An Age-Period-Cohort Analysis of Religious Involvement and Adult Health: Results from the United States, 1972 to 2008

Abstract

This study conducts an age, period, cohort analysis of how religious involvement affects adult health across the life course and over time in the United States. Cross-classified random effect models are used to examine data drawn from the General Social Survey, 1972 to 2008. The research shows clear life-course patterns, time trends and birth cohort changes in the religious involvement and health relationship with period effects surpassing the cohort effects. In general, the results show a loss of advantage in health with age for those who are more involved in religion. However, a health advantage associated with a greater level of social integration is stronger among older ages. The period effects are mainly demonstrated by an overall downward trend of self-rated health when linked to religious involvement. The health advantage of Protestants as compared to nonreligious people diminishes over time; in contrast, the tendency of reporting a better health by people with other than Protestant and Catholic religions appeared to be more significant during the past decades. The health disparities associated with religious denominational differences fluctuated when cohort progresses, suggesting significant cohort effects. Nevertheless, the research does not find an overall increasing or declining trend in health across successive birth cohorts.

Keywords: religion, religiosity, health, cohort, life course, socioeconomic status

INTRODUCTION

There has been a growing literature that examines the connection between religious involvement and aspects of mental and physical well-being (Ellison 1995; Ellison and Fan 2008;

Ferraro and Albrecht-Jensen 1991; Koenig, Smiley, and Gonzales 1988; Levin and Markides 1985; Musick, House, and Williams 2004; Nicholson, Rose, and Bobak 2009). Though findings on the implications of religious involvement for personal health and wellbeing are not unequivocal, the weight of the evidence indicates a positive association between religious involvement and personal health. The majority of the literature shows that various dimensions of religious involvement promote an individual's physical and mental well-being and longevity, reduce the risk of certain health problems and lower the level of depression (Ellison 1991; Ellison and Taylor 1996; Idler 1987; Levin and Vanderpool 1987; Musick, House, and Williams 2004; Sternthal, Williams, Musick, and Buck 2010).

The relation between religious involvement and health outcomes is clouded, however, when put in the context of life course. Analyses of religion and health are mostly concerned with cross-sectional individual-level characteristics and religious involvement. We know relatively little beyond the health disparity that correlates with religious factors at a static point in time. Thus far, few simultaneous assessments of the age, time period, and birth cohort effects are found in the analyses of health disparities and religion.

Scholars do document that health is affected by age over the individual life course with a cohort effect across birth cohorts who came of age in different historical times (Chen, Yang, and Liu 2010; Lynch 2003; Yang 2007). Religious factors, in addition, are also found to be influenced by the period and cohort effects in recent research (Schwadel 2010b). Given these considerations, there is a need to disentangle life course and cohort process effects in the study of health disparities caused by religious involvement. Distinguishing the temporal sources of variations in an individual's health condition will improve our thorough understanding of the mechanisms that explain religious involvement and health outcomes.

To incorporate the age, period and cohort effects in the analysis of religious involvement and health, this study uses the recently developed methodologies of cross-classified random effect models to analyze time-series data in the United States from the General Social Survey (GSS). Using this time-series dataset spanning 36 years, I carry out a longitudinal study of changes in health that is associated with religious involvement differentials for multiple cohorts of individuals in the United States. The research investigates how health trajectories are shaped by religious involvement of different cohorts, and how historical events may leave imprints on cohorts' life experiences so that diverse health outcomes have occurred. This is one of the first studies that consider the ever changing social contexts and bring a longitudinal scope to the research on health and religion.

RESEARCH ON RELIGIOUS INVLOVEMENT AND HEALTH

Sociological interest in religious involvement and well-being can be traced to Durkheim. Durkheim viewed religion as a beneficial factor to individual well-being since it regulates one's behavior and integrates individuals in caring social circles. According to Durkheim, religion offers support, intimacy, stability and structure. Individuals with higher levels of ritual practices tend to benefit more from religious practices and involvement. At the societal level, it is shown as a lower suicide rate (Durkheim 1879). Relating to Durkheim's original analytical strategy, a variety of studies have been conducted examining the links between religious denominations, collective religious involvement and aggregate rates of suicide and other forms of social pathology (Bainbridge 1989; Breault 1986; Pescosolido and Georgianna 1989). In recent years, a large and growing literature has focused on the connections between religion and individual health outcomes, including mental health, physical health and mortality risk (for review, see Ellison and Fan 2008).

Numerous theoretical mechanisms have also been advanced to account for the relationships between religious involvement and health outcomes. Some have argued that religious doctrines foster positive health behaviors, which decreases the risk of stressful events and conditions that undermine health and well-being (Crawford, Handal, and Wiener 1989; Idler 1987; Shapiro, Radecki, Charchian, and Josephson 1999). Others have pointed out that people who are embedded within religious communities enjoy larger, more supportive and more satisfying social networks than their unchurched counterparts. Such a cohesiveness provides religious individuals support and coping resources to achieve better health outcomes (Cacioppo 2002; Jones 2004; Strawbridge, Shema, Cohen, and Kaplan 2001). In addition, churches and synagogues offer institutional settings and regular opportunities for social interaction between people with similar minds and values. These religious institutions nurture friendships and social ties that may not be developed in secular social contexts (McIntosh and Alston 1982). Still others have highlighted the "meaningful life" effect of religion. Religion contributes to a sense of coherence and experience of life as meaningful and hopeful, which is associated with a better health (Antonovsky 1987; Siefken 1993). Intrinsic religiosity is also considered as a factor that modifies perceptions of distress and is linked to higher self-esteem (Krejci, Thompson, Simonich, Crosby, Donaldson, Wonderlich, and Mitchell 2004). Several studies further suggest that personal religious practices may yield psychological benefits due to the "divine interaction" effects (Ellison 1991; Ellison, Gay, and Glass 1989; Idler 1987). It is argued that religious individual may construct divine relations with the God in a quest for solace and guidance. As such, those individual may resolve problematic situations more easily by defining them in terms of a biblical figure's plight and by considering their conditions from the vantage point of the "God-role" (Foley 1988). The divine interaction in turn may bolster self-efficacy. Meanwhile,

the perception of unconditional divine forgiveness of sins may alleviate personal guilt feelings so that daily situations and major crisis can be managed through personal partnership with a more powerful force (Ellison 1991). Besides, the altruism and optimism effects of religion are believed to mediate the association between religious involvement and health outcomes (Krause 2005; Salsman, Brown, Brechting, and Carlson 2005; Steffen and Masters 2005).

Beyond the above explanations, a group of prior studies also suggests understanding religious members' health outcomes by examining the denominational variations among religious persons (Cochran, Beeghley, and Bock; Scheitle and Adamczyk 2010). According to Kelly (1972), strong churches differ from weaker churches in the following dimensions: they demand distinctive lifestyles and behavioral conformity; they require higher levels of organizational commitment and solidarity; they encourage personal spiritual growth rather than collective campaigns; and they promote absolutism and ideological closure to sustain coherent systems of religious meaning. These differences form various organizational cultures of the religious groups and consequently differentiate conditions of individual members' well-being. Medical research supports this line of reasoning by showing religiously conservative Mormons and members of other Protestant groups to gain more benefit from reduced risks of certain health problems (Dwyer, Clarke, and Miller 1990). Denominational variations are also found to lead to diverse social network ties, which contributes to the differentials in religious members' well-being and health condition (Fowler and Hill 2004).

AGE, PERIOD AND COHORT EFFECTS

Even with abundant studies on religion and health outcomes that are discussed above, relatively little is known about how cohort process and changes in life course simultaneously mediate the relationship between religious involvement and health. Put differently, the role of

three time-related variations-age, period, and cohort effects-has not been clarified when discussing the social mechanisms that produce disparity in health caused by religious factors. In this section of the paper, I discuss the age, period and cohort effects and highlight why they need to be considered in the studies of religion and health.

The age effects represent aging-related changes in the life course. There are several reasons to expect that aging alters the religion and health relationship. Previous studies show that the frequency of devotional activity varies by age. The positive age effect on the frequency of devotional activity is especially high among elderly adults (Ainlay and Smith 1984; Guy 1982). A high correlation between religion and subjective well-being is also found to be more significant for samples of older than younger adults (Witter, Stock, Okun, and Haring 1985). Elderly adults are found to be more inclined to turn to intrapsychic coping strategies, such as religion, to manage stressors and problems that are perceived to be insoluble (Corsentino, Collins, Sachs-Ericsson, and Blazer 2009; Reyes-Ortiz, Berges, Raji, Koenig, Kuo, and Markides 2008). It is also pointed out that the effects of divine interaction on well-being increases with age (Ellison 1991). Such a variation by age is suggested to be caused by the greater salience of matters of "ultimate concern" in later life (Koenig, Smiley, and Gonzales 1988). In a piece that studies the religious influence on people's daily life, the age effect is considered as the most strong and robust effect when compared to the period and cohort effects (Argue, Johnson, and White 1999). Given the age effects on religious involvement shown in prior research, there is a need to discern whether an individual's health outcome that is related to religion varies by age, net the effects of period and cohort. One can hypothesize that the magnitude of religious influence on an individual's health may increase with age for a number of reasons (see the above discussion) or the health disparities are due to the fact that early life advantages or disadvantages

accumulate with age over the life course (Dannefer 2003). Such a hypothesis remains an assumption though until it is formally tested under ever changing social contexts and a longitudinal scope.

Period refers to a specific time point. A period may be a year or a decade. Period effects are usually considered as changes among people of all ages from one period to another (Schwadel 2010a). Period effects usually occur due to social, cultural and economic changes that are unique to certain time periods. These changes induce similar changes in individual health of all ages. Cohort effects are associated with changes across groups of individuals who experience an initial event such as birth in the same year or years. Birth cohort refers to a group of people who were born at the same time. Cohort effects are changes across the birth cohorts regardless of age, which represents the effects of formative experience for successive age groups in successive time periods (Glenn 2003; Ryder 1965). As Ryder (1965) argued in a classic essay, social change occurs because of individual change or an ongoing massive process of personnel replacement in which older cohorts are succeeded by younger ones with different attitudes and behaviors. This type of population turnover has been called “cohort replacement” or “cohort succession” in subsequent work (Firebaugh 1989). The distinction between period effects and cohort effects lies in the way in which people view the causes of social changes. Health outcomes, in particular, can improve or become worse over time due to some relevant events or larger-scale changes. This reflects period effects. On the other hand, health outcomes may get better or worse across successive birth cohorts, which shows the cohort effects. Cohort effects on health can be caused by differentials in early life conditions, which is a commonly cited explanation for susceptibility to diseases and mortality (Barker 1998). More recent U.S. cohorts are found to have better health capital at birth than their older counterparts (Fogel and Costa 1997). Elder (1987) has also

pointed out that the same social change may impact individuals in a significantly different manner depending upon which cohort the individuals belong to.

The discussion of the period and cohort effects has been shown in religious involvement although prior studies did not aim to investigate health of religious individuals in particular. Chaves (1991), for instance, has argued that the aggregate church attendance rate is shaped by the birth and cohort effects along with the life course effects. He has noted that cohort effects exist because recent cohorts attend church at lower rates than did preceding ones; the period effects also play a role because the social process "keeps individuals away from formal religious practices" (Chaves 1991: 502). Firebaugh and Harley's (1991) research echoes Chaves' arguments by showing that recent cohorts are less inclined to attend church than were earlier cohorts at the same age. They contend that cohort replacement reduces church attendance as older and higher-attendance cohorts are succeeded by younger and lower-attendance ones. Chaves (1989) has characterized the Protestant church attendance as negative across-cohort change but positive within-cohort change, meaning there is a declining attendance across successive birth-cohorts and cross-the-broad "resurgence" in attendance, i.e., the positive effects (Chaves 1991: 488). A study by Argue and colleagues (1999) investigates the religious influence on people's daily life. Their findings demonstrate that the age, period and cohort effects exist although age is shown to be a stronger effect than the other two. A recent study conducted by Schwadel (2010a) shows large changes across cohorts and periods in religious attendance. Schwadel's (2010b) research also displays the period and cohort effects by examining the individual reports of no religious affiliation and religious disaffiliation in the United States. The cohort effects were showed by a tremendous increase in percentages of Americans with no religious preference in recent birth cohorts; and the period effects were revealed by a period-

based increase in nonaffiliation during 1990 to 2006 in the U.S. These findings suggest the compound age, period and cohort effects associated with religious changes.

Though previous analyses discussed above have demonstrated cohort and life-course changes in religious involvement and there is abundant literature that highlights a strong religious influence on health, the existing studies hardly relate religious involvement to health in the context of cohort and period changes. The existing results leave important questions unanswered: Did the influence of religious involvement on people's overall health increase or decrease over the past few decades? How do the complex effects composed by age, period and cohort influence people's health outcomes as they move through the life course? To date, there is no study that simultaneously brings the age, period and cohort effects in a multivariate analysis of religious influence on health. Indeed, the majority of the results on religion and health are drawn from one-point-in-time cross-sectional observations classified by age. Even with a few studies taking a longitudinal point of view, the age, period and cohort effects have not been explicitly distinguished and simultaneously estimated in religious studies of health. Since researchers have revealed significant cohort variations in age trajectories of health (Lynch 2003; Yang 2007), one can expect that the religious involvement effects on individual health could vary significantly by birth cohort with various experiences. Meanwhile, one can also hypothesize that the period effects play a role in shaping the religion and health relationship for the U.S. society has experienced significant social and cultural changes during the past few decades. As it has been shown, the period changes are more favorable to certain subgroups than for the others (Blanchflowera and Oswaldb 2004). Under such a proceeding, a formal test is warranted to synthetically assess the period and cohort changes in individual health across temporal component.

A major methodological obstacle that prevents researchers to isolate cohort and period changes in their analyses of religious involvement and people's health has been the "identification problem". This is because there is a linear dependency between age, period and cohort (Cohort = Period –Age), which is problematic for simultaneously modeling of age, period and cohort effects. The cohort or period effects cannot be reliably estimated without including age in the model (Firebaugh 1989). Recent methodological advancements have overcome this problem and enable researchers to update previous analyses by disentangling age, period and cohort effects on health. In the following section of the paper, I detail the method that will be used to facilitate the analysis and the data and measures that will be used to carry out a longitudinal study on religious involvement and health.

DATA AND MEASURES

Data from the General Social Surveys (GSS) conducted over the 36-year period from 1972 to 2008 are used to conduct the analysis. The GSS, an ongoing survey conducted annually or biennially by the national Opinion Research Center since 1972, is a nationally representative survey of English-speaking adults ages 18 or older in the United States. The survey monitors the attitudes and behaviors of adults in the United States with core items being repeated as well as new items being added every year (Davis, Smith, and Marsden 2004). Multistage stratified probability sampling strategy is used to choose non-institutionalized adults ages 18 or older in the United States, which yields sample sizes ranging from about 1,500 to 3,000 across survey years.

In survey years, the GSS contains an item on self-reported health, which asks: "Would you say your own health, in general, is excellent, good, fair, or poor?" The responses in this analysis are coded as "1" if the respondent reported his/her health as "poor", as "2" if reported as

"fair", as "3" if claimed as "good" and as "4" if stated as "excellent." Despite the simplicity of the health measure in the GSS, evidence from the existing literature proves the efficiency of the measure when capturing an individual's health condition (Ellison and Fan 2008; Link, Phelan, Miech, and Westin 2008; Martin, Pescosolido, Olafsdottir, and Mcleod 2007; Olafsdottir 2007; Olafsdottir and Pescosolido 2009; Scheitle and Adamczyk 2010; Warren and Hernandez 2007). Thus, this question is used as a measuring tool of an individual's overall health.

Four religious measures are used to represent religious involvement, which are denominational ties, social integration, divine relations, and existential certainty. They are considered as four distinct aspects of religious involvement (Ellison 1991). The *denominational preference* measure includes four categories: (1) Protestant, (2) Catholic, (3) other religions and (4) none religion. Based on the four categories, four dummy variables are created with Protestants being the reference group. The second independent variable, the role of religion as a source of *social integration*, is measured by frequency of attendance at religious services which is coded as three dummy variables (1 = less than once a month, 0 = otherwise; 1 = one to three times a month, 0 = otherwise; 1 = every week or more, 0 = otherwise; reference = less than once a month). The *divine interaction* variable, the third key independent variable, was initially constructed from two items: 1) "How close do you feel to God most of the time?" 2) "About how often do you pray?" The responses for the first item are initially coded as follows: 1= not close at all/does not believe, 2 = not very close, 3 = somewhat close and 4= extremely close. The coding for the second item is: 1 = never, 2 = less than once a week, 3 = once a week, 4 = several times a week, 5 = once a day and 6 = several times a day. The measure *divine interaction* variable was then constructed by taking the mean score for the two items (alpha = 0.6). When running the analysis, however, the statistical procedure did not succeed due to too many missing values for

the first item. I thus decided to use the second item only as the measure of *divine interaction.* I then code the frequency the respondent prays as three dummy variables (1= once a week or less, 0 = otherwise; 1 = several times a week, 0 = otherwise; 1 = several times a day, 0 = otherwise; reference = several times a week). A measure of *existential certainty* was first constructed from three items (alpha = 0.6), which estimates how often the respondent casts doubts on his/her religious faith due to: 1) evil in the world, 2) conflicts between faith and science, and 3) the feeling that life has nearly no meaning. The three items were considered initially because Ellison (1991: 84) argues that the use of these items in measuring the coherence afforded by religion is "especially appropriate because they tap the strength and durability of religious faith without reference to specific articles of religious doctrine." In this research, however, I found these three measures were not suitable due to the very limited numbers of individuals who responded the questions. Thus, *existential certainty* is measured by the extent to which a person feels certain the God exists. I code the *existential certainty* variable as three dummy variables (1 = do not believe in God, 0 = otherwise; 1 = believe with doubts, 0 = otherwise; 1 = believe without doubts, 0 = otherwise; reference = believe without doubts).

In addition to the key religious involvement variables, a variety of control variables that could be related to an individual's health are also included. The demographic control variables include age (reported in single years), sex (female =0, male = 1), race (white, black or other race; reference =non-white) and marital status (married =1, otherwise=0; reference = non-married). Age is controlled because it is strongly associated with mortality and health outcomes (Rogers, Hummer, and Nam 2000). The measure of race is included because blacks tend to have poorer health outcomes than whites, they are more likely to lack health insurance and tend to live in places concentrated poverty where opportunities for healthy eating and exercising are limited

(Read and Emerson 2005). Marital status is controlled in the study considering the fact that marriage has an influence on individual health and mortality (Lillard and Waite 1995). The analysis also adjusts for the respondent's socioeconomic characteristics because people with higher socioeconomic status (SES) are found to be more likely to report better health and lower rates of disability, morbidity and mortality (Rogers, Rogers, and Belanger 1992; Zimmer, Chayovan, Lin, and Natividad 2004). The socioeconomic controls are education (years of education completed), income and employment status. Income is measured on a five-point scale where 1 = less than $10,000, 2 = $10,000 to 14,999, 3 = $15,000 to $19,999, 4 = $20,000-$24,999 and 5 = $25,000 and over. The income measure in the GSS has been converted to 1986 dollars considering inflation. Employment status is coded as a dummy variable, which is coded as "1" if the respondent was working full time and "0" if the respondent was working part-time, or temporarily not working, unemployed, retired, at school, or claimed some other working status. Those who did not report working full time are the reference group.

The level-2 unit of analysis is cohort-by-period cells. Survey years and birth cohorts are level-2 contextual variables in hierarchical models, which will be discussed in the methods section below. Each survey year is a separate period. The definitions and descriptive statistics of all variables included in the analysis are presented in the Appendix.

METHODS

Given that the study is interested in examining the age, period and cohort effects in the religious involvement and health relationship, the age-period-cohort (APC) approach is an appropriate method to be used in the analysis. The conventional statistical APC analysis developed by Mason and associates (1973) focuses on modeling age-by-time period tables of aggregate population data (for instance vital rates). Such a model, as Yang and Land (2008)

argue, faces a major challenge of the underidentification problem induced by the exact linear dependency between age, period and cohort (Period = Age + Cohort) when the time intervals used to tabulate the data are of the same length for the age and period components. Yang and Land (2006) suggests solving the underidentification problem in a repeated cross-section survey by using different temporal groupings for the age, period and cohort components. Usually, single years of age, time periods corresponding to years when surveys are conducted and cohorts that are defined by five-year intervals are used to break the liner dependency at the individual respondent level. As a result, the fixed effects models in the APC approach "could be estimated by adding variables to control for the age, period and cohort effects in a conventional multiple linear regression analysis" (Yang 2008: 211). Including more covariates in the individual level is also allowed in this case. The solutions for the underidentification problem along with the fixed effects models, however, have not taken the multilevel structure of the GSS data design into consideration. In the GSS data, an individual respondent is nested in and cross-classified by two higher level contexts-period and cohort (see Table1). Raydenbush and Bryk (2002) have suggested that hierarchical linear models (HLM) can be used to analyze the cohort effect in age trajectories.

[Insert Table 1 about here]

Considering the underidentification problem associated with conventional APC approach and the multilevel structure of the GSS data design, this research uses cross-classified random effect models (CCREMs) to conduct analyses. Individuals are the level-1 unit of analysis. Periods and cohorts operate as rows and columns in a matrix generating cohort-by-period cells, which become the level-2 unit of analysis. The CCREMs adjust for the dependency between age, period and cohort by considering period and cohort as cross-classified level-2 units. Beyond

providing random cohort and period effects, CCREMs allow for random effects of independent variables, which is used to test for cross-cohort and cross-period variations in the effects of key independent (religious involvement) variables. Cohort- and period-specific random-effects coefficients suggest potential across-cohort and across-period changes in the effects of religious involvement on health. Fienberg and Mason (1982) have also proposed using nonlinear transformation approach which applies nonlinear transformation such as polynomials to ensure the relationship of at least one of the age, period and cohort covariates to others is nonlinear. Following this strategy and noting that a finding of nonlinear age effect on health and well-being (Chen, Yang, and Liu 2010; Yang 2008), this study specifies models of self-rated health condition as a quadratic function of age.

Several models are presented in the analysis. The first model only includes age and age-squared as fixed effects. This model measures the overall effects of age, period and cohort on health. Models 2 through 5 include each of the four religious involvement measures separately, controlling for the demographic and socioeconomic factors. The four religious involvement measures are not included in the same model due to multicolinearity. The interaction terms between age and the religious involvement variables are included in the models to ensure that across-cohort changes do not reflect age variations.

The full individual level or level-1 equation can be expressed as:

$$Y_{ijk} = \beta_{0jk} + \beta_{1jk}A + \beta_{2jk}A^2 + \beta_{3jk}P + \beta_{4jk}I + \beta_{5jk}R + \beta_{6jk}C + \sum_{p=10}^{p} \beta_p Xp + e_{ijk} \quad (1)$$

where Y_{ijk} represents the ordinal response outcome of self-rated health condition of the *i*th respondent for i = 1, …, n*jk* individuals within the *j*th period for j = 1, …, K birth cohort. β_{0jk} is the intercept or cell mean for respondents in period *j* and cohort *k*; "A" and "A^2"symbolize age

and age-squared (see previous paragraphs for the rationale that includes the quadratic term of age), respectively. “P” indicates “denominational preference;” “I” represents “social integration;” “R” denotes “divine relations,” and “C” indicates “existential certainty.” β_1 through β_5 are the individual level fixed effects for age (A), age-squared (A^2), denominational preference (P), social integration (I), divine relations (R) and existential certainty (C). X_p designates the vector of other individual-level covariates that interact with age and control variables. β_p represents other individual-level fixed effects where P is the maximum number of covariates. e_{ijk} represents an individual level random error term.

The level-2 model can be expressed as:

$$\alpha_{jk} = \gamma_0 + p_{0j} + c_{0k} \quad (2)$$

This model specifies the overall mean varies from period to period and from cohort to cohort. γ_0 is the model intercept, which is the expected mean at the zero value of all level-1 variables average over all periods and cohorts. Here p_{0j} and c_{0k} are the residual random effects of period and cohort, respectively. The cell mean, $\beta_{0jk,}$ is equal to the sum of the overall mean or intercept (γ_0), the residual random effect of period j (p_{0j}) and the residual random effect of cohort k (c_{0k}). The residual random effects allow me to examine the effects of each cohort and period on health.

$$\beta_{3jk} = \gamma_3 + p_{3j} + c_{3k} \quad (3)$$

$$\beta_{4jk} = \gamma_4 + p_{4j} + c_{4k} \quad (4)$$

$$\beta_{5jk} = \gamma_5 + p_{5j} + c_{5k} \quad (5)$$

$$\beta_{6jk} = \gamma_6 + p_{6j} + c_{6k} \quad (6)$$

Models (3) through (6) test for random effects of denominational preference, social integration, divine relations and existential certainty on health across cohorts and periods. In these models, γ_{3}, γ_{4}, γ_{5}, and γ_{6} represent the fixed-effects coefficients for the religious involvement variable; the symbols of p_{3j}, …, p_{6j} represent the period-specific effects of the religious involvement variables and c_{3k}, …, c_{6k} specify the cohort-specific effects of the religious involvement factors. These models are used to test whether health outcomes that are related to religious involvement-measured by denominational preference, social integration, divine relations and existential certainty-vary by time and birth cohort. All continuous variables are sorted and centered around their overall mean.

RESULTS

Table 2 presents findings of the estimatted self-rated health on religious involvement variables and other control variables from CCREMs. Among the five models that are established in the analysis, the first model only includes period, cohort covariates along with age and age-squared term. This model indicates the overall impact of age, period and cohort on health. Models 2 through 5 add four religious involvement indicators separately. As it is mentioned earlier, a full regression model which includes all religious involvement variables simultaneously is omitted due to collinearity. The fixed-effects coefficients presented in the models can be interpreted in a manner similar to ordinary least square coefficients. Some key results are also illustrated by the predicted levels of self-rated health in graphs.

[Insert Table 2 about here]

OVERALL HEALTH TRENDS AND HEALTH DISPARITIES RELATED TO RELIGIOUS INVOLVEMENT

Model 1 shows that with only age, period and cohort effects included in the model, the predicted average overall level of self-rated health is 2.97. Age has a significantly negative effect on self-rated health (coef. =-0.011, $p<.05$), which suggests that after the period and cohort effects are taken into consideration, the level of self-rated health decreases by 1.1% with every one year increase in age. Such a negative effect is demonstrated by Figure 1a. The predicted self-rated health also varies by period and cohort, controlling for the age effect. The period and cohort effects are estimated using residual random coefficients. The random-effects variance components from Model 1 indicate relatively larger differences in self-rated health outcomes by cohort than by period. As to the period effects, the predicated self-rated health shows a slightly declining trend in the 1970s, followed by a rebound in the mid-1980s, late 1980s, mid-1990s and the early 21 century; the health score then declines again after 2005 (see Figure 1b). The cohort effects show a bell curve with the cohort born during 1940-44 exhibiting better health outcomes than their earlier or later birth cohorts. The self-rated health of their earlier cohorts seems to climb whereas the health level of their later cohorts continuously to decline (see Figure 1c).

[Insert Figure1- 1a, 1b, 1c about here]

Models 2 through 5 focus on investigating the effects of *religious denomination, social integration, divine relation* and *existential certainty* on an individual's health, respectively. Additional control variables are added in the models as well. With religious involvement and control variables in the models, the effect of age-squared becomes significant. It means that age has a negative effect on health and the age effect increases slightly, as indicated by the positive effect of age-squared. In addition, period differences increase whereas cohort differences reduce considerably with religious and control variables in the models. For example, the variance component for period goes from 0.0063 in Model 1 to 0.0008 in Model 2, which suggests that

the religious denomination variable and the control variables explain more that 85% of the variations in health attributed to cohort changes in Model 1. In Models 4 and 5, the cohort effects even become nonsignificant after bringing in the control and religious variables.

As to health outcomes associated with the religious involvement variables, significant health disparities related to *religious denominational differences* are shown in Model 2, net the age effect and the random period and cohort effects. As the results show, people with no religious preference have predicted self-rated health score 14.3% lower than Protestants, the reference group. The finding echoes the results of prior research that religious denomination influences an individual's health. Model 3 demonstrates a positive association between one's health outcomes and his/her level of *social integration*, measured by the frequency of religious attendance, controlling for the age, period and cohort effects. As Model 4 shows, individuals who pray more frequently (several times a day), a measure of *divine interaction*, are more likely to report a better health than those who pray less frequently (a few times a week). Model 5 suggests that being more *certain* of the God's existence improves the respondent's self-reported health.

In sum, the results are largely consistent with prior findings about the religious influence on health. Two new findings may be drawn from the research. First, the significant individual-level effects of religious involvement factors on health remain even after level-2 period and cohort effects are considered. Second, controlling for age and the religious involvement variables along with other control variables, there is still significant variations that can be explained by period and cohort effects, which implies that constructing CRREMs to estimate the period and cohort effects on health is warranted.

The control variables - sex, marital status, race and ethnicity, education, income and labor force participation – all show significant influence on people's health. Women, whites, married people, those who worked full-time and reported higher income and obtained higher educational attainments tend to be healthier relative to men, non-whites, non-married population and those without full-time jobs and reported lower income and fewer years of schooling.

[Insert Table 2 about here]

HEALTH DISPARITIES AND RELIGIOUS INVOLVEMENT BY AGE

The results discussed above have suggested significant age, period and cohort effects in the religion and health relationship. This section of the paper focuses on discussing how the health disparities related to religious involvement vary by age through examining the age interaction terms with the religious involvement variables. Figure 2a displays the trajectories of age changes in predicted the level of self-rated health for religious groups. As it is shown in the figure, substantial health differences by age mainly occur between religious and nonreligious groups; there is hardly any health variations by age between Protestants and people who believed other religions. Religious people tend to rate their health better than nonreligious people in younger ages. This advantage, however, declines with age increasing and eventually disappears when people reach their late 80s for the religious and nonreligious groups' health outcomes converge after age 80.

In terms of social integration and health, the positive effect of attending religious services on health increases with people getting older. Those who participated religious activities every week or more often have a predicted self-rated health level being 5.8% ($e^{0.052+0.002}$) higher as compared to those who attended religious services less than once a month (the reference group), controlling for the period and cohort effects. Since the age interaction term constructed by

multiplying age and attending religious activities 1-3 times a month is nonsignificant, Figure 2b only charts the reference group (those attended religious activities less than once a month) and the group that attended religious services most frequently. Figure 2b shows, the "social integration advantage" is not evident before age 40. Afterwards, it gradually rises with age. The results answer the question that whether a better health is caused by people attending religious services more frequently with age or is due to the cumulative advantage from a higher level of social integration since younger ages. Because the study controls age, the findings support the second scenario that adjusting for other factors, aging-related changes in the life course does impact individual health.

As suggested by Model 4, age also interacts with the divine interaction variable, measured by frequency one prays, when affecting health. Figure 2c portrays how the frequency one prays interacts with age to impact health. The age variations in health caused by a stronger divine relationship, operationalized as the frequency one prays, mainly exists between the reference group (those pray a few times a week) and the group that prayed least frequently (once a week or less). In general, people who prayed more often show a higher predicted self-reported health. The health gaps caused by the level of divine interaction, nevertheless, decline with age and finally fade away after age 80. Similarly, the health advantage caused by one's existential certainty about God also decreases with age (see Model 5), which is shown in Figure 2d. The convergence and shrink in health disparities due to various forms of religious involvement indicate a loss of advantage in health with age for those who are more involved in religion. Nevertheless, the frequency attending religious services, a form of religious involvement, stands out by showing a stronger positive effect on individual health in older ages. I will also emphasize this finding in the conclusion and discussion section. These results suggest that under the context

of period and cohort effects being considered, the age effect in the religious involvement and health relationship remains substantial in the models estimated.

[Insert Figure2- 2a, 2b, 2c about here]

HEALTH DISPARITIES AND RELIGIOUS INVOLVEMENT BY TIME AND COHORT TREND

The findings on health gaps caused by religious involvement that are associated with time and cohort trends are presented under the cross-level interaction random effects in models 2 through 5. After the religious involvement and the control variables are included in these models, the across-period change surpasses the across-cohort variations in health. The predicted self-rated health also falls to 2.46 or lower after including religious involvement and control variables.

The significant variance components presented in models 2 and 3 show significant period changes in health that is related to the denominational differences and the levels of social integration. The period effects are demonstrated in Figures 3 and 4. Figure 3a shows that the estimated self-rated health associated with religious denominational differences has a downward trend over time, suggesting Americans' health related to religious involvement deteriorates over time. This could be owing to the changing pattern of age composition among the U.S. religious population. Because age has a negative effect on health, with the American society experiencing population aging, increases in the proportion of older adults could lead to a decline in health. Figures 3b and 4b further portrays how estimated health predicted by religious denominational differences and the differentials in levels of social integration varies by time period, respectively. The results show that the health disparities between Protestants and the nonreligious group decline over time. The drop in health gaps may be caused by the period changes in people's religious affiliation and non-affiliation. As Schwadel (2010b) has noted, the U.S. population

reporting no religious preference had risen in recent years; younger cohorts are more likely to be raised with no religious preference than their older counterparts. Since the proportion of younger Americans with no religious preference is increasing and younger people are more likely to report a better health, the health disparities between Protestants and those with no religious beliefs thus decline in recent years. Although the health gaps between Protestants and people affiliated with other religious groups remain minimal, people of other religious denominations began to show a better health than Protestants since the 1990s. Their differentials in health could be caused by a higher proportion of people who turned to be affiliated with non-Protestant or non-Catholic religions. It may also because people of other denominations show a higher level of religious involvement than Protestants over time, which in turn yields a better health of people affiliated with other religions.

Figure 4a echoes the results shown by Figure 3a, suggesting a downward trend of predicted self-rated health of American adults over the 36 year period. Figure 4b further displays the health gaps in self-rated health between those who participated in religious activities most infrequently (several times a year or less), the reference group, and those who attended religious services moderately (one to three times a month) stay relatively constant with a slight increase trend over time. In contrast, the health gaps between those who attended religious services most frequently and least frequently minimize over time. This finding indicates that the health advantage of those frequent church goers diminishes with time. In turn, a higher level of social integration which is represented by frequently attending religious activities may ultimately play a less influential role. The nonsignificant variance components for the divine interaction and existential certainty variables suggest there is no significant variation by time period when these religious factors affecting health.

[Insert Figures 3&4 about here]

The cohort variations in the effects of religious involvement on health are shown only in Model 2, which is also depicted by Figure 5. Figure 5a demonstrates the cohort effects by religious denomination. The health outcomes of Catholics seem to be more sensitive to cohort changes than other sub-groups. Overall, no significant increasing or declining trends are observed in the effects of denominational preference on health across cohorts. Figure 5b shows the differences in health for the three comparison groups by birth cohort. The cohort effects on health disparities between Protestants and people with no religious affiliations are most pronounced, followed by the differentials between Protestants and Catholics. The health disparities between Protestants and other religious groups are minimal and free of cohort influence. None of the other three religious involvement variables show significant variations by birth cohort when influencing health. It means that the impact of these religious factors on health is constant across successive birth cohorts.

[Insert Figure 5 about here]

DISCUSSION AND CONCLUSIONS

The age-period-cohort approach has been used in recent years to examine health outcomes. However, to date, few studies have constructed comprehensive temporal models that take account the compounding effects of age, period and cohort in explaining the way in which religious involvement influences health. Analyzing time-series data from GSS that span 36 years, this study uses CRREMs to disentangle the age, period and birth cohort effects on health that is associated with religious involvement. The analysis reveals some previously unknown patterns in health across the adult life course and over historical time. Several important findings emerge here.

First, the results clearly show life-course, period and cohort effects on health. The negative age effects on health are strong and independent of time period and cohort effects. Moreover, health of American has not been stable. There is a nonlinear trend of self-rated health over time periods and across birth cohorts. Overall, Americans reported themselves being healthier in some years than in others; the 1940 to 1944 birth cohort also seemed to enjoy a better health than their earlier or later cohorts. These results suggest that a formal test of changes in health under a context that incorporates all three time-related dimensions is warranted. The analysis certainly yields more comprehensive interpretations of health variations among individuals of the United States.

Second, the health disparities caused by three religious involvement factors - denominational preference, divine interaction, existential certainty – decrease with age. This finding suggests that for the most part, the cumulative advantage/disadvantage theory that predicts health outcomes with age may not be applicable in the religious involvement and health relationship. Rather, findings of this research imply convergence in health outcomes with age. Then why do health disparities linked to the level of religious involvement decrease with age? Possible explanations could be: when people are getting older, they are less likely to be engaged in risky behaviors; also, the strong negative effect of age on health probably overweighs the positive effects fostered by religion that encourage healthy behaviors and eventually promote health. These factors explain why health outcomes between nonreligious people and the mainline religious group, Protestants, decrease and finally converge in older ages. In addition, perhaps as one matures, one becomes more immune to life stresses. The role that solace and guidance received from the belief of a powerful force given by God (Foley 1988) and interaction with God in helping people to deal with stresses and to resolve problematic situations may not be as critical

as it was in younger ages. In turn, the positive divine interaction effect on health declines as one ages. On the other hand, the fact that a stronger level of social integration, measured by frequency of service attendance, leads to better health outcomes remains and becomes even more evident when age increases. This finding seems to support the cumulative advantage/disadvantage theory. It implies that the institutional support gained from joining religious communities (Cacioppo 2002; Jones 2004; Strawbridge, Shema, Cohen, and Kaplan 2001) has a cumulative effect, which somewhat distinguishes itself from other religious involvement variables. A higher level of social integration may provide religious individuals support and resources to achieve better health outcomes, particularly in older ages. This is because gaining social support from religious groups erodes the harmful impacts of factors such as loneliness and stressful life events, including widowhood and deaths of relatives and friends that occur in later ages. Individuals who are highly integrated to their church groups can deal with hardships more smoothly in later life stages. As a result, the positive influence of social integration is shown to be more substantial with age increasing. The result highlights religious involvement as a way of social integration in promoting individual health, particularly in later life, which echoes Durkheim's theory on social integration. Meanwhile, the analysis also provides evidence that the influence of religious involvement factors on health is not universal when age is taken into consideration.

Third, the predicted self-rated health of Americans declined during the 36 year span when health is associated with religious involvement. The deterioration of overall health may relate to a more mature population age structure over time periods. Secularization also plays a role because it lowers people's religious involvement level, which in turn affects individual health.

With the proportion of elderly Americans continuing to grow and the trend of secularization, it is expected that a downward trend in overall health will be carry on in future.

The forth major finding is that period effects exist in the health and religious involvement relationship. The health disparities between Protestants, the mainline group, and other subgroups are statistically significant over time periods. The health gaps between Protestants and people with no religious preference held over time with a slight declining pattern in recent years. Compared to Protestants, the health advantage of people affiliated with religions other than the Catholic and Protestant religions is more apparent since the 1990s. I argue that the period effects may be caused by the changing pattern of age composition of the religious groups. This is because in recent years more and more younger people become nonreligious and they are more likely to be affiliated with religions other than the Protestant and Catholic religions. Younger people generally report a better health. The period effects are also demonstrated when studying the health disparities attributed to frequency attending religious services. It is found that the health differentials of people who attended religious services most frequently and least frequently declined over time although the change is small in magnitude. Although an increasing share of younger people in the less religious group could have eased the health gaps caused by levels of divine interactions, the results may also suggest a declining effect of religious involvement on health over time periods.

Last, but not least, no significantly decreasing or increasing trends in health are observed across birth cohorts. However, substantial cross-cohort changes in the effects of religious involvement, particularly religious denomination, on health are found in the analysis. The "healthy Protestants" phenomenon is shown to be more noticeable in some cohorts than in others.

The results suggest that the self-rated health predicted by the religious involvement variables declines over time periods but it fluctuates across birth cohorts.

In all, this research has taken advantage of the CCREMs to reveal the context effects on health. Although findings of the analysis have expanded our knowledge on religious involvement and health, several important issues merit additional analyses. First, the research finds that a higher level of social integration leads to better health outcomes and such a positive correlation gets stronger with age. Then could it be the case that healthier people are more likely to be engaged in religious activities so that they show a higher level of social integration? In other words, could it be possible that the causal relationship between religious involvement and health is the other way around? Prior literature along with the empirical findings of this research has shown that the level of social integration affects health. There is a possibility that when people get older, the physical health condition affects their religious attendance. However, I have not found evidence to challenge the causal relationship shown in this research and many other studies when it comes to the religious involvement and health correlation. Future work may need to further disentangle the causal relationship between health and religious attendance to better justify the findings of this research. Additionally, my analyses provide evidence that health outcomes attributed to religious involvement declined over time periods but the study did not find momentonic decline in health across successive birth cohorts. Under the trend of "secularization," I have used the changes in age compositions of the overall population and the religious/nonreligious groups to explain the period and cohort changes in health. If the changes of age composition is the key that has caused the period changes, then why didn't it yield a downward trend of health across birth cohorts since an increase in the proportion of younger and nonreligious population is also found across cohorts? The sociological literature has suggested

that major social changes that are unique to specific time periods and certain cohorts have strong explanatory power of the health variations, especially at the societal level (Chen, Yang, and Liu 2010; Ferrao and Kelly-Moore 2003). Thus, analyses that investigate the causes of cohort and period changes in health will largely improve the findings of this current study. Finally, the research restricts the analyses to the United States. Whether the results presented in this research represent the general health patterns associated with religious involvement in other countries with drastically different social contexts is not understood. Future work may consider replying on international databases to comparatively study the age, period and cohort changes in health that is linked to religious involvement.

REFERENCES:

Ainlay, Stephen C. and D. Randall Smith. 1984. "Aging and Religious Participation." *The Journal of Gerontology* 39:357-363.

Antonovsky, A. 1987. *Unraveling the Mystery of Health*. San Francisco, CA: Jossey-Bass Press.

Argue, Amy, David R. Johnson, and Lynn K. White. 1999. "Age and Religiosity: Evidence from a Three-Wave Panel Analysis." *Journal for the Scientific Study of Religion* 38:423-435.

Bainbridge, William Sims 1989. "The Religious Ecology of Deviance." *American Sociological Review* 54:288-295

Barker, D. J. P. . 1998. *Mothers, Babies and Health in Later Life*. Edinburgh: UK: Churchill Livingstone.

Blanchflowera, David G. and Andrew J. Oswaldb. 2004. "Well-Being Over Time in Britain and the USA." *Journal of Public Economics* 88:1359-1386.

Breault, K. D. . 1986. "Suicide in America: A Test of Durkheim's Theory of Religious and Family Integration, 1933-1980." *American Journal of Sociology* 92:628-656

Cacioppo, J. 2002. "Loneliness and Health: Potential Mechanisms." *Psychosomatic Medicine* 64:407-417.

Chaves, Mark 1989. "Secularization and Religious Revival: Evidence from U.S. Church Attendance Rates, 1972-1986." *Journal for the Scientific Study of Religion* 28:464-477.

—. 1991. "Family Structure and Protestant Church Attendance: The Sociological Basis of Cohort and Age Effects." *Journal for the Scientific Study of Religion* 30:501-514.

Chen, Feinian, Yang Yang, and Guangya Liu. 2010. "Social Change and Socioeconomic Disparities in Health over the Life Course in China: A Cohort Analysis." *American Sociological Review* 75:126-150

Cochran, John K., Leonard Beeghley, and Wilbur Bock. "Religiosity and Alcohol Behavior: An Exploration of Reference Group Theory " *Sociological Forum* 3:256-276.

Corsentino, Elizabeth A. , Nicole Collins, Natalie Sachs-Ericsson, and Dan G. Blazer. 2009. "Religious Attendance Reduces Cognitive Decline Among Older Women With High Levels of Depressive Symptoms " *Journal of Gerontology* 64A:1283-1289.

Crawford, Mark E., Paul J. Handal, and Richard L. Wiener. 1989. "The Relationship between Religion and Mental Health/Distress." *Review of Religious Research* 31:16-22.

Dannefer, Dale. 2003. "Cumulative Advantage/Disadvantage and the Life Course: Cross-Fertilizing Age and Social Science Theory." *The Journal of Gerontology* 58:S327-S337.

Davis, J. A., T. W. Smith, and P.V. Marsden. 2004. "General Social Surveys: Cumulative Codebook, 1972-2004." National Opinion Research Center, Chicago.

Durkheim, Emile. 1879. *Suicide*. New York: NY: Free Press.

Dwyer, Jeffrey W., Leslie L. Clarke, and Michael K. Miller. 1990. "The Effect of Religious Concentration and Affiliation on County Cancer Mortality Rates." *Journal of Health and Social Behavior* 31:185-202

Elder, Glen H. . 1987. "War Mobilization and the Life Course: A Cohort of World War II Veterans " *Sociological Forum* 2:449-472.

Ellison, Christopher G. 1991. "Religious Involvement and Subjective Well-Being." *Journal of Health and Social Behavior* 32:80-99.

Ellison, Christopher G. . 1995. "Race, Religious Involvement and Depressive Symptomatology in a Southeastern U.S. Community " *Social Science & Medicine* 40:1561-1572

Ellison, Christopher G. and Daisy Fan. 2008. "Daily Spiritual Experiences and Psychological Well-Being Among U.S. Adults." *Social Indicators Research* 88:247-271.

Ellison, Christopher G., David A. Gay, and Thomas A. Glass. 1989. "Does Religious Commitment Contribute to Individual Life Satisfaction?" *Social Forces* 68:100-123

Ellison, Christopher G. and Robert Joseph Taylor. 1996. "Turning to Prayer: Social and Situational Antecedents of Religious Coping among African Americans." *Review of Religious Research* 38:111-131.

Ferrao, Kenneth F. and Jessica A. Kelly-Moore. 2003. "Cummulative Disavantage and Health: Long-Term Consequences of Obesity?" *American Sociological Review* 68:707-729.

Ferraro, Kenneth F. and Cynthia M. Albrecht-Jensen. 1991. "Does Religion Influence Adult Health?" *Journal for the Scientific Study of Religion* 30:193-202.

Fienberg, Stephen E. and William M. Mason. 1982. *Specification and Implementation of Age, Period and Cohort Models*, Edited by S. E. Fienberg and W. M. Mason. New York: NY: Springer-Verlag.

Firebaugh, Glenn. 1989. "Methods for Estimating Cohort Replacement Effects." *Sociological Methodology* 19:243-262.

Firebaugh, Glenn and Brian Harley. 1991. "Trends in U.S. Church Attendance: Secularization and Revival, or Merely Lifecycle Effects?" *Journal for the Scientific Study of Religion* 30:487-500.

Fogel, Robert W. and Dora L. Costa. 1997. "A Theory of Technophysio Evolution, With Some Implications for Forecasting Population, Health Care Costs, and Pension Costs." *Demography* 34:49-66.

Foley, Daniel Patrick 1988. "Eleven Interpretations of Personal Suffering." *Journal of Religion and Health* 27:321-328

Fowler, Dawnovise N. and Hope M. Hill. 2004. "Social Support and Spirituality as Culturally Relevant Factors in Coping Among African American Women Survivors of Partner Abuse." *Violence against Women* 10:1267-1282

Glenn, Norval D. 2003. "Distinguishing Age, Period, and Cohort Effects." Pp. 465-476 in *Handbook of the Life Course*, vol. VI, A, edited by J. T. Mortimer and M. J. Shanahan. New York: NY: Springer Publisher.

Guy, Rebecca Faith. 1982. "Religion, Physical Disabilities, and Life Satisfaction in Older Age Cohorts." *International Journal of Aging and Human Development* 15:225-232.

Idler, Ellen L. 1987. "Religious Involvement and the Health of the Elderly: Some Hypotheses and An Initial Test." *Social Forces* 66:226-238.

Jones, James W. 2004. "Religion, Health, and the Psychology of Religion: How the Research on Religion and Health Helps Us Understand Religion." *Journal of Religion and Health* 43:317-327.

Kelley, Dean M. . 1972. *Why Conservative Churches Are Growing: A Study in Sociology of Religion*. New York: NY: Harper and Row.

Koenig, Harold G., Mona Smiley, and Joann Ploch Gonzales. 1988. *Religion, Health and Aging: A Review and Theoretical Investigation*. Westport, CT: Greenwood Press.

Krause, N. 2005. "Exploring Age Differences in the Stress-Buffering Function of Social Support." *Psychological Aging* 20:714-717.

Krejci, M. J., K. M. Thompson, H. Simonich, R.D. Crosby, M.A. Donaldson, S.A. Wonderlich, and J.E. Mitchell. 2004. "Sexual Trama, Sprituality, and Psychopathology." *Journal of Child Sexual Abuse* 13:85-103.

Levin, Jeffrey S. and Kyriakos S. Markides. 1985. "Religious Attendance and Subjective Health." *Journal for the Scientific Study of Religion* 25:31-40.

Levin, Jeffrey S. and Harold Y. Vanderpool. 1987. "Is Frequent Religious Attendance Really Conducive to Better Health? Toward an Epidemiology of Religion." *Social Science and Medicine* 24:589-600.

Lillard, Lee A. and Linda J. Waite. 1995. "Til Death Do Us Part: Marital Disruption and Mortality." *The American Journal of Sociology* 100:1131-1156.

Link, Bruce G. , Jo C. Phelan, Richard Miech, and Emily Leckman Westin. 2008. "The Resources That Matter: Fundamental Social Causes of Health Disparities and the Challenge of Intelligence." *Journal of Health and Social Behavior* 49:72-91.

Lynch, S. M. 2003. "Cohort and Life-Course Patterns in the Relationship between Education and Health: A Hierarchical Approach." *Demography* 40:309-331.

Martin, Jack K. , Bernice A. Pescosolido, Sigrun Olafsdottir, and Jane D. Mcleod. 2007. "The Construction of Fear: Americans' Preferences for Social Distance from Children and Adolescents with Mental Health Problems." *Journal of Health and Social Behavior* 48:50-67.

Mason, Karen Oppenheim, William M. Mason, H. H. Winsborough, and W. Kenneth Poole. 1973. "Some Methodological Issues in Cohort Analysis of Archival Data." *American Sociological Review* 38:242-258.

McIntosh, Wm. Alex and Jon P. Alston. 1982. "Lenski Revisited: The Linkage Role of Religion in Primary and Secondary Groups." *American Journal of Sociology* 87:852-882

Musick, M. A., J. S. House, and D. R. Williams. 2004. "Attendance at Religious Services and Mortality in a National Sample." *Journal of Health and Social Behavior* 45:198-213.

Nicholson, Amanda, Richard Rose, and Martin Bobak. 2009. "Association between attendance at religious services and self-reported health in 22 European countries." *Social Science & Medicine* 69:519-528.

Olafsdottir, Sigrun 2007. "Fundamental Causes of Health Disparities: Stratification, the Welfare State, and Health in the United States and Iceland." *Journal of Health and Social Behavior* 48:239-253.

Olafsdottir, Sigrun and Bernice A. Pescosolido. 2009. "Drawing the Line: The Cultural Cartography of Utilization Recommendations for Mental Health Problems." *Journal of Health and Social Behavior* 50:228-244.

Pescosolido, Bernice A. and Sharon Georgianna. 1989. "Durkheim, Suicide, and Religion: Toward a Network Theory of Suicide." *American Sociological Review* 54:33-48.

Raudenbush, Stephen W. and Anthony S. Bryk. 2002. *Hierarchical Linear Models: Applications and Data Analysis Methods*. Newbury Park, CA: Sage Publications.

Read, Jen'nan Ghazal and Michael O. Emerson. 2005. "Racial Context, Black Immigration and the U.S. Black/White Health Disparity Racial Context, Black Immigration and the U.S. Black/White Health Disparity." *Social Forces* 84:181-199.

Reyes-Ortiz, Carlos A. , Ivonne M. Berges, Mukaila A. Raji, Harold G. Koenig, Yong-Fang Kuo, and Kyriakos S. Markides. 2008. "Church Attendance Mediates the Association Between Depressive Symptoms and Cognitive Functioning Among Older Mexican Americans." *Journal of Gerontology* 63:480-486.

Rogers, Richard G., Robert A. Hummer, and Charles B. Nam. 2000. *Living and Dying in the USA: Behavioral, Health, and Social Differentials of Adult Mortality*. New York: NY: Academic Press.

Rogers, Richard G., Andrei Rogers, and Alain Belanger. 1992. "Disability-Free Life among the Elderly in the United States: Sociodemographic Correlates of Functional Health." *Journal of Aging and Health* 4:19-42

Ryder, Norman B. . 1965. "The Cohort as a Concept in the Study of Social Change." *American Sociological Review* 30:843-861.

Salsman, J. M., T. L. Brown, E. H. Brechting, and C. R. Carlson. 2005. "The Link between Religion and Spirituality and Psychological Adjustment: the Mediating Role of Optimism and Social Support." *Personality Social Psychology Bulletin* 31:522-535.

Scheitle, Christopher P. and Amy Adamczyk. 2010. "High-cost Religion, Religious Switching, and Health." *Journal of Health and Social Behavior* 51:325-342.

Schwadel, Philip. 2010a. "Age, Period, and Cohort Effects on U.S. Religious Service Attendance: The Declining Impact of Sex, Southern Residence, and Catholic Affiliation." *Sociology of Religion* 71:2-24.

Schwadel, Philip 2010b. "Period and Cohort Effects on Religious Nonaffiliation and Religious Disaffiliation: A Research Note." *Journal for the Scientific Study of Religion* 49:311–319.

Shapiro, J., S. Radecki, A. S. Charchian, and V. Josephson. 1999. "Sexual Behavior and AIDS-Related Knowledge among Community College Students in Orange County, California." *Journal of Community Health* 24:29-43.

Siefken, S. . 1993. "The Hispanic Perspective on Death and Dying: A Combination of Respect, Empathy, and Spirituality." *Pride Institute Journal of Long-Term Home Health Care* 12:26-28.

Steffen, P. R. and K. S. Masters. 2005. "Does Compassion Mediate the Intrinsic Religion-Health Relationship?" *Annals of Behavioral Medicine* 30:217-224.

Sternthal, Michelle J., David R. Williams, Marc A. Musick, and Anna C. Buck. 2010. "Depression, Anxiety, and Religious Life: A Search for Mediators." *Journal of Health and Social Behavior* 51:343-359.

Strawbridge, W., S. Shema, R. Cohen, and G. Kaplan. 2001. "Religious Attendance Increases Survival by Improving and Maintaining Good Health Behaviors, Mental Health, and Social Relationships." *Annals of Behavioral Medicine* 23:68-74.

Warren, John Robert and Elaine M. Hernandez. 2007. "Did Socioeconomic Inequalities in Morbidity and Mortality Change in the United States over the Course of the Twentieth Century?" *ournal of Health and Social Behavior* 48:335-351.

Witter, Robert A., William A. Stock, Morris A. Okun, and and Marilyn J. Haring. 1985. "Religion and Subjective Well-Being in Adulthood: A Quantitative Synthesis." *Review of Religious Research* 26:332-342

Yang, Yang. 2007. "Is Old Age Depressing? Growth Trajectories and Cohort Variations in Late-Life Depression." *Journal of Health and Social Behavior* 48:16-32.

—. 2008. "Social Inequalities in Happiness in the United States, 1972 to 2004: An Age-Period-Cohort Analysis." *American Sociological Review* 73:185-356.

Yang, Yang and Kenneth C. Land. 2006. "A Mixed Models Approach to the Age-Period-Cohort Analysis of Repeated Cross-Section Surveys, with An Application to Data on Trends in Verbal Test Scores." *Sociological Methodology* 36:75-97.

—. 2008. "Age–Period–Cohort Analysis of Repeated Cross-Section Surveys: Fixed or Random Effects?" *Sociological Methods & Research* 36:297-326.

Zimmer, Zachary , Napaporn Chayovan, Hui-Sheng Lin, and Josefina Natividad. 2004. "How Indicators of Socioeconomic Status Relate to Physical Functioning of Older Adults in Three Asian Societies." *Research on Aging* 26:224-258.

Table 1. Percentages of Respondents Who Self-Rated Their Health as "Excellent" by Period and Cohort: U.S., 1972-2008

Cohort	Period								Total	
	1972 to 1978		1980 to 1989		1990 to 1998		2000 to 2008			
	%	N*	%	N	%	N	%	N	%	N
Pre-1899	15.5	458	15.6	122					15.5	580
1900-04	15.0	399	17.4	219	13.3	30			15.7	648
1905-09	16.0	568	12.5	313	14.7	116			14.7	997
1910-14	18.3	600	19.0	510	19.2	224	8.5	47	18.4	1,381
1915-19	21.1	707	19.0	598	15.4	370	12.9	171	18.5	1,846
1920-24	24.4	787	22.4	707	20.5	463	15.3	249	21.9	2,206
1925-29	32.8	723	24.9	686	23.8	495	17.0	376	25.9	2,280
1930-34	34.8	689	31.1	608	20.9	502	19.0	438	27.6	2,237
1935-39	38.1	824	32.2	665	25.6	550	21.4	509	30.5	2,548
1940-44	44.4	929	37.7	814	31.9	741	25.7	638	35.8	3,122
1945-49	42.2	1040	38.2	1,052	31.4	948	28.3	805	35.6	3,845
1950-54	42.7	1001	37.3	1,218	32.9	1,093	27.1	966	35.1	4,278
1955-59	38.2	348	38.1	1,230	33.1	1,242	30.7	1,134	34.4	3,954
1960-64			41.0	939	38.1	1,211	29.8	1,045	36.2	3,195
1965-69			37.1	377	36.2	1,059	31.9	1,061	34.5	2,497
1970-74			50.0	26	39.8	817	32.4	1,039	35.9	1,882
1975-79					39.0	323	36.0	952	36.8	1,275
1980-84					16.7	6	36.2	671	36.0	677
1985-89							38.1	260	38.1	260
Total	31.7	9106	31.8	10,136	31.2	10,207	28.9	10,393	30.9	39,842

Source: The U.S. General Social Survey conducted by the National Opinion Research Center.
* Base N in each cell.

Table 2. Regression Results of Self-Rated Health on Religious Involvement Variables and Other Control Variables from Hierarchical Age-Period-Cohort Models: U.S. 1972-2008

Fixed Effects	Model 1 Coef.	Model 2 Coef.	Model 3 Coef.	Model 4 Coef.	Model 5 Coef.
Intercept	2.973***	2.356***	2.305***	2.456***	2.374***
Denominational preference variables					
(ref. = Protestant)					
Catholic		-0.034			
Other religion		0.003			
No religion		-0.143**			
Social integration variable					
Frequency attends religious services (ref. = Attend 1, <once a month)					
Attend 2 (1-3 times a month)			0.011		
Attend 3 (every week or more)			0.052*		
Divine interaction variable					
Frequency prays (ref. = Pray 2, a few times a week)					
Pray 1 (<= once a week)				0.073	
Pray 3 (several times a day)				-0.086*	
Existential certainty variable					
Certainty of the existence of God (ref.=Certainty 3, believe God exists)					
Certainty 1 (don't believe/not sure)					-0.145*
Certainty 2 (believe with doubts)					-0.063
Control Variables					
Age	-0.011***	-0.029***	-0.029***	-0.027***	-0.028***
Age^2	0.000	0.000***	0.000***	0.000***	0.001***
Sex		-0.028**	-0.012	-0.030*	-0.022
White		0.107***	0.122***	0.078***	0.074**
Married		0.072***	0.059***	0.075***	0.101***
Years of Education		0.053***	0.052***	0.055***	0.053***
Income		0.026***	0.025***	0.027***	0.026***
Work full time		0.183***	0.185***	0.183***	0.215***
Age interaction terms					
Age * Catholic		0.001			
Age * Other religion		-0.001			
Age * No religion		0.003**			
Age * Attend services 2			0.001		
Age * Attend services 3			0.002**		
Age * Pray 1				0.002*	
Age * Pray 3				-0.001	
Age * Certainty 1					0.003*
Age * Certainty 2					-0.000
Random Effects [a]	Variance Component	Variance Component	Variance Component	Variance Component	Variance Component
Period effect					

Intercept	0.0005***	0.0024***	0.0019***	0.0022***	0.0016**
Catholic		0.0001*			
Other religion		0.0004**			
No religion		0.0001*			
Attends services 2			0.0001***		
Cohort effect					
Intercept	0.0063***	0.0008***	0.0014***	0.0001	0.0004
Catholic		0.0010*			
Goodness-of-fit (deviance)	96440.91	79130.85	78517.83	32348.75	19360.35

a. Only statistically significant cross-level interaction effects are presented in the interest of space.
Note: *<.05, **<.01, ***<.001, two-tailed test.
Source: The U.S. General Social Survey conducted by the National Opinion Research Center.

Figure 1. Overall Age, Period and Cohort Effects on Self-Rated Health: GSS, 1972-2008

Figure 1a. Age Effects

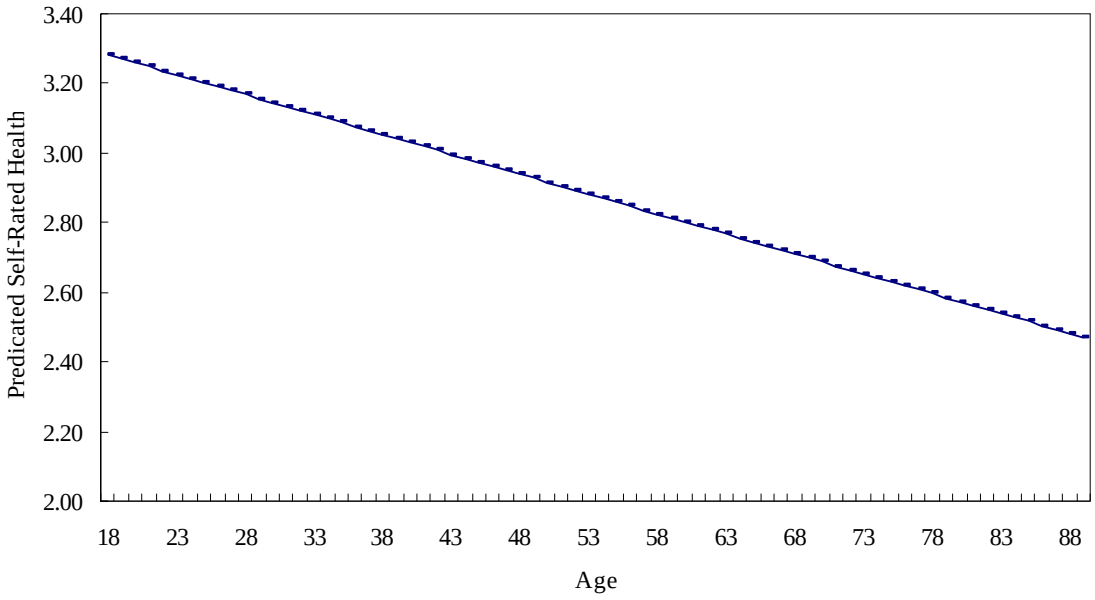


Figure 1b. Period Effects

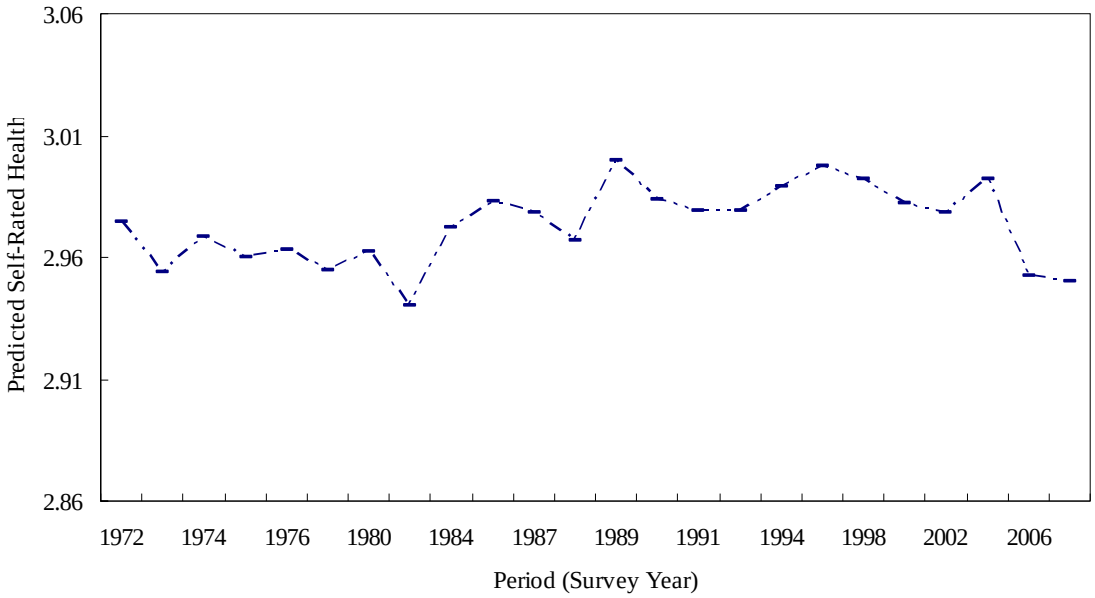
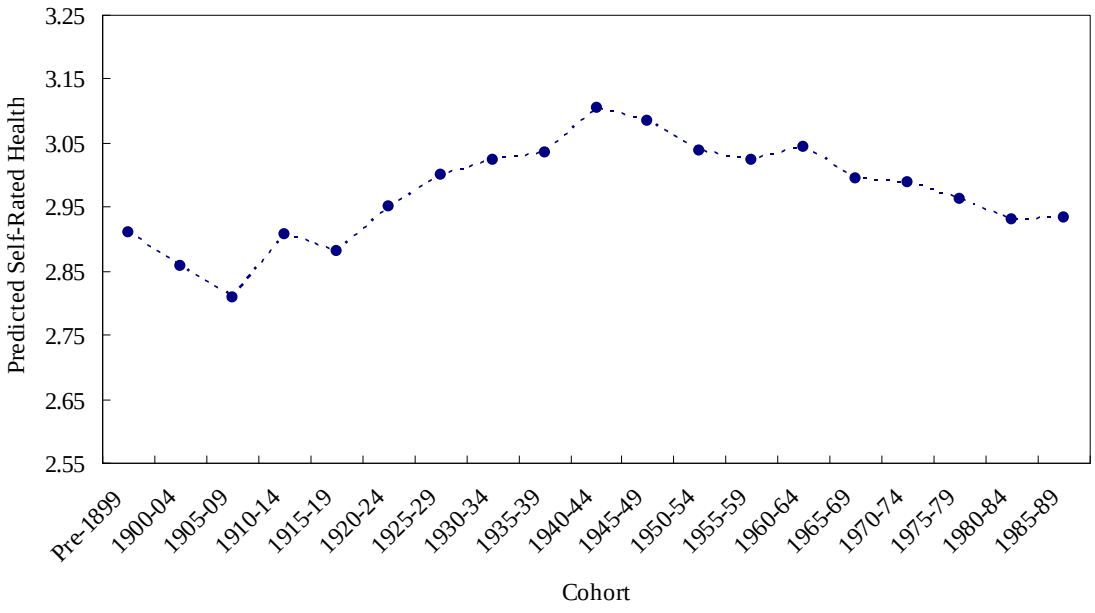


Figure 1c. Cohort Effects



Note: Period and cohort effects are based on random effects estimated from models. Age effects are based on fixed-effects coefficients in models. Other variables are set at their means. n = 39,708.

Figure 2. Effects of Religious Denominational Differences on Predicted Self-Rated Health by Age: GSS, 1972-2008

Figure 2a. Age * Religious Denominational Preference Effects (Model 2)

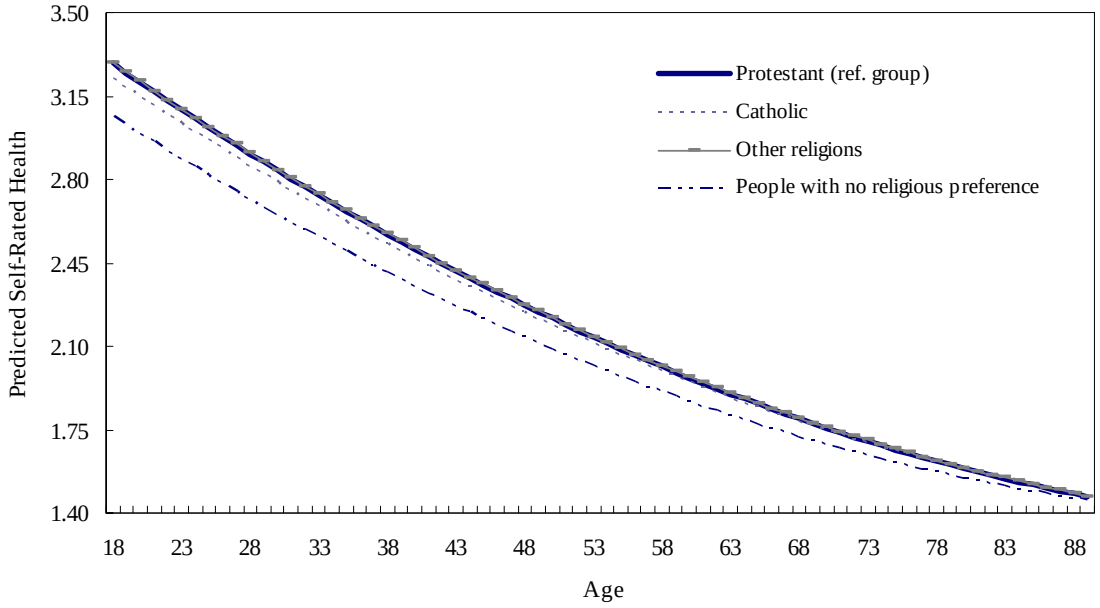


Figure 2b. Age * Religious Attendance Effects (Model 3)

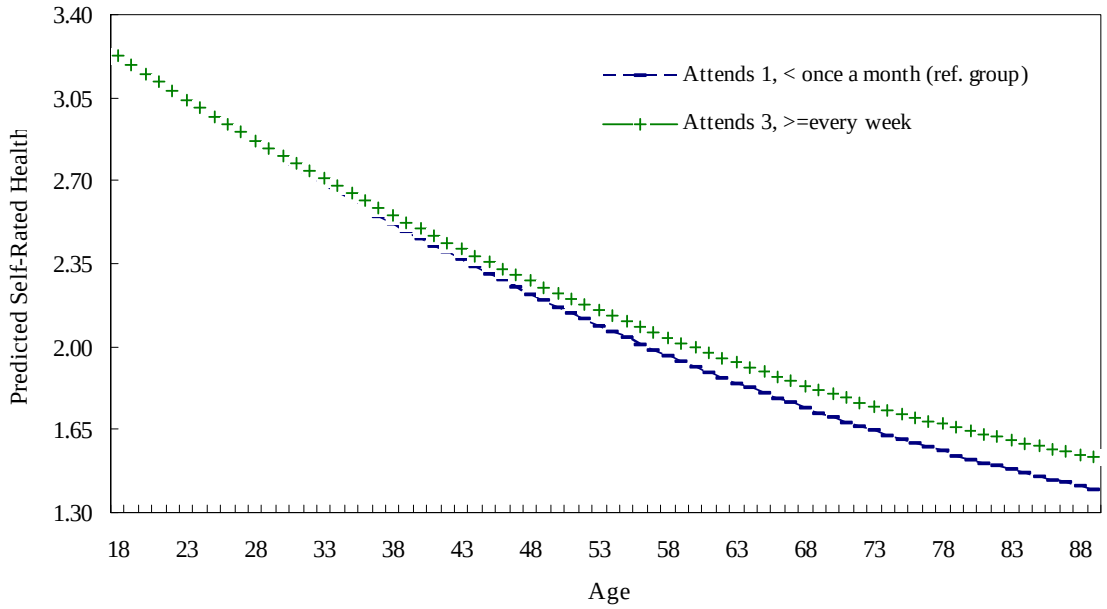


Figure 2c. Age * Pray Effects (Model 4)

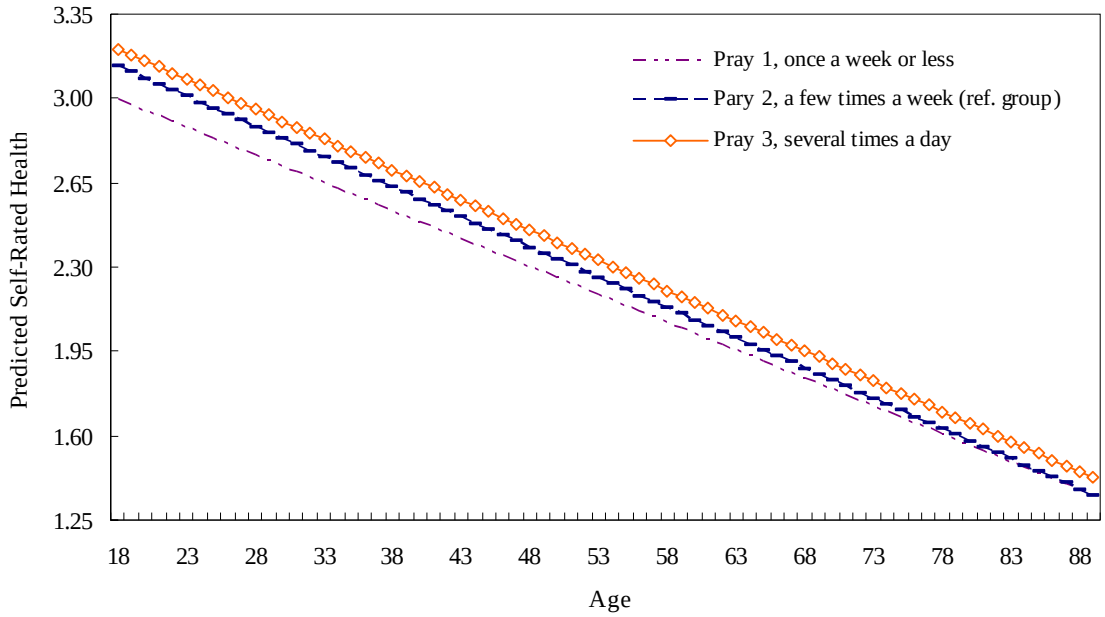


Figure 2d. Age * Existential Certainty Effects (Model 5)

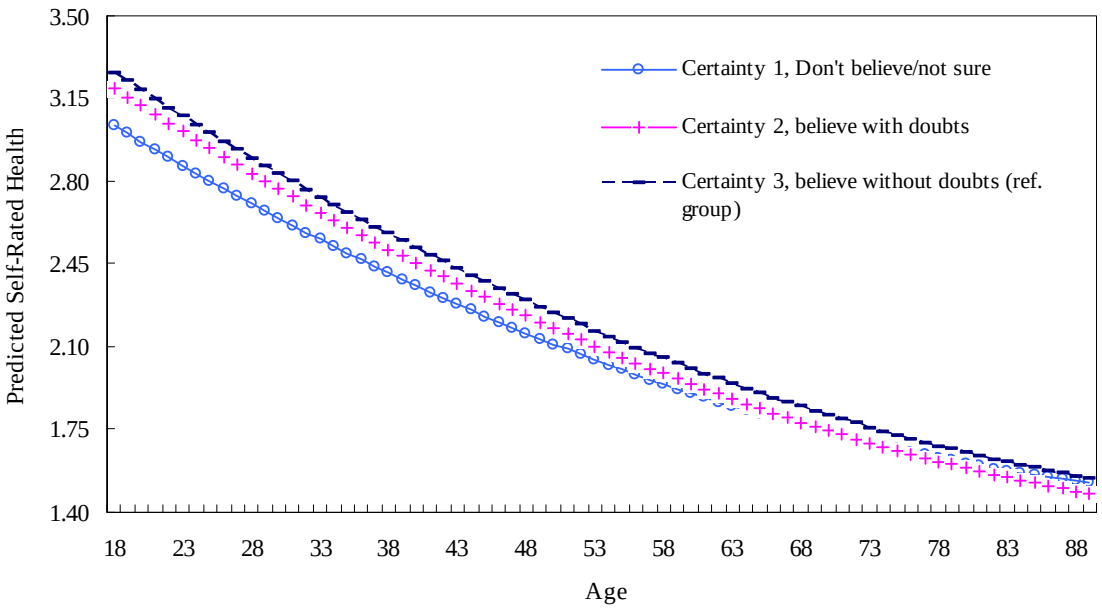


Figure 3. Effects of Religious Denominational Differences on Predicted Self-Rated Health by Time Period: GSS, 1972-2008

Figure 3a. Period Effects by Religious Denominational Preference

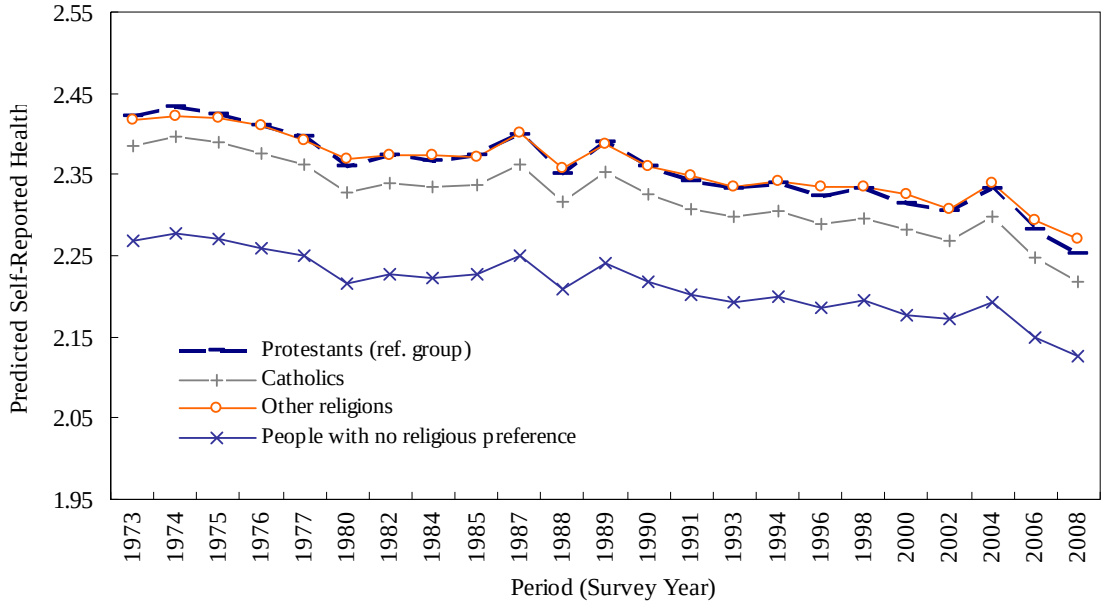


Figure 3b. Estimated Difference in Predicted Self-Rated Health by Religious Denomination over Time Periods

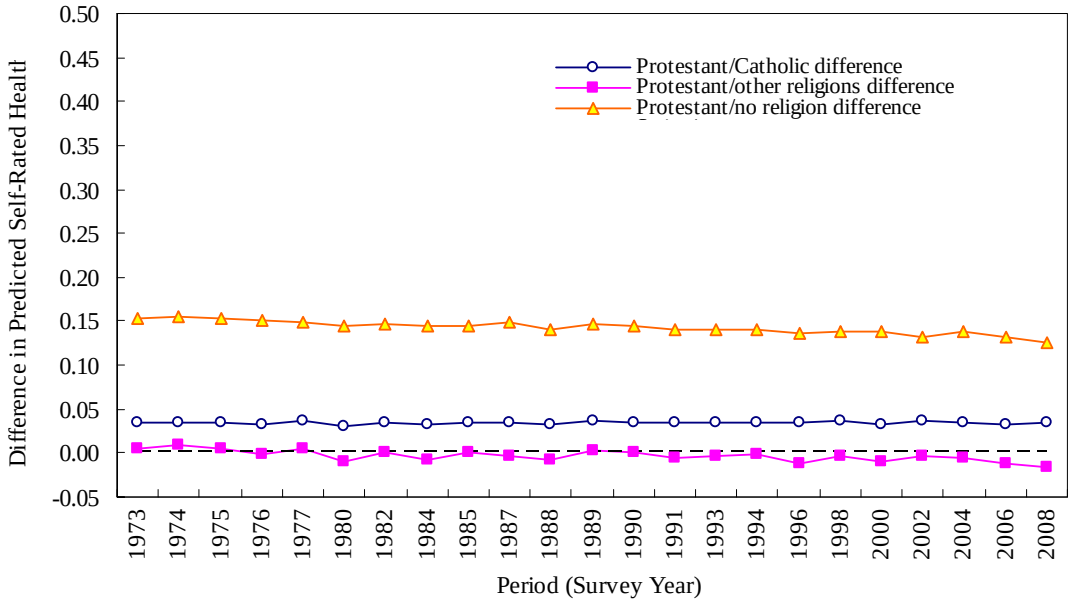


Figure 4. Effects of Social Integration on Predicted Self-Rated Health by Time Period: GSS, 1972-2008

Figure 4a. Period Effects by Frequency Attends Religious Services

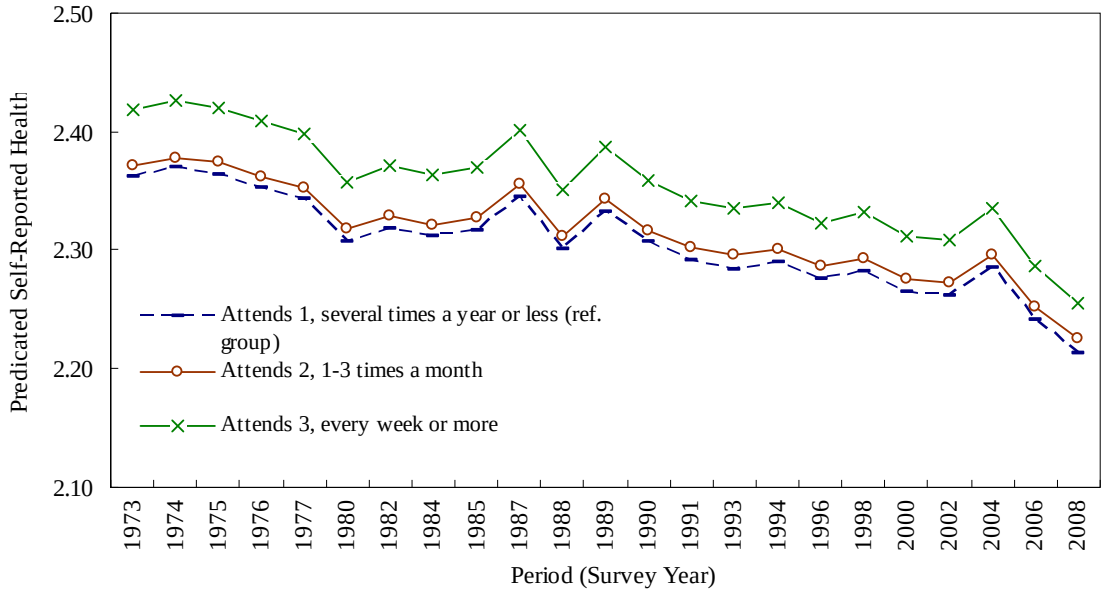


Figure 4b. Estimated Difference in Predicted Self-Rated Health by Frequency Attends Religious Services and by Period: GSS, 1972-2008

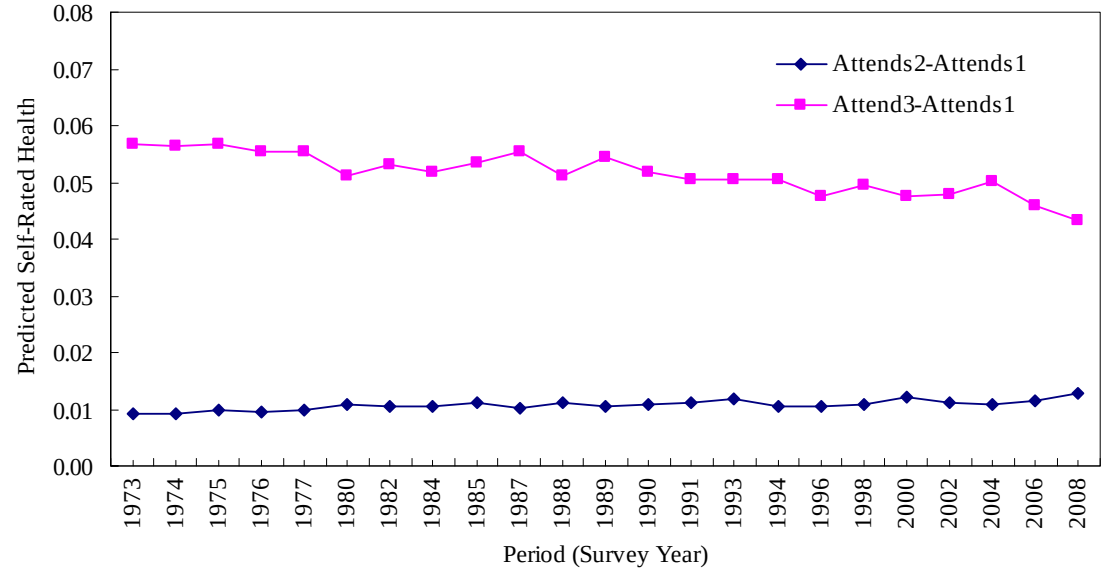


Figure 5. Effects of Religious Denominational Differences on Predicted Self-Rated Health by Birth Cohort: GSS, 1972-2008

Figure 5a. Cohort Effects by Religious Denominational Preference

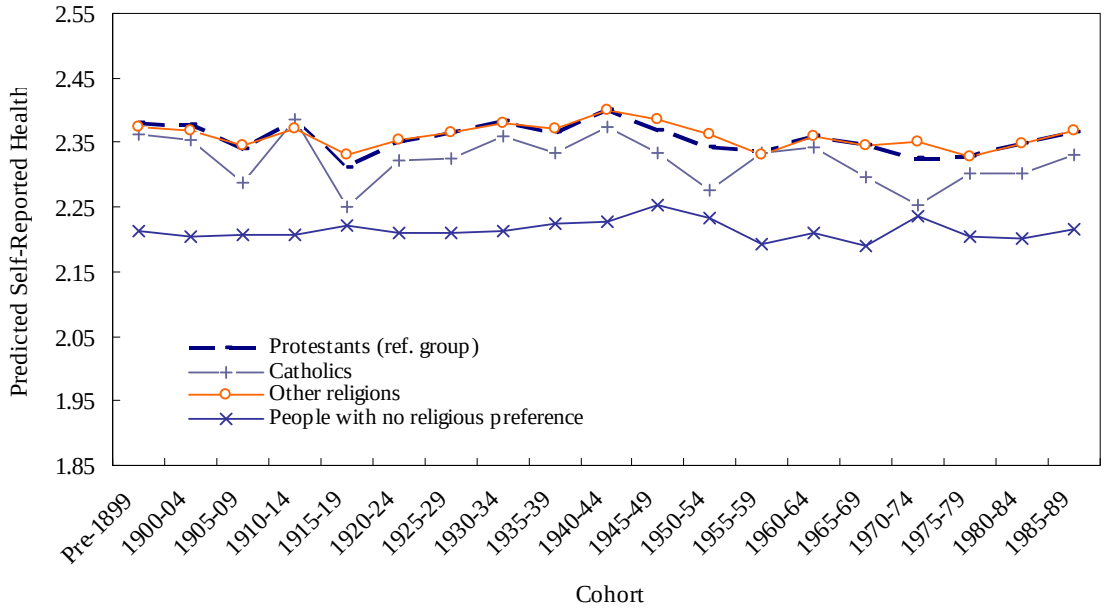
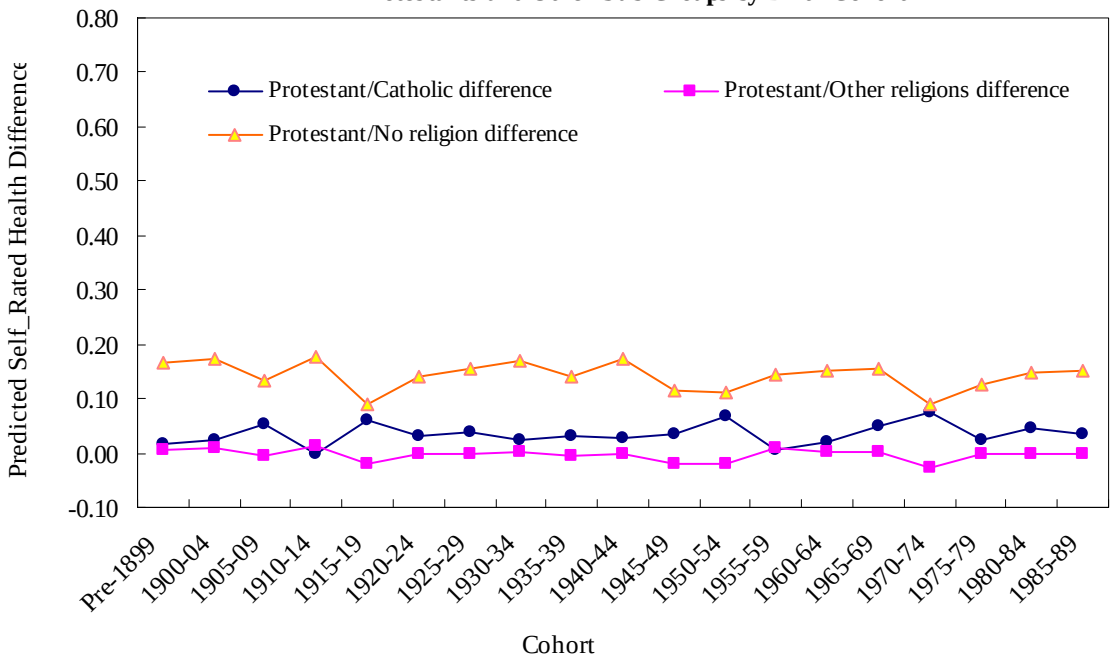


Figure 5b. Estimated Difference in Predicted Self-Rated Health between Protestants and Other Sub-Groups by Birth Cohort



APPENDIX. Summary Statistics for All Variables in the Analysis: GSS, 1972-2008

Variable	Description and Coding	Mean (or %)	S.D.	Min	Max
Dependent variable					
R's self-rated health	1 = poor to 4 = excellent			1	4
Poor		5.6			
Fair		18.7			
Good		44.9			
Excellent		30.9			
Independent variables					
Level 1 Variables					
Key religious involvement variables					
1) Denominational preference	R's religious preference (ref.= Protestant)			0	1
Protestant	1= Protestant, 0 = otherwise	59.8			
Catholic	1= Catholic, 0 = otherwise	24.6			
Other	1= Other, 0 = otherwise	5.4			
None	1= None, 0 = otherwise	10.2			
2) Social integration					
Attends religious services	Frequency R attends religious services (ref. = Attends 1, less than once a month)			0	1
Attends 1	1 = Less than once a month, 0 = otherwise	50.0			
Attends 2	1 = 1-3 time a month, 0 = otherwise	16.1			
Attends 3	1 = Every week or more, 0 = otherwise	33.7			
3) Divine relations					
How often R prays	Frequency R prays (ref. = Pray 2, several times a week)			0	1
Prays 1	1 = once a week or less, 0 = otherwise	30.0			
Prays 2	1 = several times a week, 0 = otherwise	43.2			
Prays 3	1 = several times a day, 0 = otherwise	26.8			
4) Existential certainty	R feels certain about/believes God's existence (ref. = believe without doubts)			0	1
Certainty 1	1 = Don't believe in God, 0 = otherwise	15.8			
Certainty 2	1 = Believe with doubts, 0 = otherwise	20.5			
Certainty 3	1 = Believe without doubts, 0 = otherwise	63.7			
Other variables					
Age (mean)	Age of R.	45.5	17.4	18	89
Sex	Sex of the respondent			0	1
Male	(1=male, 0=female; ref.=female)	45.9			
Female		54.1			
Race and ethnicity	R's race (1=white, 0=Black or other; ref. =0, Black or other)			0	1
White		81.7			
Black or other		13.8			
Other		4.5			
Marital status	R's marital status (1= married, 0 =otherwise; ref. = 0, otherwise)			0	1
Married		54.6			

Never married		9.8			
Widowed		12.1			
Separated		3.5			
Never married		20.0			
Highest year of school completed	R's year of schooling	12.7	3.1	0	20
Total family income	Family income in 1986 dollars; ranges from 1= less than $10,000 to 5= $25,000 or more			1	5
Less than $10,000		20.7			
$10,000-$14,999		12.5			
$15,000-19,999		9.8			
$20,000-$24,999		9.6			
$25,000 and over		47.5			
Labor force status	R's work status (1= working full time, 0=otherwise; ref. = 0, otherwise)			0	1
Working fulltime		49.7			
Working part time		10.2			
Temp. not working		2.2			
Unemployed		3.1			
Retired		13.1			
At school		3.0			
Other		18.8			
Level-2 Variables			N	Min	Max
Period	Survey year		26	1972	2008
Cohort	Five-year birth cohort		20	1899	1991

Note: some sub-categories may not add up to 100% due to rounding. "R" refers to the respondent.
Source: The U.S. General Social Survey conducted by the National Opinion Research Center.