abbreviations, the key to which is found in the Supplementary Materials Item 1.

In Fig. 1, the strongest negative association between participation and health is in China where a one-unit increase in participation

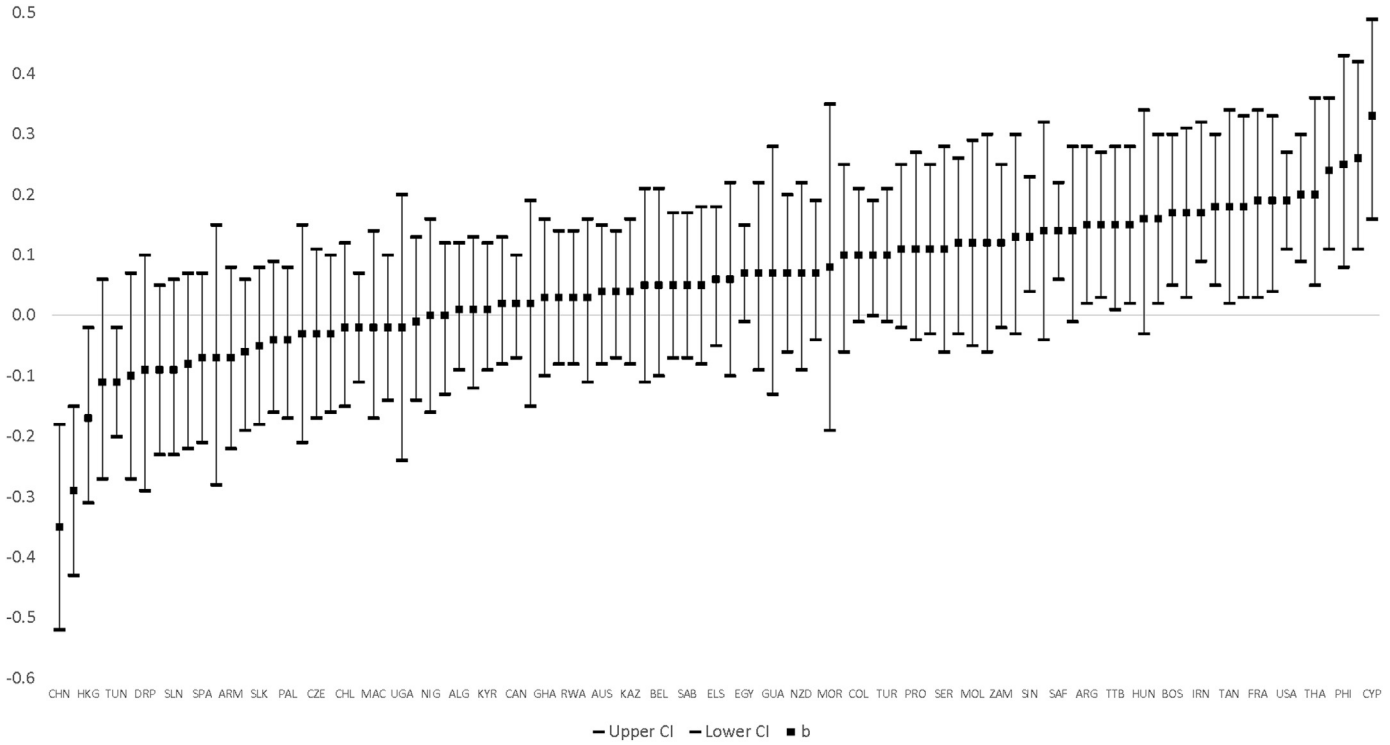

Fig. 1. Country specific log odds for the relationship between religious participation and self-assessed health, showing point estimates and 95% confidence intervals. Each result controls for age, age-squared, sex and social class. Country names are abbreviated. The key to the abbreviations is found in Supplementary Materials Item 1.

associates with -0.33 log odds of being in a higher category of self-assessed health. The confidence intervals indicate that the association in China is statistically significant. The strongest positive association is in Cyprus, which virtually mirrors the association with China. Put simply, religious participation associates with much poorer health in China and much better health in Cyprus. Pakistan and Iraq have the next strongest negative associations and Philippines and Ethiopia have the next strongest positive. Looking across countries, the preponderance of

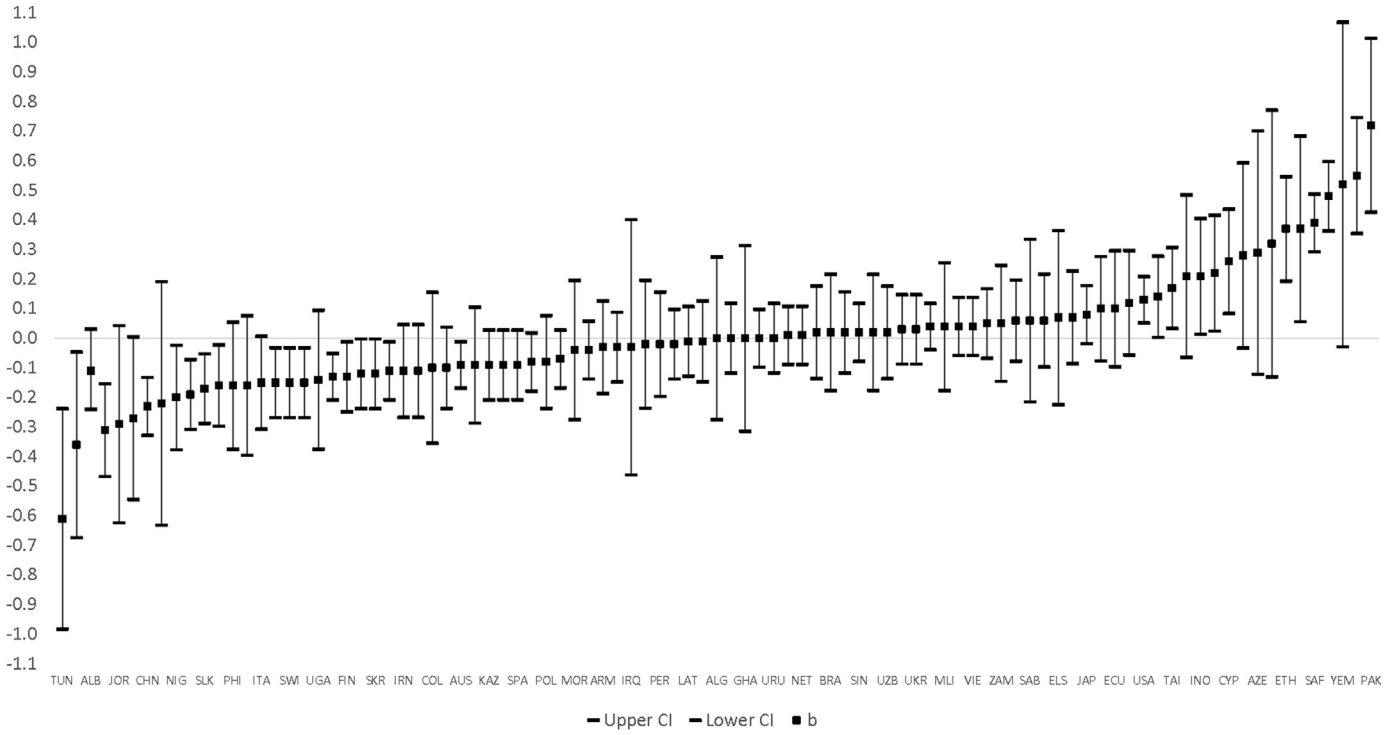

Fig. 2. Country specific ordered logit log odds for the relationship between importance in god and self-assessed health, showing point estimates and 95% confidence intervals. Each result controls for age, age-squared, sex and social class. Country names are abbreviated. The key to the abbreviations is found in Supplementary Materials Item 1.

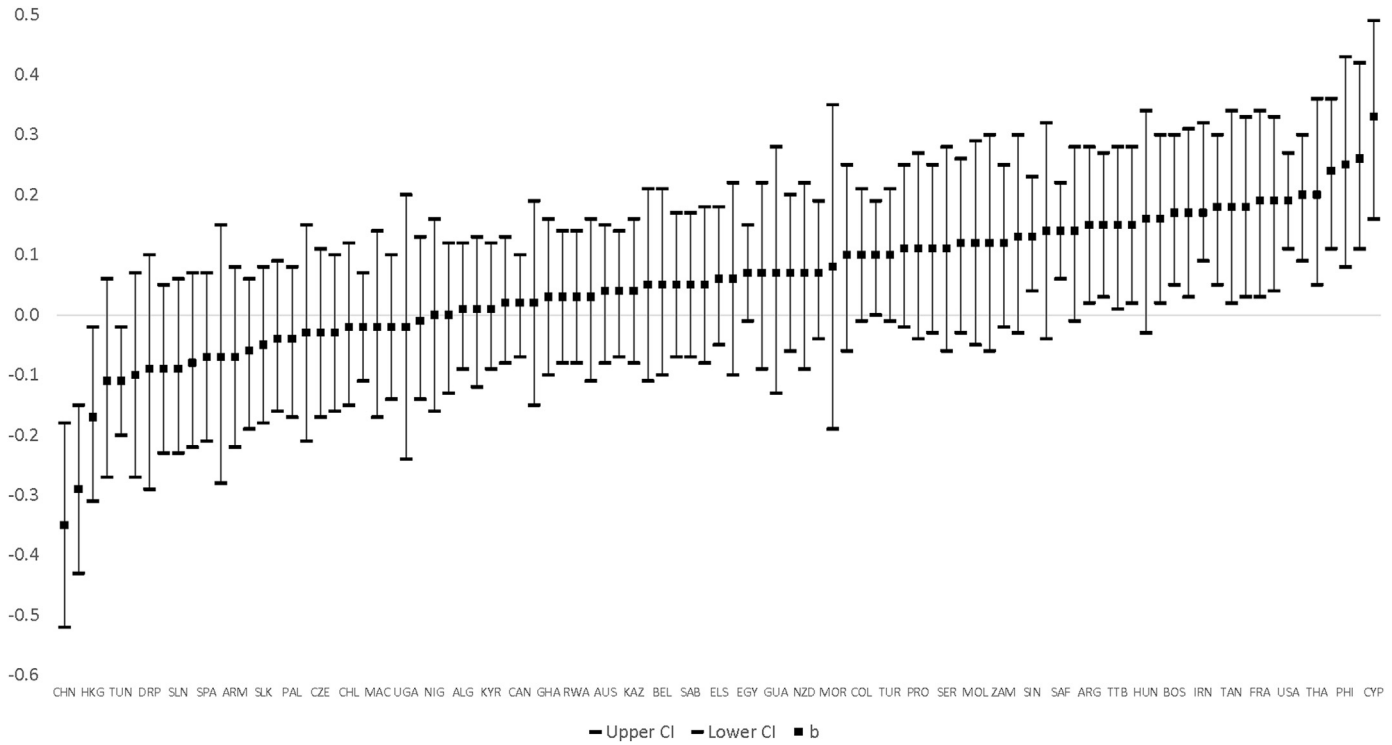

Fig. 3. Country specific ordered logit log odds for the relationship between meaning and self-assessed health, showing point estimates and 95% confidence intervals. Each result controls for age, age-squared, sex and social class. Country names are abbreviated. The key to the abbreviations is found in Supplementary Materials Item 1. Outlier Rwanda (b = .78; 95% CI .65-.90) omitted.

Table 2
Log odds ratios predicting self-assessed health in 93 countries, non-interaction models (N = 121,770).

	Model 1	Model 2	Model 3
Individual-level			
Religiosity indicators			
Participation	0.050***		
Importance		-0.000	
Meaning			0.025
Female	-0.232***	-0.224***	-0.219***
Age	-0.027***	-0.027***	-0.027***
Age-squared	-0.00011***	-0.00011***	-0.00011**
Social class			
Low	–	–	–
Middle	0.383***	0.385***	0.383***
High	0.727***	0.727***	0.725***
Missing	0.217***	0.218***	0.222***
Country-level			
Diversity	0.438**	0.556**	0.460**
Restrictions	0.059	0.029	0.098
HDI	1.170***	.949***	.962***
Communism	-0.753***	-0.714***	-0.767***
Intercept 1	-3.447	-3.512	-3.552
Intercept 2	-1.255	-1.318	-1.357
Intercept 3	0.979	0.918	0.881
Random components			
Intercept (S.E.)	0.211(.026)	0.198 (.026)	0.211 (.026)
Slope (S.E.)	0.0078 (.0021)	0.0262 (.0080)	0.0186 (.0050)
LL	-135,840.9	-135,787.3	-135,723.6

* 0.05 < P < 0.10
*** P < 0.01
** 0.01 < P < 0.05

associations between participation and self-assessed health is positive. Coefficients range from plus to minus 0.4. A significant positive association is present in 23 countries and a significant negative association is present in only 4. However, variation is enormous, ranging from strongly negative to strongly positive and everything in between. There is no single universal association between religious participation and health across countries.

For importance in Fig. 2, associations with self-assessed health again vary greatly. Most of the coefficients are in the range of about plus to minus 0.4. The strongest negative associations are found in Tunisia, Dominican Republic, and Albania, and the strongest positive associations are in Yemen, Burkina Faso and Pakistan. Significant positive associations exist in 11 countries and significant negative ones in 17.

Fig. 3, which looks at the indicator meaning, has one outlier in Rwanda with a log odds of +0.77. This is removed from the figure. Most of the other coefficients generally range from about plus to minus 0.2, again with substantial cross-country variation. The strongest negative associations are in Germany, Croatia, and Belarus, and strongest positive, besides Rwanda, are in Pakistan, Azerbaijan, and Ecuador.

To sum, significant positive associations with self-assessed health across all three religiosity indicators are found in three countries only: Georgia, South Africa, and the U.S. Only two countries, Slovenia and Tunisia, have negative associations between religiosity and health that are significant across all religiosity indicators. In 30 countries associations are consistently positive, and in 12 consistently negative, but not always significant, while 45 countries display a mix of positive and negative associations across the three religiosity indicators. Significant positive associations exist in 24 countries and significant negative ones are found in 19.

Multilevel models

Data across countries are pooled and multilevel models fitted with individual and country-level components. The first set of models does not include cross-level interactions. Three models are included, one for each indicator of religiosity. Results are shown in Table 2. The preponderance of the association between participation and health across

Table 3
Log odds ratios predicting self-assessed health in 93 countries, cross level interaction models (N = 121,770).

	Model 1	Model 2	Model 3
Individual-level			
Religiosity indicator (RI)			
Participation	0.018		
Importance		0.274*	
Meaning			0.272***
Female	-0.233***	-0.223***	-0.219***
Age	-0.027***	-0.027***	-0.027***
Age-squared	-0.00011***	-0.00011**	-0.00011**
Social class			
Low	–	–	–
Middle	0.383***	0.385***	0.383***
High	0.726***	0.727***	0.724***
Missing	0.217***	0.218***	0.222***
Country-level			
Diversity (D)	0.428**	0.501**	0.342*
Restrictions (R)	0.053	-0.025	0.000
HDI (H)	1.198***	1.005***	.992***
Communism (C)	-0.757***	-0.681***	-0.716***
Cross-level interactions			
RI X D	0.110***	–	–
RI X R	–	–	0.111**
RI X H	–	-0.328*	-0.365***
RI X C	-0.053**	-0.095***	-0.073***
Intercept 1	-3.434	-3.503	-3.615
Intercept 2	-1.241	-1.309	-1.420
Intercept 3	0.993	0.927	0.818
Random components			
Intercept (S.E.)	0.211(0.026)	0.197 (0.027)	0.202 (0.026)
Slope (S.E.)	0.0062 (0.0018)	0.0198 (0.0059)	0.0138 (0.0039)
LL	-135,835.1	-135,781.2	-135,708.4
Δ -2 X LL[d]	11.6***	12.2***	30.4***

*** P < 0.01
** 0.01 < P < 0.05
* 0.05 < P < 0.10
[d] In comparison to the non-interaction model.

the world is positive. There is no significant association with importance or meaning. That said, the random components indicate that both the overall levels of self-assessed health and the slopes describing associations with religiosity significantly vary across countries. This confirms the observation made across the three figures regarding the global variation in the association between religiosity and health, regardless of indicator of religiosity.

Self-assessed health is more favorable in countries with greater religious diversity and higher levels of development (as indicated by HDI), and less favorable in current/past communist countries. Government restriction has no significant association with self-assessed health. Females, older persons, and those that self-assess their social class as low, have worse health than others.

Results for the three models that include cross-country interactions are presented in Table 3. Because the random slope coefficients are smaller here than in the previous table, it is noted that the cross-country interactions partially explain the variation in religiosity slopes across countries. Only interactions that improve model fit are included. No longer are high levels of religious participation generally related to better health. As indicated by the cross-level interaction terms, participation relates to better health in countries that have high religious diversity. In contrast, importance is no longer non-significant. Religious importance improves health in countries with low levels of development (as assessed by HDI). Meaning is no long non-significant. It associates with better health in countries where levels of development are low and where there is a high degree of government restriction on religious practice. Finally, interactions with communism are negative across all models, indicating that all religiosity indicators predict better health in non-communist countries. Change in -2 X LL statistics show that all the models improve fit over those shown in the previous table, suggesting a level of significance for the cross-level interactions.

Predicted probabilities

Predicted probabilities allow for an intuitive interpretation of these models. The predicted probability of having very good health is graphed in Fig. 4 across the world's 10 most populous countries plus, for comparative purposes, Taiwan. These countries represent a range of religious diversity, government restriction on religion, development, and include two current/former communist governments in China and Russia. The probabilities are calculated using coefficients from Table 3, setting age, sex and social class at total sample means, and manipulating other variables so that they are representative of the specific country for which probabilities are calculated.

With the exception of China, greater participation is associated with better self-assessed health across these countries, although the magnitude of the association differs vastly. In the U.S., for instance - a country with a high degree of religious diversity (score of 0.75) - those that have

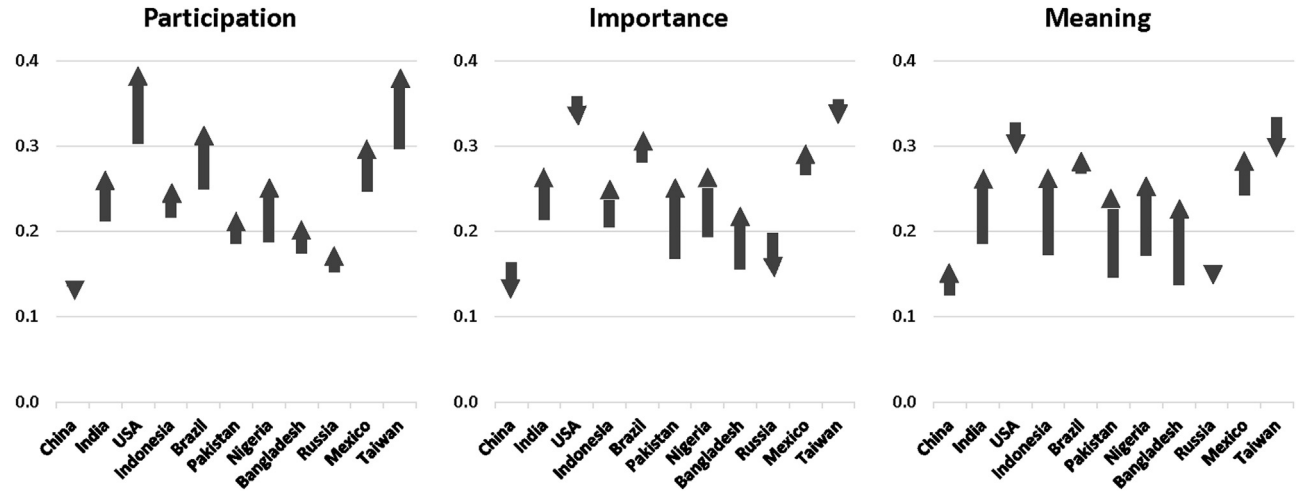

Fig. 4. Predicted probability of reporting very good self-assessed health given highest and lowest scores for three religiosity measures for selected countries. Results are based on models from Table 3. The ends of the vertical lines indicate lowest and highest probabilities. The arrows indicate the direction of the relationship such that arrows pointing upward means religiosity increases the probability of very good health and arrows pointing downward means religiosity decreases the probability of very good health. The height of the vertical lines indicate the magnitude of the change in probability between lowest and highest religiosity.

low participation have a 0.330 probability of reporting very good health and this increases to 0.394 if participation is high, a 19% increase. In countries with less religious diversity, participation does not have the same relationship. For instance, for Pakistan, - a country with a low value for religious diversity (score of 0.11) - the chances of reporting very good health increase from 0.210 for low participation to 0.225 for high participation, a barely perceptible increase. In China, a country with low diversity and a communist system of governance, the change is negligible.

While the association between participation and self-assessed health across countries is somewhat dependent on diversity, with religious importance, the important factor is HDI. Individuals living in countries with low levels of development based on HDI benefit most from a strong belief in god or a high level of religious importance. In Bangladesh, for instance (HDI score of 0.48), the probability of very good self-assessed health rises from 0.162 to 0.216, a change of 33%. Nigeria and Pakistan, other countries with low HDI, also show strong associations. This means that in Bangladesh, Nigeria, and Pakistan a high level of religious importance associates with better health than a low level. There are however some negative relationships as well. In Taiwan, which has a very high HDI (score of 0.89), the chance of very good self-assessed health declines from 0.356 to 0.344 indicating that a high level of religious importance associates with worse health.

Some of the most robust associations are found with the meaning indicator. Defined by often pondering the purpose and meaning of life, a high level is associated with a much greater predicted probability of reporting very good health in non-communist countries with a low HDI and a high degree of government restriction on religious expression. Therefore, in Bangladesh, which has high restriction (score of 0.52) and low development (HDI of 0.48), pondering the purpose and meaning of life is good for health, increasing the chance of very good self-assessed health by 50%, from 0.163 to 0.244. Where HDI is high and restriction low, meaning is associated with worse health. So, in Taiwan, the chance of very good health is lower for those that often ponder the purpose and meaning of life and higher for those that rarely do. Russia, has above average development (HDI of 0.79) and an above average restriction (score of 0.74), but has previous communist governance. The net result is that in Russia the association between meaning and health is negligible.

Discussion

This study, which examines the global association between religiosity and health, and how it varies across national contexts, arrives at several conclusions.

First, the cross-sectional association between religiosity and health varies tremendously across national populations. A positive association between religiosity and health, which is the most frequent result in extant literature, is found in only a handful of countries. One such country is the U.S., where most of the research on the topic has taken place and where most of the evidence that religion exerts a strong salutary effect derives. In many countries the association varies by indicator, and is non-significant in many instances.

Second, the religiosity indicator being examined matters a great deal. In some countries religious participation is associated with better health. In other countries better health shows little association with religious participation but is strongly related to how individuals respond to a question about the importance of god in their life. It would appear as if these indicators are addressing different constituents of religiosity, each of which shape health in ways that depend upon particular contextual dynamics.

Third, some country-level characteristics partially explain why associations differ across countries. The salutary impact of religious participation is partly explained by the degree of religious diversity present in a country. In contrast, individuals with a strong belief in the importance of god report better health in countries where socioeconomic resources are deficient, with these resources measured by the HDI. Pondering the purpose and meaning of life is also beneficial for the health of individuals living in countries with low HDI as well as in countries with substantial government restriction on religious practice. All religiosity indicators perform poorly in communist and former communist countries of Asia and Eastern Europe.

We are left to speculate upon reasons for the variation in effects across countries and measures. While it has not been tested frequently, our results are supported by a small number of recent studies that have looked comparatively at religiosity and several measures of well-being (Diener, Tay, & Myers, 2011; Elliott & Hayward, 2009; Lun & Bond, 2013; Okulicz-Kozaryn, 2010; Stavrova, 2015). These plus our analyses support the perspective that religious participation is associated with positive well-being in countries where there is a fair degree of religious diversity. We conjecture that this occurs because in such places individuals freely practice without fear, shame or pressure to conform, and thus participation is affirming. Where practice is a choice, people that engage gain something tangible from it and thus are drawn to religion for practical reasons – it is good for them and good for their health. In countries where participation is not seen as an option or specific forms of expressions are restricted, there are pressures to conform and this results in less salutary outcomes for those that participate more frequently.

Alternatively, in less developed countries where socioeconomic resources are deficient, more internally felt indicators like importance of god or meaning of life are beneficial. In these countries individuals are less likely to have institutions outside the church that they can rely on for health inducing activity. A strong belief system may provide satisfaction given an otherwise difficult life. Where religion is constrained by government restrictions, contemplative activity, such as pondering life's meaning, rather than outward expressions or religiosity, appear more helpful. Despite a highly restrictive religious environment, the chance that an individual will experience religious retribution is minimal when their religiosity is expressed internally rather than in public and when their practice involves inward thinking. This type of thinking, normally performed in private, may help to reduce stress and anxiety, which provide pertinent health benefits.

Religiosity does not tend to be associated with health in communist and post-communist countries in Eastern Europe and Asia. As suggested by Inglehart (2010), religion in these societies may still be frowned upon and adherents are likely new, unhappy, and unhealthy and therefore those most likely to be looking for meaning. An illustrative example is the comparison of our findings in China versus Taiwan: countries with a common history, shared ethnic backgrounds, and values and norms based on Confucian ideals, yet different forms of government, levels of religious diversity, and restriction. In Taiwan, participation in religious activity is related to better health, but believing in the importance of god and often pondering the meaning of life is unrelated to health. In China there is little relationship between any of these indicators and health. The China/Taiwan comparison highlights that our study stands in contrast to the majority of research implicating religion as having a beneficial impact on health (Hummer et al., 2004; Koenig, 2012; Krause, 2011; Lavretsky, 2010; Oman & Reed, 1998), not least because almost all of this research has taken place in the U.S. Indeed, our country-specific findings indicate that the U.S. stands as only one of three countries where associations between religiosity and health are consistently positive across all three religiosity indicators. Clearly the conclusion regarding how religiosity and health associate depends on the country within which the analysis is being conducted.

Limitations to this study include cross-sectional data. While we can be confident about relationships existing we cannot be confident about the causal nature of those relationships. There is the likelihood of reverse causation whereby those ably bodied are most likely to attend religious services. Alternatively, some have suggested that those in ill-health may resort to religion for the support and meaning to life that it can provide (Doane & Elliott, 2016; Park, 2005).

Self-assessed health is subjective and individuals with similar disorders are likely to rate their health differently across populations. It is however the only measure of health available in the WVS, and there is no other data source containing information on religiosity across this many countries. Moreover, while it may differ across populations, within population self-assessed health is a solid measure of overall health that encompasses both physical and psychological status. For all its disadvantages, self-assessed health has been shown to be easily translatable, reliable, to have content and predictive validity (in particular being highly associated with mortality), and to represent an inclusive and holistic conception of health (Idler & Benyami, 1997; Molarius & Janson, 2002).

Indicators of religiosity imperfectly represent constructs. There has been substantial research on religious constructs, which cannot be reconstructed given the variables available in the WVS (Idler et al., 2003). Especially, the question used to indicate meaning in this study does not mention religion or spirituality directly and therefore there is some question as to what is really being measured. However, the notion of contemplating the meaning and purpose of life is related to something non-physical and transcendent, characteristics that are thought to indicate a level of spiritual thinking. The question is indeed included in WVS in a section with other questions on religiosity, an indication that those who organize and direct the study consider it to be a religiosity indicator. The associations with pondering life's meaning are relatively similar to those with importance in god, perhaps suggesting some overlap in connotation. Whether our measure of meaning is or is not a good indicator of religiosity, it is a very strong predictor of health in some countries, which stands is in contrast to its association with other measures of well-being (Joshanloo & Weijers, 2014).

Our models are relatively parsimonious. Each includes age, age-squared, sex and social class. It is possible other variables available in WVS, of which there are hundreds, may further explain the religiosity health association. It is difficult to include and interpret large numbers of control variables in comparative research with this many countries since many of these variables will have different meanings across countries. Examples include education or specific faith, two potential control variables, but variables that will mean different things in different countries. While we keep our models undiluted, future research may explore additional individual-level explanatory factors. That said, note that we ran a large number of models before deciding on the final ones to present here. We considered rural/urban residence, other measures of social status, family size, marital status, to name a few. None of these changed the basic associations presented in this paper. In fact, earlier versions of the paper did not include social class and it is telling that adding social class had virtually no impact on the main findings. At the country-level, alternative indicators of wealth and development were included in earlier runs, and these did not alter the basic findings. Part of this is because HDI, the development/wealth variable included, is an encompassing measure that accounts for much of what is normally considered in the concept of national socio-economic standing.

Finally, it is important to recognize that while variation in the effect of religiosity is reduced when introducing country-level interactions, substantial variation across countries is unexplained. Random slopes provide an indication of the degree to which country-level variation is explained. Comparing Tables 2 and 3, the random slope for participation decreases from 0.0078 to 0.0062 after country-level interactions are introduced. This is a decline of 26% in the slope variance; 74% still remains. This suggests that multilevel and country-specific findings will at times diverge. A case in point is that while multilevel models with cross-level interactions predict that importance in god and pondering meaning in life would not improve health in the U.S., country-specific results tell us that in fact all three religiosity indicators relate to better self-assessed health in the U.S. Religion is clearly a very complicated construct and notwithstanding what we have been able to determine here, associations between religiosity and health across populations are proving to be somewhat idiosyncratic.

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Conflicts of interest

The authors confirm no conflicts of interest and no financial interest in this research.

Ethical statement

This paper adheres to ethical standards. The research uses only secondary unidentifiable data. IRB approval for the project from which this paper derives is included as a supporting file.

Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.ssmph.2018.11.006.

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