TRAJECTORIES OF SOCIAL ENGAGEMENT AND MORTALITY

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Abstract

This study uses social integration theory within a life course framework to examine trajectories of social engagement over time and how those patterns relate to mortality. The analysis uses data from the Americans' Changing Lives survey, a nationally representative panel study, with mortality information spanning from 1986 to 2005. Results suggest that even after controlling for known predictors of mortality, membership in social engagement trajectories that were initially high on social engagement and either increased or only slightly decreased were related to lower risk of mortality. These findings suggest the importance of maintaining high levels of social engagement over time for the health of older adults.

Since the time of Durkheim ([1897] 1979), researchers have been interested in the relationship between social integration and health. Social relations in their various forms have been linked to better self-rated health (Nummela, Sulander, Rahkonen, Karisto, and Uutela 2008), longer survival (Kiely and Flacker 2003), and a host of other health outcomes. Much of the research on social integration and health, however, does not take into account stability and change in social relations over time (Bennett 2002; Obisesan and Gillum 2009). Social integration is not necessarily fixed across time but rather may fluctuate with the ebb and flow of social attachments across the life course. These patterns of change in social integration may have important consequences for health whereas static conceptions of social relations can mask important variability in how social integration relates to health outcomes. The present study examines trajectories of social relations over time and how they affect mortality, which can provide important leverage in more fully understanding these relationships within a longitudinal context.

Another contribution of this study is the use of both person-centered and variable-centered approaches. Most studies on social relations and health employ solely a variable-centered approach, common in correlation and regression studies (Muthén and Muthén 2000). This approach typically assumes a relatively homogeneous population and answers questions about how well predictor variables explain differences in outcome variables (Laursen and Hoff 2006). A person-centered approach does not assume one homogeneous population but rather that the sample is heterogeneous with multiple unobserved groups within the sample (von Eye and Bogat 2006). This approach focuses on classifying individuals who share similar

characteristics or relations of characteristics into distinct groups (Jung and Wickrama 2008), and it can answer questions concerning patterns of group or individual differences over time, elucidating individuals' life trajectories. The person-centered and variable-centered approaches can be complementary—rather than competing—orientations. These approaches can enable the researcher to examine phenomena from the perspectives of differences in individuals and differences in relations among variables (Laursen and Hoff 2006). The present study combines these approaches, using the person-centered approach to classify individuals into distinct trajectory classes of social engagement over time using growth mixture modeling and the variable-centered approach to examine the association between social engagement trajectory class membership and mortality using survival analysis (Laursen and Hoff 2006).

Social Integration Theory and Social Engagement

Social integration theory builds upon Durkheim's ([1897] 1979) classic study of suicide and argues that integration in the social structure can influence health. The defining characteristic of social integration at the individual level is attachment to the social structure. Social attachments can influence health through several mechanisms, such as by shaping resources available, providing a sense of purpose, and increasing motivation and social pressure to engage in behaviors that promote health (Bassuk, Glass, and Berkman 1999; Berkman, Glass, Brissette, and Seeman 2000). Social integration can enhance the flow of health-related information and help individuals more effectively utilize health care services (Cohen 2004). Social attachments can serve as a buffer for adverse social conditions and stressful events (Schwerdtfeger and Friedrich-Mai 2009; Wortman 1984) as well as influence health through physiological pathways,

such as through neuroendocrine reactivity and reduction of allostatic load (Seeman and McEwen 1996).

Much research to date has defined the concept of social integration in terms of formal social roles, such as "mother" and "worker" (Hsu 2007; Moen, Dempster-McClain, and Williams 1989; Sieber 1974; Verbrugge, Gruber-Baldini, and Fozard 1996). Much of this research does not take into account frequency of broader social interactions, which is relevant for understanding the degree to which individuals are socially integrated. Social engagement is conceptualized in this study as frequency of participation in activities that involve interactions between or among people, capturing a broader array of social interactions and intensity of interaction that can contribute to greater attachment to the social structure. Although some social roles may be embedded within these social activities (e.g., frequency of visiting with family members implies familial roles), the frequency of interaction in these activities is what is important for the present study.

It is important to situate social integration theory and social engagement in the context of the life course. The life course perspective emphasizes the life-long process of aging, stability and change in individuals' lives, individual agency within the constraints of social circumstance, individual embeddedness in time and place, and the interdependence of lives in shared relationships (Elder, Johnson, and Crosnoe 2003). Social engagement among older adults may be especially important. Over the life course, individuals move into and out of multiple social roles, but as they age they are more likely to lose than to replace or add formal social roles, such as the loss of the worker role at retirement (Evandrou and Glaser 2004; Lee and Powers 2002). Despite the potential loss of formal social roles, older adults often have the ability and agency to still participate frequently in social activities that can link their lives to others, encouraging the

formation of more social attachments. This participation can contribute to greater integration in the social structure and likely benefit health, indicating the particular importance of examining these social interactions among the older population.

The life course perspective's emphasis on stability and change in individuals' lives is encapsulated in research using trajectories. Trajectories are uniquely able to take into account patterns of stability and change of social phenomena over the life course. Within-person analysis of an individual's trajectory of social engagement, for example, focuses on the social engagement embedded in a person's past and whether that social engagement has changed over time. An individual's pattern of social engagement over time may have important consequences for his or her mortality, yet there is a dearth of empirical research examining these relationships.

Social Engagement and Mortality

Social engagement may have important protective effects on mortality. Social isolation, which can be considered a lack of social engagement, has been linked to higher rates of mortality, with socially isolated African American elderly women three times more likely to die than their non-socially isolated counterparts (LaVeist, Sellers, Brown, and Nickerson 1997). One aspect of social engagement, organizational attendance, was associated with lower rates of mortality among Japanese elders (Sugisawa, Liange, and Liu 1994). Similarly, older adults in Israel who engaged in group leisure activities had lower mortality rates (Walter-Ginzburg, Blumstein, Chetrit, and Modan 2002). Those who had more contact with friends and relatives, belonged to a church, and belonged to other formal and informal groups were less likely to die over a study period of nine years (Berkman and Syme 1979). Using a similar index to Berkman and Syme's (1979) Social Network Index, Obisesan and Gillum (2009) found that low scores on

their index involving marital status, contact with friends and relatives, religious attendance, and voluntary association membership, were associated with a higher risk of dying. Participation in social and productive activities had salutary effects on mortality over a study period of six years (Menec 2003). Women who occupy more social roles had greater longevity (Moen, Dempster-McClain, and Williams 1989). Low social engagement in the form of an additive scale of 20 items (including both social and solitary activities) was a significant precursor of mortality after eight years (Bennett 2002). For nursing home residents, those with higher levels of social engagement (defined by ease of interaction in various group activities) had reduced odds of dying (Kiely and Flacker 2003; Kiely, Simon, Jones, and Morris 2000).

Less empirical research has examined the effects of patterns of change in social relations on mortality. One of the few studies to address this examined respondents' levels of social ties at two time-points to predict mortality (Cerhan and Wallace 1997). These authors found that among rural elders, those who had low levels of social ties at both time points had an increased risk of mortality while those who had an increase in levels of social ties from low to high had similar mortality risk to those who had stably high social tie levels. Among the Danish elderly, women with consistently low amounts of contact with family and friends or a decline in the frequency of contact over the two time points had higher odds of dying over four years than those with consistently high levels of contact (Lund, Modvig, Due, and Holstein 2000). Male health professionals who were socially isolated had higher mortality rates due to accidents, suicide, and non-cancer and non-cardiovascular causes, while an increase in social ties over the two time points of the study had protective effects on mortality (Eng, Rimm, Fitzmaurice, and Kawachi 2002).

Although these studies are an important initial step in studying changes in social relations over time and how these patterns affect mortality, these studies largely construct ad hoc categories reflecting changes in social relations based only on two time points. It is important to incorporate three or more times of measurement to better assess patterns of change (George 2009). Further, ad hoc classification has several disadvantages compared to empirically-derived trajectories because ad hoc classification cannot be statistically verified, may fail to identify rare but real patterns, and cannot measure the precision with which individuals are classified (Nagin and Tremblay 2005). Trajectories in the present study are empirically-derived via growth mixture modeling using four waves of nationally representative panel data. These trajectories reflect intra-individual patterns of change in social engagement over time.

Previous studies illustrate the importance of examining patterns of change in social relations and their potential effects on mortality. Based on this evidence and social integration theory, this study hypothesizes that those who have high or increasing social engagement will have lower risk for mortality.

METHODS

Data

Data come from the Americans' Changing Lives (ACL) survey housed at the University of Michigan's Institute for Social Research and funded by the National Institute on Aging (House, 2007). This nationally representative panel study collected data in 1986, 1989, 1994, and 2002. Wave 1 (N = 3,617) used a multistage stratified area probability sample of the continental United States' household population aged 25 and older, with an oversampling of African Americans and adults aged 60 and older. The current analysis focuses on adults aged 60

and older (N=1,669 in Wave 1). This decision was made due to the particular importance of social engagement and mortality for the older population. In general, mortality occurs in greater proportions among older adults and is an outcome often associated with aging (Horiuchi, Finch, Mesle, and Vallin 2003). As described previously, examining social engagement may be of particular value for the older population due to the importance of participation in broader social activities that can help older adults maintain their integration in the social structure despite potential role losses as they age.

Measures

Mortality. The National Death Index provided information on the mortality of respondents in the Americans' Changing Lives survey from 1986 until 2005. In almost every case, deaths were verified with death certificates. There were 1,140 deaths (68% of the sample) among adults aged 60 and older during this time period.

Social Engagement. The latent variable, social engagement, is measured with five observed variables indicating frequency of involvement in several social activities: (1) "In a typical week, about how many times do you talk on the telephone with friends, neighbors, or relatives?" (2) "How often do you get together with friends, neighbors or relatives and do things like go out together or visit in each other's homes? (3) "How often do you attend meetings or programs of groups, clubs or organizations?" (4) "How often do you usually attend religious services?" and (5) about how many hours were spent on volunteer work during the last 12 months. Response categories for volunteering were: 0 = did not volunteer, 1 = less than 20 hours, 2 = 20-39 hours, 3 = 40-79 hours, 4 = 80-159 hours, 5 = 160 hours or more. Response categories for frequency of talking on the phone were: 0 = never, 1 = less than once a week, 2 =

about once a week, 3 = 2 or 3 times a week, 4 = once a day, 5 = more than once a day. Response categories for the other indicators were: 0 = never, 1 = less than once a month, 2 = about once a month, 3 = two or three times a month, 4 = once a week, and 5 = more than once a week.

Control Variables. This study controls for sociodemographic characteristics, health conditions, and health behaviors at Wave 1. Sociodemographic characteristics include a*ge* (in years), *race* (1=white, 0=nonwhite [largely African American, along with small numbers of American Indian, Asian, and Hispanic respondents]), s*ex* (1=female, 0=male), *marital status* (1=currently married, 0=not currently married)*, employment status* (1=currently employed, 0=not currently employed), *family income* (using the midpoint of each of the ten income categories, ranging from $2,500 to $110,000), and *education* (continuous measure of highest grade completed).

Several health behavior and health condition variables are included. *Cigarette smoking* contains three categories: never smoked, former smoker, and current smoker. *Alcohol Consumption* is a three-category variable based on the number of alcoholic drinks consumed per month: nondrinkers (zero drinks consumed in the past month), moderate drinkers (1 to 79 drinks in the past month), and heavy drinkers (80 or more drinks in the past month). *Body mass index (BMI)* is weight in kilograms divided by height in meters squared (both self-reported). Established cut-points in the distribution of BMI generated the following categories: underweight (BMI less than or equal to 18.5), average weight (18.6 to 24.9), overweight (25 to 29.9), and obese (30 or higher). Three categories comprise *self-rated health*: excellent or very good, good, and fair or poor. The inclusion and coding of the preceding variables is consistent with Lantz, Golberstein, House, and Morenoff's (2010) study on mortality using ACL data. The inclusion of *number of chronic conditions* appears in several mortality studies (e.g., Hsu 2007;

LaVeist, Sellers, Brown, and Nickerson 1997), and in this study can range from 0 to 9, and includes the following conditions: arthritis, lung disease, hypertension, heart attack, diabetes, cancer, stroke, broken bones, and urine beyond control. The *health limitations* variable comes from a question asking, "How much are your activities limited by health?" Response categories include: 0 = not at all, 1 = a little, 2 = some, 3 = quite a bit, and 4 = a great deal.

Analytic Strategy

This study uses growth mixture modeling (GMM) to estimate trajectory classes of social engagement over time. Class membership in the social engagement trajectories derived from the GMM analysis are then used as a set of dummy variables in Cox proportional hazards models to examine the relationship between membership in these social engagement trajectory classes and mortality. Analyses were conducted using Mplus version 5 (Muthén and Muthén 2007) and Stata version 10.

Growth mixture models are instances of finite mixture models useful for modeling data that are suspected or known to contain multiple subgroups or that have unknown distributional shapes (Everitt 1996; McLachlan and Peel 2000). These models began to be applied in the social sciences with Heckman and Singer's (1984) article on mixtures of hazard regressions, were developed and extended over the years (Nagin 2005; Nagin and Land 1993), and are now applied to study many types of trajectories (George 2009). Conventional latent growth curve models estimate a mean growth curve, describing an overall pattern of change in a single population (Muthén and Muthén 2000). The intercept (initial level) and slope (growth rate over time) are latent factors comprising the model and are allowed to vary across individuals. Growth mixture modeling relaxes the conventional growth modeling assumption of a single population and

describes longitudinal change in unobserved subgroups using latent trajectory classes (Ram and Grimm 2009). Similar to latent class growth analysis (LCGA), growth mixture models estimate mean growth curves for each class rather than one average trajectory as in conventional growth curve modeling (Muthén 2004). However, in latent class growth analysis individuals within each class are treated as homogeneous, allowing zero variance and covariance in the growth factors, whereas growth mixture models allow for individual variation around each of the growth curves, similar to conventional growth models (Muthén and Muthén 2000). The following equations are for a linear growth mixture model with K latent trajectory classes, where in Class k (k = 1, 2,…, K):

$$y_{it} = \eta_{0i} + \eta_{1i}\alpha_{kt} + \varepsilon_{it} \quad (1)$$

$$\eta_{0i} = \alpha_{0k} + \gamma_{0k} w_i + \zeta_{0i} \quad (2a)$$

$$\eta_{1i} = \alpha_{1k} + \gamma_{1k} w_i + \zeta_{1i} \quad (2b)$$

Equation 1 represents within-individual change over time. Equations 2a and 2b represent between-individual change over time. The outcome variable is y_{it} (i.e., social engagement), η_0 is the intercept, η_1 is the slope, t is the time point, and w is the covariate. The subscript *i* indicates that the parameter varies across individuals. The α_k parameters vary across classes to capture different types of trajectories. The γ_k parameters allow the influence of the covariates on the growth factors to vary across class (Muthén 2002). Residuals are represented by ε_{it}, ζ_{0i}, and ζ_{1i}. Typically linear time scores are estimated with scores of 0, 1, 2, 3 for four waves. Due to the unequal spacing between waves in the ACL, the time scores reflect the number of years since Wave 1 (with the Wave 1 time score equal to zero).

Several fit indices were used to determine the number of class trajectories in the growth mixture models. Models were iteratively tested with increasing numbers of classes, and models with linear and quadratic slopes were tested. Muthén (2004) argues that it is important to take covariates into account when determining the number of classes in growth mixture modeling. Thus, age, sex, race, marital status, employment status, income and education were included in the modeling process determining the number of trajectory classes (though unconditional baseline models [without covariates] were estimated for comparison purposes and had larger information criteria values). Preferred models had smaller Bayesian Information Criteria (BIC), sample-size adjusted BIC, and Akaike Information Criteria (AIC) values and a significant Lo, Mendell, Rubin (2001) likelihood ratio test (LMR-LRT) statistic (Jung and Wickrama 2008). A significant p-value for the LMR-LRT statistic indicates a solution with $C - 1$ classes is not sufficient and should be rejected in favor of C classes (Ram and Grimm 2009).

This study uses full information maximum likelihood (FIML) to handle missing data. FIML is a theory-based approach to missing data that incorporates all respondents in the data regardless of whether they participated in every wave of the survey or responded to every item. FIML uses all available data, including information about the mean and variance of the missing parts of a variable, given observed portions of other variables (Wothke 2000). FIML has been shown to be less biased and more efficient than other ways of handling missing data, such as listwise deletion, pairwise deletion, or mean substitution (Schafer and Graham 2002; Schlomer, Bauman, and Card 2010; Wothke 2000). In many cases, FIML produces equivalent results to multiple imputation methods (Collins, Schafer, and Kam 2001).

Once the social engagement trajectory classes were derived from the growth mixture models, the classes were coded into a series of dummy variables to examine the relationship

between the patterns of social engagement over time and mortality, with Cox proportional hazards models. The data were expanded into person-years, with an analytic sample of 22,532 person-years. There were 1,140 deaths from 1986 to 2005.

[TABLE 1 ABOUT HERE]

RESULTS

Table 1 displays the descriptive statistics of key variables. The mean age of respondents was 70 years at baseline, and respondents averaged 10.3 years of education and had a mean income of $17,500 in 1986. A majority of respondents were women (67.1%) and white (68.5%), a little over half were married, and around 22% were employed. Forty-four percent of respondents rated their health as "excellent" or "very good," 25% as "good," and 31% as "fair" or "poor." Respondents had an average of 1.7 chronic conditions. On average, respondents experienced a little bit of limitation in their activities due to their health. About 3% of respondents were underweight, 41% were average weight, 37% were overweight, and 18% were obese. Approximately half of respondents had never smoked cigarettes, 30% were former smokers, and 20% were current smokers. About 64% of respondents did not consume any alcoholic drinks in the past month, 34% were moderate drinkers, and 2% were heavy drinkers. Sixty-eight percent of the respondents died by 2005.

A five-class linear solution for trajectories of social engagement fit the data best in the growth mixture models. This model had small information criteria values (AIC, BIC, sample-size adjusted BIC) relative to other class solutions and a significant Lo, Mendell, Rubin (2001) likelihood ratio test statistic. The model had high entropy at 0.92, indicating a clear delineation

of classes with little overlap (Celeux and Soromenho 1996). Several covariates, including age, sex, race, marital status, employment status, income and education, were controlled when determining the class trajectories.

Figure 1 displays the social engagement trajectory classes. About 58% of the sample (N=996) comprised trajectory class 1 of social engagement, which was characterized by high levels of social engagement with a slight decrease over time. Trajectory class 2 (10.5% of the sample, N=176) was also characterized by high initial levels of social engagement, but decreased more than the class 1 trajectory over time. Approximately 13% of the sample (N=222) belonged to the class 3 trajectory, which was characterized by high levels of social engagement that increased slightly over time. About seven percent of the sample (N=112) comprised trajectory class 4, which had medium levels of social engagement that increased over time. Finally, trajectory class 5 was characterized by relatively low and decreasing levels of social engagement over time, with 11.5% belonging to this class (N=161).

[FIGURE 1 ABOUT HERE]

Next, the social engagement trajectory classes were used as dummy variables in Cox proportional hazards models to examine the relationship between patterns of social engagement and mortality (shown in Table 2). Class 5 (low and decreasing social engagement) is the reference category. The social engagement trajectory classes are the only variables included in Model 1. Membership in each of the social engagement trajectory classes is significantly associated with lower risk of mortality than belonging to the low-decreasing social engagement

trajectory class. Belonging to class 3 (high-slightly increasing social engagement) has the lowest hazard ratio of mortality out of all the social engagement trajectory classes.

Model 2 adds the sociodemographic, health condition, and health behavior variables. Women, younger people, and those with higher incomes have significantly lower hazard ratios for mortality. Those who have more chronic conditions, poor self-rated health (compared to excellent or very good health), and more health limitations reducing activities have significantly higher risk of mortality. Compared to those with average BMI, those who are underweight experience significantly higher hazard ratios for mortality while those who are overweight experience significantly lower hazard ratios. Compared to those who have never smoked cigarettes, both current smokers and former smokers have higher risk of dying, though the odds of dying are higher for current smokers. Both nondrinkers and heavy drinkers have higher risk of mortality compared to those who moderately consume alcohol.

Once these sociodemographic, health behavior, and health condition variables were added, those in Class 2 (high-moderately decreasing social engagement) and in Class 4 (medium-increasing social engagement) were no longer significantly less likely to die than those in Class 5. Class 1 (high-slightly decreasing social engagement) and Class 3 (high-slightly increasing social engagement) remained significantly associated with lower risk of mortality.

[TABLE 2 ABOUT HERE]

DISCUSSION

The present study uses social integration theory within a life course framework to examine the relationship between trajectories of social engagement and mortality. This study contributes to the literature on social relations and health in several ways. Situating social integration theory within the life course framework can provide important insights into the relationship between social relations and health. The life course perspective emphasizes stability and change in individuals' lives as they age and the interdependence of lives in shared relationships (Elder and Shanahan 2005; George 1993). The linking of lives in social relations is important for health (House, Landis, and Umberson 1988), but these social relations are not fixed across time. Static conceptions of social integration can mask our understanding of the connections between social relations and health. Most studies on social integration and mortality, however, do not take into account the dynamic nature of social relations over time.

The few studies that do incorporate patterns of changes in social relations into mortality analyses typically only use two time points (Cerhan and Wallace 1997; Lund, Modvig, Due, and Holstein 2000), which can limit the ability to assess patterns of change (George 2009). Further, these studies typically construct ad hoc trajectories, which have several limitations such as the inability to statistically verify the trajectories, to identify rare but real patterns, or to measure the precision with which individuals are classified, all of which can be done with empirically-derived trajectories (Nagin and Tremblay 2005).

The conceptualization and measurement of social engagement provides further contribution to the literature by incorporating frequency of participation in a broader array of social interactions than often used in research employing social integration theory. Focusing solely on formal social roles, as is common in much literature on social integration (e.g., Moen, Dempster-McClain, and Williams 1992; Verbrugge 1983), may neglect important sources of

social interactions that can provide attachment to the social structure and potentially benefit health. This may be especially important in the context of the loss of formal social roles that often occurs as adults age (Evandrou and Glaser 2004; Lee and Powers 2002). This study's measurement of social engagement further improves upon past research by using a latent variable approach that reduces measurement error rather than a summed index (e.g., Obisesan and Gillum 2009).

The incorporation of both variable-centered and person-centered approaches is another contribution of this study. Most research on social relations and health uses a variable-centered approach exclusively, focusing only on between-person differences to predict outcomes (Laursen and Hoff 2006; Muthén and Muthén 2000). A person-centered approach focuses on classifying individuals who are similar to each other into distinct groups (Jung and Wickrama 2008). The present study combines person-centered and variable-centered approaches, using the person-centered approach to classify individuals into distinct trajectory classes of social engagement over time and the variable-centered approach to examine the relationship between social engagement trajectory class membership and mortality (Laursen and Hoff 2006).

This study provides support for social integration theory. When only including the social engagement trajectories, membership in each of the social engagement trajectory classes was associated with reduced risk of mortality compared to membership in the low-decreasing social engagement trajectory class. This suggests that greater attachment to the social structure through high or increasing social engagement may be protective for health. Once sociodemographic, health behavior, and health condition variables were controlled, membership in the social engagement trajectory class that was high in social engagement initially and only decreased slightly (class 1) and in the trajectory class that was initially high in social engagement and

increased slightly over time (class 3) both remained significantly associated with lower risk of mortality compared to low-decreasing social engagement (class 5). After including covariates in the model, starting out high in social engagement but decreasing more than just a slight amount (as in class 2) was not significantly different from the low-decreasing trajectory in its association with mortality risk, indicating the importance of maintaining high levels of social engagement over time. Starting out with medium levels of social engagement and increasing over time (as in class 4) also was not significantly different from the low-decreasing trajectory after including controls in the model, suggesting that starting out with lower levels of social engagement may prove to be less protective even if the levels of social engagement increase over time.

Many of the covariates were also significantly related to mortality. As expected, older people, men, and those with lower incomes had significantly higher risk of dying. Those who had more chronic conditions, poor self-rated health, and health limiting their activities also were at greater risk of dying. Underweight people, current and former smokers, and both nondrinkers and heavy drinkers were at higher risk of mortality, but those who were overweight had a lower risk of dying. These associations are in line with the results of previous research (e.g., Lantz, Golberstein, House, and Morenoff 2010). With mortality as the outcome, reverse causality for social engagement and mortality is not an issue in the traditional sense. Poor health, however, could have a causal effect on both patterns of social engagement and mortality. Consequently, the fact that patterns of social engagement are significant predictors of mortality even with several measures of health controlled is especially important and provides strong evidence for the benefits of social integration for health.

This study has several limitations. First, although the social engagement variable improved upon some previous measures of social engagement, the indicators of this variable did

not take into account the quality of the social interactions involved. It is likely that negative experiences while participating in social engagement activities affect health differently from positive experiences (August, Rook, and Newsom 2007). It is important for future research to explore this. Another limitation is that respondents self-reported their information for all of the variables except for mortality. Previous research shows that self-reported behaviors are generally valid when the behaviors in question are not illegal (Cohen and Vinson 1995). It is still possible, however, that respondents under-reported or over-reported some of their behaviors. Statistical power issues may have contributed to the non-significant coefficients for class 2 (high, moderately increasing social engagement) and class 4 (medium, increasing social engagement). Only 176 and 112 respondents belonged to classes 2 and 4, respectively, which may have been too small to uncover significant effects.

Despite these limitations, this study provides important information about the relationship between social engagement and mortality. This study provides support for social integration theory and does so within a life course framework taking into account patterns of stability and change in social engagement. The use of trajectories and the life course perspective enriches this study by incorporating individual heterogeneity and a dynamic, longitudinal analysis. Trajectories of social engagement that are initially high and either increase or only decrease slightly are related to lower risk of dying even after controlling for known predictors of mortality. These findings indicate the importance of maintaining high levels of social engagement over time. The links between social engagement and better health outcomes highlight the benefits of older adults' participation in broader social activities. The results of this study, combined with the life course perspective's emphasis on individual agency within the constraints of social circumstance (Elder, Johnson, and Crosnoe 2003), could encourage older

adults to maintain high levels of social engagement as one of several ways to reduce their risk of mortality.

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Table 1. Descriptive Statistics, Means or Percentages

	Wave 1	Wave 2	Wave 3	Wave 4
Age (in years)	70.1			
Female	67.1%			
Race				
White	68.5%			
Nonwhite (mostly African American)	31.5%			
Currently Married	51.1%			
Currently Employed	22.4%			
Income	$17,500			
Education (in years)	10.3			
# Chronic Conditions (0-9)	1.7			
Self-Rated Health				
Excellent or Very Good	44.2%			
Good	24.9%			
Fair or Poor	30.9%			
Activity Limitations Due to Health (0-4)	1.2			
BMI				
Underweight	2.9%			
Normal Weight (reference)	41.4%			
Overweight	37.4%			
Obese	18.3%			
Smoking				
Never (reference)	49.5%			
Former	30.2%			
Current	20.3%			
Alcohol Consumption (%)				
Nondrinker	63.5%			
Moderate Drinker (reference)	34.2%			
Heavy Drinker	2.3%			
SOCIAL ENGAGEMENT				
Visits with friends and relatives (0-5)	3.3	3.3	3.4	3.5
Talks on phone with friends and relatives (0-5)	3.5	3.8	3.7	3.8
Attend meetings/programs of organizations (0-5)	1.8	1.8	2.0	2.2

Attends religious services (0-5)	2.7	2.7	2.8	2.8
Hourly categories of volunteer work (0-5)	0.9	1.1	1.0	1.1
	N=1,669	N=1,279	N=889	N=436

Figure 1. Estimated Means for Trajectory Classes of Social Engagement

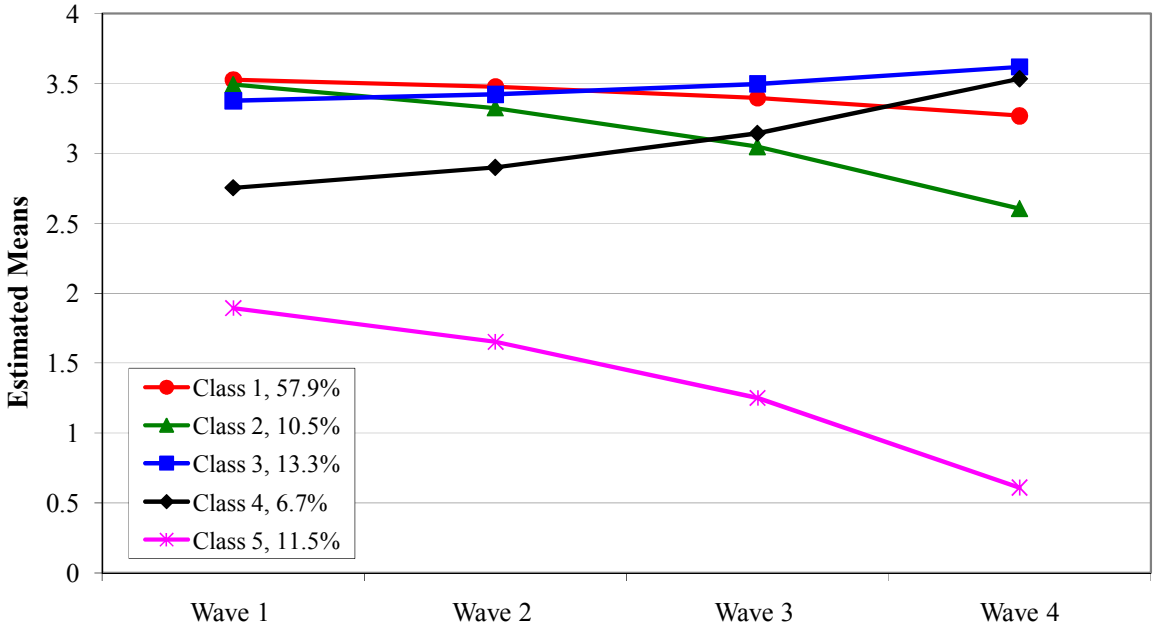

Table 2. Hazard Ratios for the Relationship between Social Engagement Trajectory Class Membership and Mortality

	Model 1	Model 2
Class 1 (high - slight decrease)	0.446*** (0.041)[a]	0.804* (0.080)
Class 2 (high - moderate decrease)	0.297*** (0.038)	0.737 (0.120)
Class 3 (high - slight increase)	0.182*** (0.024)	0.517*** (0.094)
Class 4 (medium - increasing)	0.315*** (0.046)	0.765 (0.140)
Age		1.080*** (0.006)
Female		0.532*** (0.040)
White		0.917 (0.066)
Married		0.969 (0.069)
Employed		0.950 (0.091)
Income		0.994** (0.002)
Education		1.013 (0.010)
# Chronic Conditions		1.123*** (0.033)
Poor Self-Rated Health		1.204* (0.102)
Good Self-Rated Health		1.038 (0.082)

Health Limitations		1.078** (0.028)
Underweight		1.817*** (0.296)
Overweight		0.862* (0.059)
Obese		0.954 (0.085)
Current smoker		1.805*** (0.154)
Former smoker		1.233** (0.092)
Non-drinker		1.179* (0.084)
Heavy drinker		1.459* (0.272)
Observations	22532	22532

Note: Class 5 (low-decreasing social engagement) is the reference group for the class membership variables.
[a] Standard errors in parentheses
* p<.05, **p<.01, ***p<.001