RELIGIOUS INVOLVEMENT AND U.S. ADULT MORTALITY*

ROBERT A. HUMMER, RICHARD G. ROGERS, CHARLES B. NAM, AND CHRISTOPHER G. ELLISON

We use recently released, nationally representative data from the National Health Interview Survey–Multiple Cause of Death linked file to model the association of religious attendance and sociodemographic, health, and behavioral correlates with overall and cause-specific mortality. Religious attendance is associated with U.S. adult mortality in a graded fashion: People who never attend exhibit 1.87 times the risk of death in the follow-up period compared with people who attend more than once a week. This translates into a seven-year difference in life expectancy at age 20 between those who never attend and those who attend more than once a week. Health selectivity is responsible for a portion of the religious attendance effect: People who do not attend church or religious services are also more likely to be unhealthy and, consequently, to die. However, religious attendance also works through increased social ties and behavioral factors to decrease the risks of death. And although the magnitude of the association between religious attendance and mortality varies by cause of death, the direction of the association is consistent across causes.

Spurred by Durkheim's ([1897] 1951) pioneering work, there is a long history and continued tradition of sociological research surrounding the association between religion and mortality, specifically suicide. Only in recent years, however, have the medical sociology and public health communities taken a serious interest in this association in a more general sense, often, for example, linking religion to various measures of physical and mental health (Ellison and Levin 1998; Levin 1994a, 1994b). Nevertheless, few demographic studies have examined the relationship between religious involvement and mortality. In large part, this is because of the scarcity of demographic data that allow inquiry into the association between religious involvement and mortality. For example, the most frequently used source of U.S. mortality data, vital statistics, does not include any information about religion.

We use a nationally representative sample of U.S. adults from the National Health Interview Survey linked to subsequent mortality data to examine the relationship between religious involvement, measured by attendance at church or services, and the risk of mortality over a nine-year follow-up period. Four questions guide our research: (1) Is religious involvement associated with U.S. adult mortality? (2) If so, to what extent and why? (3) Does the association vary across social and demographic characteristics? (4) Does the association vary by underlying cause of death?

PREVIOUS LITERATURE

Most previous studies have investigated the association between religious denominational membership and mortality. In general, people belonging to behaviorally strict and wealthy denominations have lower mortality risks than people who belong to other or no religious groups (Dwyer, Clarke, and Miller 1990; Goldstein 1996; Kark et al. 1996; Lyon et al. 1976; Phillips et al. 1980). Further, strict adherents of many religious groups tend to exhibit lower mortality than those tied more loosely to the same groups (Gardner and Lyon 1982).

A larger literature investigates the association between religion and health outcomes (e.g., Ellison 1991; Idler 1987; Levin and Markides 1986; Levin and Vanderpool 1989; Musick 1996). Most of these studies uncover a beneficial association between religious involvement and health, regardless of the specific measurement of the key independent and dependent variables (Jarvis and Northcott 1987; Levin 1994a). Yet another line of research examines the association between religion and the timing of death. Mortality among elderly adults is linked to religious holidays: Individuals are less likely to die in the period before the most significant celebrations of their respective traditions (Idler and Kasl 1992).

A few studies have focused on the general linkage between religious involvement and the risk of mortality. Comstock and Partridge (1972) documented an association between church attendance and lower cause-specific mortality among adults in Washington County, Maryland. However, Comstock and Tonascia (1976) later suggested that this association was spurious because of the socioeconomic and health selectivity of church attendants. Using the Alameda County Study data, Wingard (1982) demonstrated that church membership was related to lower mortality for both women and men, but that socioeconomic and behavioral controls eliminated the association. A more recent analysis of the Alameda County data suggests that frequent religious attendance at baseline is associated with lower

*Robert A. Hummer, Population Research Center and Department of Sociology, University of Texas at Austin, 1800 Main Building, Austin, TX, 78712; E-mail: rhummer@ prc.utexas.edu. Richard G. Rogers, Department of Sociology and Population Program, University of Colorado at Boulder; Charles B. Nam, Department of Sociology and Center for the Study of Population, Florida State University; and Christopher G. Ellison, Department of Sociology and Population Research Center, University of Texas at Austin. This paper was originally presented at the annual meeting of the Southern Demographic Association, Memphis, TN, October 17–19, 1996. This research was supported, in part, by National Science Foundation Grants SBR-9617760 and SBR-9617905. We are grateful to Donna Hoyert, Felicia LeClere, Starling G. Pullum, and Sameer Rajbhandary for invaluable methodological assistance and to Patrick Gillham, Jay Kaufman, colleagues at the University of Texas Population Research Center, and fellows of the German-American Academic Council who commented on presentations of the results.

mortality over a 28-year follow-up period, even net of many social and behavioral variables (Strawbridge et al. 1997). In addition, both the Alameda County Study and the Tecumseh Community Health Study found a beneficial net effect of a social network index, one component of which was church membership, on mortality (Berkman and Syme 1979; House, Robbins, and Metzner 1982; Seeman et al. 1987). Further, Zuckerman, Kasl, and Ostfeld (1984) found that among poor elderly residents in Connecticut, an index of religiousness was associated with lower mortality in a longitudinal follow-up.

A recent meta-analysis also investigated the association between religious involvement and mortality. Drawing on a thorough literature search involving a wide range of academic disciplines, hundreds of journals, and thousands of empirical studies, McCullough et al. (1998) found just 29 previous studies that, in any form, linked religious involvement with mortality. None of these were published in the mainstream demographic literature, and all but one of the identified studies was community based. Overall, McCullough et al. (1998) found that the effect of religious involvement on mortality is strong and on the same magnitude of some other psychosocial risk factors, such as social support.

We identified only a few mortality studies conducted at the national level that included a variable for religion, and these studies focused on the effects of family structure and general social activities on mortality. For example, Rogers (1996), in an analysis of U.S. adults aged 55 and older, found that persons attending church in the past two weeks exhibited about 30% lower mortality in a subsequent seven-year follow-up period than those who had not, net of a number of demographic, social, and health characteristics. In a similar analysis of African Americans aged 55 and older, Bryant and Rakowski (1992) also found that church attendance in the past two weeks was strongly associated with lower subsequent mortality, net of demographic, social, and health characteristics. However, none of the above studies analyzed a nationally representative sample across the entire adult age range; none looked at life expectancy differences across levels of religious involvement; some date back several decades; and few included an extensive array of independent variables or analyzed cause-of-death differences by religious involvement.

CONCEPTUAL FRAMEWORK

Based on the previous literature, we expect that religious involvement is associated with a lower risk of adult mortality. In this section, we outline some of the mechanisms that might produce this relationship and the variables in our study that measure them.

Religious Attendance

Our data limit our measurement of religious involvement to public religious attendance and include the following question: "How often do you go to church, temple, or other religious services?" (Chyba and Washington 1993). There are other, perhaps very important, dimensions of religious involvement that we cannot consider. For example, our data set contains no information on respondents' religious affiliation, frequency of prayer or meditation, belief in a god or the afterlife, or perceived comfort received from religious involvement.

Nevertheless, religious attendance has been the most commonly used and robust indicator of religious involvement in many studies, including several of those related to health and mortality outcomes (Williams 1994). Because the reasons for religious attendance vary from childhood socialization to social desirability to spiritual reasons, we consider religious attendance to be a general indicator of a person's involvement in a religious community. Religious communities constitute a network of people who provide social resources, behavioral norms, and instrumental support to one another (Ellison and George 1994; Jarvis and Northcott 1987; Musick 1996). Moreover, and perhaps very important for health and survival reasons, involvement in a religious community may be psychologically rewarding and stress reducing, particularly in times of personal difficulty (Kark et al. 1996). Thus, there are multiple reasons to expect religious involvement to be associated with lower mortality.[1]

Factors Linking Religious Involvement and Mortality

Selectivity. People who frequently attend church or religious services may differ demographically from people who attend less often. Much research suggests than people who attend religious services are older, on average, than people who do not attend services, and are also more likely to be southern, female, and black (Levin, Taylor, and Chatters 1994; Taylor et al. 1996). Because these demographic characteristics are also related to the risks of mortality, we control for them in all of our models.

Another type of potential selectivity involves socioeconomic factors. For example, people who are more educated may be more likely to attend services and also have lower mortality (Comstock and Tonascia 1976). Thus, an observed association between religious involvement and mortality may, in fact, be due to socioeconomic characteristics. Fortunately, our data set allows control not only for the education of individuals but also for family income. Consequently, we can directly assess the selectivity impact of two important socioeconomic factors.

Those who do not attend services or who attend only infrequently may also be limited, because of their health, in the kinds of physical activity they can perform and, there-

1. Due to the well-publicized recent deaths among some U.S. cult members, many people are well aware of possible increases in mortality risks due to religious factors. Jarvis and Northcott (1987), although they argued that religious involvement is beneficial for health and survival, also suggested that religion can increase the risk of mortality by proscribing behavior that is harmful to life or by forbidding behavior that may prevent illness or have a positive effect on treatment. Nonetheless, most previous research points toward improved health and reduced risks of mortality associated with religious involvement, and our preliminary results suggested the same. Thus, we focus on the beneficial aspects.

fore, may also be more likely to exhibit higher mortality risks (Jarvis and Northcott 1987; Levin and Markides 1986). Thus, we control for the baseline health status and activity limitation status of respondents. Further, our data set is a nationally representative sample of the *noninstitutionalized* U.S. population. Although the noninstitutionalized sample slightly inhibits the comprehensiveness of coverage of the adult population, this sample feature also excludes some of the most unhealthy and activity-limited adults. For example, people who reside in nursing homes and prisons are not included in the sample.

Mediating factors. Some factors are best viewed as mediating the relationship between religious involvement and mortality (Jarvis and Northcott 1987). Perhaps most widely speculated, differential health behavior may help to account for this association. That is, through norms and denominational proscriptions, people who frequently attend church or religious services may be less likely to smoke cigarettes, to use alcohol in excess, or to be overweight than people who attend less regularly (Levin 1994a, 1994b). Whereas some religious groups strictly forbid behavior thought to be harmful to health, other groups encourage moderation in such behavior and frown upon extreme risk taking. Behavioral factors like cigarette smoking, heavy use of alcohol, and obesity[2] are associated with adult mortality, particularly for certain causes of death. For example, cigarette smoking is a well-known risk factor for cancer, respiratory disease, and heart disease.

The association between religious involvement and mortality may also be due to the beneficial impacts of social ties among people who are involved in religious communities. That is, people who frequently attend church or religious services are more likely to be married, to be involved in a networks of friendships, and to participate in social activities than those who do not attend regularly (Jarvis and Northcott 1987).[3] Marital stability over time, in fact, has been linked to higher levels of religious involvement (Strawbridge et al. 1997). Doctrinal emphases on certain forms of social organization, such as marriage, no doubt helps account for this. In addition, churches and temples often sponsor dinner groups, educational programs, and other social events, thereby encouraging social interaction, communication, and friendship. Informally, church members provide support for one other through prayer and friendship (Taylor and Chatters 1986). Ellison and George (1994), in fact, reported that frequent religious participation is related not only to an increased number of social ties and interactions but also to more positive evaluations of these ties. Thus, congregations may cultivate friendships that can develop further in more secular settings (Ellison and Levin 1998). In turn, a number of studies have shown that social ties, including marriage, are associated with better health and lower mortality (House, Landis, and Umberson 1988; Rogers 1996).

Finally, religious involvement may be related to several factors, which we cannot measure, that may work to reduce the risk of mortality. Recent theoretical work suggests that the association between religious involvement, health, and mortality is multifactorial in origin and that statistical models may not account for the complete set of effects (Ellison and Levin 1998; Levin 1994a). For example, religious involvement may help people to generate a more coherent world view and may ease the impact of stressful life events such as illness and grief (Ellison 1994; Kark et al. 1996). Coping resources acquired through religious involvement, particularly in times of stress, may be important for health and mortality outcomes (Krause 1998). These resources may include increased satisfaction with social support and the perceived availability and reliability of support from other congregation members. Further, people who are religiously involved may also encounter fewer nonhealth stressors, such as marital and family problems, legal hassles, and on-the-job troubles, potentially resulting in health benefits (Ellison and Levin 1998). Churches and temples may also provide food and clothing, counseling, and financial and housing assistance, particularly to attending members (Antonucci 1990). Finally, religious involvement may also affect other health behaviors that we cannot consider by promoting the formal health care system, encouraging healthy dietary patterns and exercise regimes, and discouraging high-risk sexual activity (Jarvis and Northcott 1987).

Religious Involvement and Mortality: Variation Across Groups and by Cause of Death

Several studies have suggested that the influence of religious involvement on health and mortality may vary across sociodemographic characteristics. For example, Levin et al. (1994:138) suggested that churches in the African American community provide more significant social support networks and psychosocial and coping resources than do those in the white community. Other studies suggested that religious effects on health and mortality may vary by age and gender (Bryant and Rakowski 1992; House et al. 1982). Because each of these interaction effects is largely unexplored in the mortality literature, we test for first-order interaction effects between religious attendance and each of our social and demographic factors on mortality.

The association between religious involvement and mortality may also vary by cause of death. Some research has documented especially low cancer mortality risks among religious groups characterized by strong behavioral norms against smoking and drinking, particularly among more active members (Gardner and Lyon 1982). Moreover, a recent county-level analysis demonstrated that religious concentration (membership per population) and denominational affiliation (more conservative) display significant associations with lower cancer mortality rates (Dwyer et al. 1990). Circu-

2. Weight-for-height is not strictly a behavioral variable, but is strongly linked to diet and exercise.

3. Although religious involvement may lead to marriage and an increased number of social ties, marriage and friendships may also facilitate increased religious attendance. Thus, the causal arrangement of these variables is somewhat ambiguous. Nevertheless, many have argued that religious involvement fosters increases in the quantity and quality of social ties (e.g., Ellison and George 1994; Ellison and Levin 1998).

latory disease and respiratory disease mortality risks, because they are associated with cigarette smoking, may also be lower among those who are more religiously involved. Lower levels of hypertension among more religious people may also lead a reduced risk of circulatory disease mortality (Levin and Vanderpool 1989). In addition, heavy alcohol use and social isolation have been linked to increased mortality risk due to accidents, suicides, and homicides. To the extent that increased religious involvement is associated with lower alcohol use and more extensive social ties, we also expect that external cause-of-death risks will be lower among those who are more religiously involved.

DATA, MEASUREMENT, AND METHODS

Data Set

The data for this study come from a nationally representative supplement of the 1987 National Health Interview Survey (NHIS), called the Cancer Risk Factor Supplement–Epidemiology Study, which is linked to the Multiple Cause of Death file (NCHS 1997). In all, 22,080 people were included in the Cancer Risk Factor supplement of the NHIS. In addition to the religious attendance question, the data include behavioral items such as cigarette smoking and alcohol use, information on marital status and other social ties, and the usual demographic and health questions available on the NHIS core questionnaire (NCHS 1989).

Recently, the National Center for Health Statistics (NCHS) matched the respondents of this survey to the Multiple Cause of Death (MCD) file through the National Death Index. NCHS devised a probabilistic matching scheme that assigns weights to 12 items (such as social security number, name, race, sex, and others) to determine the quality of potential matches (NCHS 1997). Patterson and Bilgrad (1986) demonstrated that the matching methodology is highly accurate. For a small number (454, or 2.1%) of cases, we had insufficient identification information to link them with the MCD file. Because their inclusion would be tantamount to assuming that they do not die, they must be excluded from the analysis (NCHS 1997).[4] An additional 422 (1.9%) of the respondents did not answer the question on religious attendance; they were also dropped from the analysis.[5] This leaves 21,204 cases for analysis, of whom 2,016 were identified as having died between 1987 and 1995.

Respondents were exposed to death during part of 1987 and for eight additional years through the end of 1995. Thus, we created a duration variable to allow for variability in exposure to death (in months). Surviving individuals, of course, were censored at the end of the follow-up period. Information on the timing and cause of death have been added to the NHIS questionnaire data, creating a powerful data set for mortality analysis.

Variables, Measurement, and Statistical Analysis

The main independent variable we consider is religious involvement as measured by religious attendance. Some have questioned the validity of survey reports of religious attendance and have offered evidence that they may be overstated in comparison with head-count approaches (Hadaway, Marler, and Chaves 1998). On the other hand, Hout and Greeley (1998) presented evidence that the magnitude of overreporting is small, closer to a factor of 1.1 rather than 2.0 as estimated by Hadaway et al. (1998). Smith (1998) suggested that although standard survey items seem to yield modest overreports, respondents often understand religious attendance to be broader than formal participation in worship services. Thus, surveys report higher levels of religious attendance than worship service head-count approaches, with much of the so-called overreporting representing individuals' participation in prayer groups, Bible studies, and the like (Smith 1998). Because we consider religious attendance to be a general indicator of a person's involvement in a religious community and not a strict count of attendance at worship services, concern about overreporting of religious attendance is minimized. Following suggestions from earlier literature (e.g. Levin and Schiller 1987; Williams 1994), we create four categories of this measure: those who never attend services, those who attend less than once a week, those who attend weekly, and those who attend more than once a week. We demarcate those who report attending more than once a week as the reference category.

The demographic control variables are age, sex, race, and region. Age is measured in single years, ranging from 18 to 89. Sex, race, and region are all dichotomous dummy variables; race is measured as black and nonblack because there were too few members of other racial/ethnic groups for analysis. Region is measured as South and non-South because preliminary modeling suggested that people in the three non-southern regions (West, Midwest, Northeast) have nearly identical mortality risks.

Our three health selectivity measures include activity limitations, self-reported health status, and bed-sick days. We designate people as activity limited if they are unable to perform, or are limited in performing, their major activity (such as paid employment or housework) or other unspecified activities because of health reasons (NCHS 1989). This dichotomous measure is an inclusive measure of activity limitation specifically constructed to eliminate health selectivity most comprehensively. Further, self-reported health is a frequently used measure ranging from excellent to poor; we create dummy variables for four of the groups, comparing them

4. We examined data for the 454 respondents who were excluded from the analysis for this reason. Compared with the rest of the sample, they were somewhat more likely never to attend religious services (39.9% versus 32.0%) and somewhat less likely to attend more than once a week (6.1% versus 8.5%). Because of the relatively small size of the excluded group (N = 454, with an expected 45 deaths over the follow-up period), any resulting bias is probably not large.

5. Respondents who did not answer the question regarding religious attendance exhibited odds of death during the follow-up nearly identical to those of respondents who answered the question. In addition, preliminary analyses using imputed values for religious attendance yielded virtually identical results to those we present. Thus, the small amount of missing data for religious attendance does not seem to be a problem.

with those in excellent health. Despite being self-reported, this measure reflects a person's general health condition well and is a strong predictor of subsequent mortality in many studies (Idler and Benyamini 1997). Further, we separate those people who spent more than one month in bed sick in the past year from those who were sick less frequently, as another measure of health selectivity that might limit religious attendance.

Our socioeconomic measures are education and family income. Education is categorized into three groups: 0–11 years, 12 years, and 13 or more years. Family income is measured on an equivalence scale, which takes into account the family income and family size of the respondent. Here, income equivalence (W) is equal to family income (I) divided by family size (S), raised to an equivalence elasticity of .38 (Van der Gaad and Smolensky 1982), which adjusts for differences in consumption across families of different sizes:

$$W = I/S^{.38}.$$

This measure exhibited a stronger association with mortality than competitors such as income in dollars or logged dollars. We measure income equivalence continuously in units of $10,000.[6]

We also include measures of health behavior and social ties. We include four groups of cigarette smokers: never, former, current light, and current heavy. For alcohol use, we contrast heavy drinkers (four or more drinks per day when drinking) and nondrinkers to light drinkers. Our weight-for-height measure contrasts those who are in the bottom 10% and the top 10%, respectively, of the sex-specific distribution to those in the middle 80% of the distribution. For social ties, we measure marital status in three categories (previously, never, or currently married) and create dichotomous measures of social activity, friends to call on in times of need, and relatives to call on in times of need. We view these variables as indicators of the social integration of individuals, with people who report that they are not married, partake in no social activities, have no friends to call on in times of need, and have no relatives to call on in times of need thought to be at greater mortality risk than their more socially integrated counterparts (House et al. 1988).

We begin the analysis by calculating life expectancy estimates at age 20 ($e20$) and mortality risks by religious involvement for all causes. Subsequently, we use seven cause-of-death categories based on the three-digit codes presented in the *International Classification of Diseases* (U.S. Department of Health and Human Services 1990). The groupings include circulatory diseases (ICD 390–459), cancers (ICD 140–239), respiratory diseases (ICD 466–496), diabetes (ICD 250), infectious diseases (ICD 001–139), external causes (ICD E800–E999), and a residual seventh category.

Because the deaths for those surveyed in 1987 could have taken place in any of nine follow-up years, the $e20$ estimates use person-years as the unit of analysis. Consequently, we use a Cox proportional hazards model to estimate the gross and net associations of religious attendance with mortality (Shah, Barnwell, and Bieler 1996). Independent variables are added in blocks according to the logic of the conceptual framework. We report all coefficients in the form of hazards ratios. All analyses are weighted to approximate the U.S. noninstitutionalized population of adults. Because the NHIS includes a complex clustering and stratified sampling design, we correct the standard errors (Shah et al. 1996).

RESULTS

Table 1 presents life expectancy estimates at age 20 by religious attendance.[7] There are substantial differences in life expectancy at age 20 by religious attendance for the overall population (i.e., for both sexes and for both racial groups) and for each sex and racial group. For the overall population, the life expectancy gap between those who attend more than once a week (62.9) and those who never attend (55.3) is over seven years, similar to the female-male and white-black gaps in U.S. life expectancy. Those who attend once a week (61.9) and those who attend less than once a week (59.7) exhibit intermediate $e20$ figures for the overall population. These estimates indicate a graded relationship between religious involvement and mortality, with the largest step difference (4.4 years) exhibited between those who never attend and those who attend less than once a week. Within sex and racial groups, there is some variation in the graded association. In general, however, people who frequently attend services exhibit higher $e20$ estimates than people who attend less often or not at all. Among blacks, most strikingly, there

6. Detailed income was missing for 11.2% of the respondents in the file. Thus, we imputed values for missing detailed income based on regressions of age, sex, race, region, marital status, and education. We stratified by whether the person's family income was less than $20,000 or $20,000 or more, which was missing for only 2% of the cases.

7. We calculated life expectancy estimates using five-year age groups beginning at age 20. Consequently, a small number of persons aged 18 and 19 in our data set were dropped from this analysis. We compared our overall, sex-specific, and race-specific life expectancy estimates to those reported by U.S. Vital Statistics using the 1991 vital statistics data (i.e., the approximate midpoint of our mortality follow-up period). As expected, our life expectancy estimates were somewhat higher than those reported by Vital Statistics (see the table below; NCHS 1996). This difference is likely due to two factors. First, the NHIS is a noninstitutionalized sample, thus eliminating some of the most unhealthy people from consideration. Second, although highly accurate, the procedure used by NCHS to match deaths from the National Death Index (NDI) to NHIS survey respondents results in an underestimate of mortality and overestimate of life expectancy, simply because the NDI misses a small percentage of known decedents (NCHS 1997:29). Although imperfect, life expectancy estimates from the NHIS–MCD data are relatively consistent with Vital Statistics data and reflective of known sex and race differences. Further, we have no reason to suspect that differential life expectancy estimates by religious attendance are systematically biased.

Life Expectancy Estimates at Age 20

	NHIS–NDI	Vital Statistics
Both Sexes, Both Races	59.1	56.8
Women, Both Races	61.9	59.9
Men, Both Races	56.1	53.4
Nonblacks, Both Sexes	59.9	57.4
Blacks, Both Sexes	53.1	51.3

TABLE 1. U.S. LIFE EXPECTANCY ESTIMATES AT AGE 20, BY RELIGIOUS ATTENDANCE

	Religious Attendance				
	Never	Less Than Once per Week	Once per Week	More Than Once per Week	Total
Both Sexes, Both Races	55.3	59.7	61.9	62.9	59.1
Women, Both Races	56.9	62.8	66.0	64.0	61.9
Men, Both Races	53.9	56.8	56.8	61.3	56.1
Nonblacks, Both Sexes	56.1	60.1	63.5	63.4	59.9
Blacks, Both Sexes	46.4	57.9	52.4	60.1	53.1

Source: National Health Interview Survey–Multiple Cause of Death Linked File (NCHS 1989, 1997).

is nearly a 14-year advantage for those who attend more than once a week compared with those who never attend. The *e*20 figures for blacks who attend less than once a week and once a week, although intermediate, do not follow the graded pattern exhibited for the entire population.

Table 2 provides descriptive statistics for all variables for the entire sample (column 1) and for the deaths occurring during the follow-up period (column 2). For categorical variables, percentage distributions are shown; for continuous variables, mean values are shown. Highly consistent with other national surveys (Smith 1998), about 37% of the sample reported attending church or services at least once a week. A comparison of the two columns for religious attendance shows that death is most likely to occur among those who never attend and least likely among those who attend less than once a week. Those who are older, male, black, southern, lower income, and less educated are more likely to die. Further, those who are less healthy, were previously married, have few social ties, are former smokers, are nondrinkers, and are over- or underweight exhibit higher percentages of death relative to the same categories for the entire population. These are simply bivariate tabulations, however.

Multivariate Models of Religious Attendance and Mortality

The first model of Table 3 displays the baseline religious attendance and mortality relationship, controlling for age, sex, race, and region. Consistent with the overall research hypothesis and the life expectancy estimates shown in Table 1, those who most often attend services exhibit the lowest mortality risks over the follow-up period, and those who never attend exhibit the highest risks. Compared with those who attend more than once a week, those who never attend exhibit 87% higher risks of dying, those who attend less than once a week exhibit 31% higher risks, and those who attend once a week exhibit 15% higher risks (a nonsignificant difference).

TABLE 2. MEASUREMENT AND WEIGHTED DESCRIPTIVE STATISTICS OF RELIGIOUS ATTENDANCE AND INDEPENDENT VARIABLES FOR THE ENTIRE SAMPLE AND FOR DEATHS OCCURRING DURING THE FOLLOW-UP PERIOD, 1987–1995

Variables	Entire Sample	Deaths
Religious Attendance (%)		
Never	32.0	41.0
< Once per week	31.2	22.0
Weekly	28.2	30.0
> Once per week (ref.)	8.5	7.0
Demographic Variables		
Mean age	43.2	66.0
Sex (%)		
Male	47.5	53.0
Female (ref.)	52.5	47.0
Race (%)		
Black	10.9	12.9
Nonblack (ref.)	89.1	87.1
Region (%)		
South	33.6	36.3
Non-South (ref.)	66.4	63.7
Health		
Activity limitations (%)		
Limited	16.3	45.5
Not limited (ref.)	83.7	54.5
Self-reported health (%)		
Poor	3.4	15.1
Fair	9.0	23.7
Good	25.0	30.8
Very good	28.2	16.9
Excellent (ref.)	34.4	13.4
Bed days in last year (%)		
31 or more	2.5	8.2
30 or fewer (ref.)	97.5	91.8
Socioeconomic Variables		
Mean income equivalence (in 10 thousands)	1.9	1.5
Education (%)		
0–11 years	22.7	46.2
12 years	39.1	31.8
13+ years (ref.)	38.2	22.0
Social Ties		
Marital status (%)		
Previously married	16.2	33.1
Never married	18.7	7.7
Currently married (ref.)	65.1	59.2
Social activity (%)		
No social activities	37.0	53.6
One or more activities (ref.)	63.0	46.4
Relatives to call on (%)		
None	9.8	13.3
One or more (ref.)	90.2	86.7
Friends to call on (%)		
None	14.1	26.4
One or more (ref.)	85.9	73.6

(continued)

(Table 2, continued)

Variables	Entire Sample	Deaths
Health Behavior		
Cigarette smoking (%)		
Never (ref.)	49.4	40.4
Former	21.9	32.3
Current light	11.8	10.2
Current heavy	16.8	17.0
Alcohol use (%)		
Nondrinker	30.8	49.0
Drinker, < 4 drinks when drink (ref.)	54.5	44.2
Drinker, 4+ drinks when drink	14.3	6.8
Body mass index (%)		
Top 10%	10.0	12.7
Bottom 10%	10.0	12.2
Middle 80% (ref.)	80.0	75.1
Unweighted *N*	21,204	2,016

Source: 1987 National Health Interview Survey–Multiple Cause of Death Linked File (NCHS 1989, 1997).

Inclusion of the health selectivity variables (Model 2) alters the magnitude of the association between religious attendance and mortality somewhat, but does not change the general pattern of the relationship. The attenuated effect for those who never attend services suggests that poor health plays a part in the higher risks of death for this group; nevertheless, those who never attend demonstrate substantially higher mortality than those who attend more often. Controlling for health factors also slightly widens the mortality gap between those who attend weekly and those who attend more than once a week. In addition, controlling for health factors may result in a conservative estimate of the association between religious attendance and mortality, because some of the impact of religious attendance may, in fact, be mediated by these health factors (House et al. 1988:541).

To test the impact of health selectivity on the association between religious attendance and mortality further, we modeled the effects of religious attendance, demographic controls, and health selectivity variables on the risk of mortality, while excluding those in the sample that died between 1987 and 1991. That is, we tested the association between religious attendance as reported in 1987 and follow-up mortality risk from 1992 to 1995, thinking that many of the most unhealthy people in 1987 would have died in the next five years. The results (not shown, but available from the first author) suggested that the association between religious attendance and mortality was similar to that reported in Model 2 of Table 3, whereas the influence of health factors (particularly bed days) was considerably weaker. Such results make us even more confident about the strength of religious involvement as well as the effectiveness of our controls for health selectivity.

The inclusion of the socioeconomic variables in Model 3, in turn, has little influence on the association between religious attendance and mortality (compare Model 3 with Model 1). Thus, in contrast to some others (e.g. Comstock and Tonascia 1976), we find little evidence that religious attendance is associated with mortality only because of confounding by socioeconomic factors. Model 4, then, includes both health and socioeconomic factors and demonstrates that the association between religious attendance association and mortality persists in a graded fashion net of both health and socioeconomic selection factors.

Models 5 and 6 introduce indicators of social ties and health behaviors, respectively. Model 5 shows that the inclusion of social ties diminishes the association between religious attendance and mortality that was exhibited in Model 4, but a strong religious attendance effect remains. This finding supports the conceptual model of Jarvis and Northcott (1987), who suggested that religious involvement works, in part, through increased social integration to lower the risks of mortality. The effects of the variables for religious attendance, although reduced, are aligned in a graded manner consistent with the research hypothesis. Model 6 focuses on the influence of behavioral factors and demonstrates that the association between religious attendance and mortality is also weaker than in the selectivity model (Model 6 compared with Model 4). In particular, in Model 6, those who never attend display somewhat attenuated higher mortality than those who attend more than once a week. This finding provides support to the idea that health behaviors, at least in part, are also responsible for the association between religious attendance and mortality.

Finally, Model 7 includes the full set of independent variables. Once again, the religious attendance effect is consistent with expectations, but the association is weaker than in the less inclusive models. Changes in the religious attendance hazards ratios from Models 5 and 6 provide evidence that both social ties and health behaviors mediate the association between religious attendance and mortality. Net of all controls, however, those who never attend exhibit 50% higher risks of mortality over the follow-up period than those who attend most frequently. Further, those who attend weekly or less than once a week display about 20% higher risks of mortality than those who attend more than once a week.

Because evidence suggests that the association between religious attendance and mortality may vary across groups, we tested for first-order interaction terms between religious attendance and each demographic and socioeconomic variable by including one multiplicative set of interaction terms at a time to the most complete model (Model 7) specified in Table 3. The results of the interaction equations showed that the net association between religious attendance and mortality was not statistically different across the categories of these variables (results not shown).[8] That is, most coefficients for these interaction terms did not prove to be statistically significant, and their inclusion did not improve the

8. For example, the religious attendance by race interaction did not improve the overall fit of the model. Further, none of the individual coefficients were significant at the .05 level. Larger sample sizes will be necessary for more comprehensive tests of interaction effects.

TABLE 3. HAZARDS RATIOS OF ADULT MORTALITY BY RELIGIOUS ATTENDANCE AND OTHER VARIABLES: UNITED STATES, 1987–1995

Variable	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Religious Attendance							
Never	1.87**	1.70**	1.87**	1.72**	1.61**	1.57**	1.50**
< Once per week	1.31**	1.30**	1.37**	1.34**	1.29**	1.28**	1.24*
Weekly	1.15	1.21*	1.18	1.23*	1.23*	1.21*	1.21*
> Once per week (ref.)	—	—	—	—	—	—	—
Demographic Variables							
Age	1.09**	1.08**	1.08**	1.08**	1.08**	1.08**	1.08**
Sex							
Male	1.52**	1.61**	1.60**	1.65**	1.71**	1.56**	1.60**
Female (ref.)	—	—	—	—	—	—	—
Race							
Black	1.56**	1.24**	1.40**	1.20*	1.19*	1.22*	1.22*
Nonblack (ref.)	—	—	—	—	—	—	—
Region							
South	1.13**	1.09	1.10*	1.07	1.11*	1.04	1.07
Non-South (ref.)	—	—	—	—	—	—	—
Health							
Activity limitations							
Limited		1.54**		1.53**	1.50**	1.47**	1.43**
Not limited (ref.)		—		—	—	—	—
Self-reported health							
Poor		2.78**		2.58**	2.63**	2.51**	2.58**
Fair		1.92**		1.82**	1.84**	1.80**	1.82**
Good		1.44**		1.41**	1.39**	1.38**	1.36**
Very good		1.10		1.08	1.06	1.08	1.06
Excellent (ref.)		—		—	—	—	—
Bed days							
31+		1.31**		1.29**	1.22*	1.27*	1.20*
< 31 (ref.)		—		—	—	—	—
Socioeconomic Variables							
Income equivalence			0.86**	0.94*	0.97	0.95*	0.97
Education							
0–11 years			1.22**	1.11	1.13	1.07	1.10
12 years			1.11	1.09	1.11	1.07	1.09
13+ years (ref.)			—	—	—	—	—
Social Ties							
Marital status							
Previously married					1.13*		1.11*
Never married					1.59**		1.57**
Currently married (ref.)					—		—
Social activity							
Inactive					1.14*		1.08
Active (ref.)					—		—
Friends to count on							
None					0.93		0.94
One or more (ref.)					—		—
Relatives to count on							
None					1.00		0.98
One or more (ref.)					—		—

(continued)

(Table 3, continued)

Variable	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Health Behavior							
Cigarette smoking							
Current heavy						1.64**	1.63**
Current light						1.32**	1.30**
Former						1.15*	1.18**
Never (ref.)						—	—
Weight-for-height							
Bottom 10%						1.44**	1.46**
Top 10%						1.11*	1.14*
Middle 80% (ref.)						—	—
Alcohol use							
Nondrinker						1.10	1.08
Heavy drinker						1.12	1.11
Light drinker (ref.)						—	—
–2 Log-Likelihood	64,231.10	62,859.80	63,867.90	62,557.70	59,976.50	60,750.70	58,417.10

Source: 1987 National Health Interview Survey–Multiple Cause of Death Linked File (NCHS 1989, 1997).

*$p < .05$; **$p < .01$ (one-tailed tests)

overall fit of the model. Thus, we were unable to accept the hypothesis that the religious attendance effect varies across groups.

Religious Attendance and Cause-Specific Mortality

Table 4 displays the results of cause-specific models of religious attendance and mortality, controlling for the different sets of independent variables as in the overall mortality models.[9] For each cause-of-death category examined, save external causes, people who do not attend display the highest risks of mortality when we control for demographic factors (Model 1 for each cause of death). Even for external causes, mortality is higher among those who attend once a week or less than among those who attend more than once a week. Religious attendance–related mortality differences for circulatory diseases and cancer are smaller than those for the remaining causes,[10] and those for respiratory diseases, diabetes, and infectious diseases are greatest. For example, compared with people who attend more than once a week, those who never attend are about four times as likely to die from respiratory disease, diabetes, or infectious diseases. Thus, the association between religious attendance association and mortality, although differing in magnitude across causes of death, is generally consistent in direction for each cause category analyzed.

Models 2 through 7 for each cause of death demonstrate the impact of the selective and mediating factors on the association between religious attendance and cause-specific mortality. For most causes, the inclusion of the health variables in Model 2 has an attenuating influence on the religious attendance mortality differences, particularly when we compare those who never attend with those who attend more than once a week. For example, the nearly fourfold higher diabetes mortality for those who never attend is reduced to less than a threefold difference with the inclusion of the health variables, suggesting that poor health is associated with both reduced religious involvement and higher risks of diabetes mortality. The inclusion of health factors, on the other hand, has relatively little influence on religious attendance differences in external-cause mortality—a reasonable finding given that external causes are probably least influenced of all the causes by health factors. The inclusion of socioeconomic factors in Model 3 for each cause, consistent with the overall cause models in Table 3, further demonstrates that socioeconomic factors have relatively little influence on religious attendance mortality differences for any cause.

In contrast, some of the mediating factors linking religious attendance to cause-specific mortality clearly stand out. For example, the association between infrequent or no religious attendance and increased respiratory disease mortality is substantially reduced with the inclusion of behavioral factors (compare Model 6 with Model 4). Because both religious attendance and respiratory disease mortality are strongly associated with cigarette smoking, the mediating impact of behavioral factors seen here is very plausible. A similar but less striking pattern is evident when behavioral factors are added to the model for circulatory disease (compare Model 6 with Model 4); the cancer mortality models also demonstrate this pattern, albeit with much smaller and

9. The complete set of cause-of-death tables is available from the first author.

10. However, these are the two leading cause categories of death, accounting for about 70% of the deaths in this data set (Table 4). Thus, relatively small risk differences can result in a substantial difference in the actual number of deaths.

TABLE 4. RELIGIOUS ATTENDANCE DIFFERENCES IN CAUSE-SPECIFIC ADULT MORTALITY WITH AND WITHOUT CONTROLS FOR SELECTIVITY AND MEDIATING VARIABLES: UNITED STATES, 1987–1995

Religious Attendance[a]	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Circulatory Diseases (42.6% of deaths)							
Never	1.67**	1.57**	1.66**	1.58**	1.45*	1.43*	1.32†
< Once per week	1.22	1.24	1.28†	1.28†	1.25	1.22	1.18
Weekly	1.07	1.16	1.09	1.17	1.17	1.15	1.14
Cancer (27.7% of deaths)							
Never	1.27†	1.16	1.26†	1.16	1.25†	1.05	1.14
< Once per week	1.12	1.10	1.13	1.08	1.10	1.01	1.03
Weekly	1.05	1.07	1.05	1.06	1.11	1.04	1.09
Respiratory Diseases (7.1% of deaths)							
Never	3.99**	3.34**	3.97**	3.36**	2.95**	2.13*	2.11*
< Once per week	2.30**	2.24*	2.44**	2.31**	2.17*	1.63†	1.62†
Weekly	1.22	1.36	1.25	1.37	1.35	1.11	1.15
Diabetes (2.4% of deaths)							
Never	3.76*	2.87*	3.65*	2.91*	1.80	3.23*	2.09
< Once per week	1.64	1.57	1.66	1.55	1.30	1.70	1.43
Weekly	0.76	0.85	0.77	0.86	0.79	0.77	0.70
Infectious Diseases (3.0% of deaths)							
Never	3.99*	3.57*	3.89*	3.56*	2.69†	3.91*	2.92†
< Once per week	1.39	1.37	1.39	1.36	1.19	1.57	1.36
Weekly	0.98	0.93	0.99	0.93	0.86	0.93	0.85
External Causes (5.1% of deaths)							
Never	2.31†	2.17	2.20	2.11	2.14	2.18	2.09
< Once per week	3.06*	3.01*	3.13*	3.07*	2.75†	3.20*	2.72†
Weekly	2.43†	2.46†	2.49†	2.52†	2.54†	2.57†	2.51†
Residual Causes (12.0% of deaths)							
Never	2.89*	2.59*	3.19*	2.90*	2.30*	2.99*	2.42*
< Once per week	1.18	1.15	1.43	1.37	1.15	1.40	1.25
Weekly	1.48	1.58†	1.76*	1.85*	1.67†	1.93*	1.73†

Source: 1987 National Health Interview Survey–Multiple Cause of Death Linked File (NCHS 1989, 1997).

Notes: Model 1 includes controls for demographic variables. Model 2 includes controls for demographic and health variables. Model 3 includes controls for demographic and socioeconomic variables. Model 4 includes controls for demographic, health, and socioeconomic variables. Model 5 includes controls for demographic, health, socioeconomic, and social ties variables. Model 6 includes controls for demographic, health, socioeconomic, and behavioral variables. Model 7 includes controls for demographic, health, socioeconomic, social ties, and behavioral variables.

[a]The reference category for religious attendance is more than once per week.

†$p < .10$; *$p < .05$; **$p < .01$

nonsignificant differences by religious attendance. Thus, the mediating impact of behavioral factors is strongest for respiratory and circulatory diseases.

The mediating impact of social ties is most clear when we examine diabetes mortality. Comparing Model 5 with Model 4 demonstrates that the addition of social ties evinces a substantially reduced association between religious attendance and mortality. Again, this effect is highly plausible in that many diabetics rely heavily on family, friends, and other support networks to help maintain a pattern of regimented care (Zhang, Markides, and Lee 1991).

Relatively little change is exhibited in the religious attendance effects across models for external and residual causes. For external causes in particular, the lack of explanatory power of the selective and mediating factors may be due to the insufficiency of these measures to tap the most important factors associated with both religious attendance and external-cause mortality. For example, risk taking in driving behavior and the regular use of seat belts may be highly important mediating variables for religious attendance differences in accident mortality; depression may be a highly relevant mediating factor for suicide mortality. The testing of these linkages must await the construction of data sets that include such items in conjunction with indicators of religious involvement and survival status. That the variables we included here did not reduce the religious attendance effects

for external-cause mortality or completely erase the effects for other causes indicates that some variables that link religious attendance to mortality are unmeasured.

CONCLUSION

We used a recently released, nationally representative sample of U.S. adults, which was linked to follow-up mortality data, to investigate the relationship between religious involvement—as measured by attendance at church or worship services—and the risk of subsequent mortality over a nine-year follow-up period. We showed that religious involvement is strongly associated with adult mortality in a graded fashion. Those who never attend services exhibit the highest risk of death, and those who attend more than once a week exhibit the lowest risk. Our life expectancy estimates further indicated that differences in mortality by religious attendance are similar in magnitude to those by sex and race.

To determine why religious involvement is associated with mortality, we controlled for demographic, socioeconomic, health, behavioral, and social variables. Religious attendance exhibited a significant association with all-cause mortality and most specific causes, even net of socioeconomic and health selection effects. Controlling for health factors, however, narrowed the mortality gap between those who do not attend and those who attend more than once a week, particularly for diabetes but also for most causes of death. Thus, health selectivity must be considered in investigations of the relationship between religious involvement and health outcomes. Our inclusion of social ties and behavioral variables also illustrated that at least part of the linkage between religious involvement and mortality is due to these two sets of mediating factors. Behavioral factors were clearly more important as mediating factors for respiratory disease and circulatory disease mortality; social ties were more relevant for diabetes and infectious disease mortality. The mediating influences of health behaviors and social ties corresponds with the conceptual models of religious involvement and health most recently put forth by Ellison and Levin (1998), Levin (1994a, 1994b), and Jarvis and Northcott (1987).

Nevertheless, a strong association between infrequent or no religious attendance and higher mortality risk persisted for overall mortality and most causes of death even after we controlled for all of the independent variables. Thus, future work should explore how other mediating effects, such as stress, coping resources, and other health behaviors, may work to link religious involvement with mortality. Clearly, understanding the pathways by which social and demographic variables influence mortality outcomes is an iterative process (see Preston and Taubman (1994) for discussion of this issue regarding research on socioeconomic status and mortality). Additional data collection efforts and research investigations are warranted, particularly when multifactorial measures of religious involvement can be included in national-level studies. For example, the effects of religious attendance demonstrated here may be stronger among some denominational groups than among others or stronger among people who are both privately and publicly religious. Increased availability and precise specification of mediating variables will also be important for the further understanding of the linkages between religious involvement and mortality. Perhaps more than anything, data needs are critical; few adequate national-level data sources have been available to measure the association and uncover the linkages between religious involvement and mortality.

Given the long-noted association between religion and suicide, the documented linkages between religious involvement, mortality, and various health outcomes, and the multiple mechanisms by which religious involvement may influence health and mortality, religion, like socioeconomic status, might best be conceptualized as a "fundamental cause" of mortality (Link and Phelan 1995). That is, a fundamental cause of mortality is multidimensional, allows for access to important resources, affects various health and cause-of-death outcomes, and may even maintain an association with health and mortality when intervening mechanisms change over time (Link and Phelan 1995). Religious involvement, however, has received far less attention in the mortality literature than socioeconomic status. Moreover, there is still a sense among much of the scientific community that religious effects are minor at best or are even irrelevant (see Levin 1994c:xvi). Our findings help to dispel such a notion.

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