

Structural Relationships Between Social Activities and Longitudinal Trajectories of Depression Among Older Adults

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Purpose: This study examines the structural relationships between social activities and trajectories of late-life depression. **Design and Methods:** Latent class analysis was used with a nationally representative sample of older adults ($N=5,294$) from the Longitudinal Study on Aging II to classify patterns of social activities. A latent growth curve model captured longitudinal changes in depression and tested the impact of social activities while controlling for residential relocation, health status, insurance, and sociodemographics. **Results:** We found 3 different patterns of participation across 8 social activities. Specific activities of volunteering and exercise, self-perception of social activity level as “enough,” and a higher participation level pattern were associated with lower initial status and longitudinal changes in depression. **Implications:** Assessing involvement in multiple social activities is important when using social activities to prevent and treat depression. Future work with improved measures can further clarify how specific activities may reduce risk for depression.

Key Words: Activity theory, Mental health, Latent class analysis, Latent growth curve modeling

The proposition that activity participation promotes well-being in later life has been a mainstay in the literature for more than 40 years (Havighurst, Neugarten, & Tobin, 1963). Researchers have extensively described the impact of activities

on overall well-being, life satisfaction, successful aging, and mortality (Atchley, 1995; Everard, Lach, Fisher, & Baum, 2000; Glass, Mendes de Leon, Marottoli, & Berkman, 1999; Rowe & Kahn, 1998). A few studies also indicate that activity participation may protect against depression (Glass, Mendes de Leon, Bassuk, & Berkman, 2006; Kivelä, Köngäs-Saviaro, Laippala, Pahkala, & Kesti, 1996) and be an effective treatment for depression (Cuijpers, van Straten, & Warmerdam, 2006; Greaves & Farbus, 2006). However, questions remain about the specific relationship between activity participation and depression.

Depression is an important indicator of well-being because it negatively affects 15%–20% of older adults (Gallo & Lebowitz, 1999). Older adults with depression have increased risks for overall mortality (Adamson, Price, Breeze, Bulpitt, & Fletcher, 2005), suicide (Heisel & Duberstein, 2005), functional impairments (Penninx et al., 1998), productivity losses (Langa, Valenstein, Fendrick, Kabeto, & Vijan, 2004), and general medical costs (Katon, Lin, Russo, & Unützer, 2003). Furthermore, longitudinal studies evaluating the impact of risk and protective factors on the trajectories of depression over time are needed, given that 30% of depressed older adults report continued symptoms after 4 years (Cole, Bellavance, & Mansour, 1999; Mojtabai & Olfson, 2004).

Older adults resemble the general population in terms of the following known risk factors for depression: female gender, lack of social support, disability, lifetime history of depression, and negative life events (e.g., death of a spouse or residential relocation into supportive care settings; Cole, 2005; Schoevers et al., 2000). For chronic courses of depression, risk factors include impaired social

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support and increased medical and functional comorbidities (Hayes et al., 1997). Self-rated health is another predictor of depression (Lyness et al., 2006). Although it may be confounded with depression, self-rated health can effectively stratify research participants according to adverse health risks (DeSalvo, Fan, McDonnell, & Fihn, 2005). Lastly, insurance coverage facilitates access to mental health care, which may influence depression rates over time (Bruce, Wells, Miranda, Lewis, & Gonzalez, 2002; Landerman, Burns, Swartz, Wagner, & George, 1994). Thus, this study considers these known risk factors when exploring the relationship between social activities and longitudinal trajectories of depression.

Conceptual Framework

Activity theory provides a conceptual basis for the link between activities and depression. Here, *activity* is broadly defined as any form of doing that can be measured in terms of level (i.e., amount) or patterns that are differentiated into various types of activities (Atchley, 1995). Types of activities include social, leisure, productive, service, intellectual, physical, spiritual, and meaningful domains (Betts Adams & Leibbrandt, 2007). They are presumed to be integrated within the social roles and context of an individual's life course (Hooyman & Kiyak, 2002). However, activity types may differentially affect life satisfaction, health, and functioning. For example, activities that require higher skill level, involvement, commitment, and affiliations with family, friends, church, or community have been found to be related to greater life satisfaction (Larson, Zuzanek, & Mannell, 1985; Mannell, 1993; Riddick & Stewart, 1994). Similarly, exercise, social activities, and instrumental activities are positively associated with better physical health, whereas low-demand leisure activities (e.g., sewing, reading, watching television, and listening to music) are associated with better mental health (Everard et al., 2000). Physical, social, and productive activities all have unique effects on minimizing risk for mortality (Glass et al., 1999).

Previous cross-sectional research fails to assess how specific social activities may operate as modifiable risk factors for depression. Furthermore, variations in the definition and measurement of activities are extensive, and researchers claim that current classifications of social activities lack any

empirical basis. In particular, the commonly used summative scales are critiqued for combining conceptually distinct activities (Kerby & Ragan, 2002; Ritchey, Ritchey, & Dietz, 2001). Because debate persists regarding measurement, this study uses two strategies for defining the social activity predictor variables: (a) specific types of social activities and (b) latent patterns of social activities. This study also uses longitudinal data to assess the impact of these predictors on depression trajectories over time. The research questions are as follows:

1. What is the pattern of participation in various social activities?
2. How are the longitudinal trajectories of depression structured over time among older adults?
3. Are specific social activities associated with the initial status of and longitudinal changes in depression?
4. Are the patterns of social activities associated with the initial status of and longitudinal changes in depression?

Methods

Data

The Longitudinal Study on Aging (LSOA) II includes health, service use, and activity participation data from a nationally representative sample of noninstitutionalized persons aged 70 years and older. We analyzed longitudinal trajectories in depression for 5,294 older adults who completed three waves between 1994 and 2000. Participant death, hospitalization, and loss to follow-up accounted for attrition from the first interview, which included 9,447 participants. We conducted multiple imputation (MI) with a Markov Chain Monte Carlo method to replace missing values (Allison, 2002). All variables had fewer than 15% missing values, except for income, which had 21% missing values. Depression scores for 8.4% of participants were missing at baseline, 17.5% were missing at Wave 2, and 21.6% were missing at Wave 3. The probability of missing data for depression at Waves 2 and 3 was significantly related to depression status at the first interview. Thus, the assumption of missing at random is in question, so we excluded observations with attrition from the imputation process. Using five data sets generated through the MI procedure in SAS 9.1, individual probabilities of participating in social activities were averaged over the set of analyses. The final analysis of the latent growth curve

Table 1. Descriptive Statistics and Operationalization of the Study Variables (N=5,294)

Variables	Operationalization	%/M		
Sociodemographics				
Age	Number of actual years	75.52		
Race	White	88.95		
Gender	Female	63.07		
Education	0 = None/kindergarten only	0.57		
	1 = Elementary	20.67		
	2 = High school	50.13		
	3 = College	22.66		
	4 = Post-college graduate or more	5.96		
Marital status	Married	55.42		
Income	Family income ranged from 0 = <i>less than \$1,000</i> to 26 = <i>\$50,000 and over</i>	17.12 ^a		
Social activities				
	Sum from participation in eight specific activities	4.19		
Working	Yes	11.65		
Volunteering	Yes	21.61		
Religious services	Yes	57.02		
Exercise	Yes	43.48		
Getting together	Yes	91.61		
Talking on phone	Yes	94.71		
Going to sports/movies	Yes	32.01		
Eating out	Yes	69.35		
Self-perceived social activity				
Do more activities	Would like to do more activities	20.82		
Do enough activities	Whether current social activities are enough	68.83		
Do too much	Whether current social activities are too much	2.29		
Residential relocation	Whether they had moved in the last year	5.87		
Access to health care				
Medicaid	Covered by Medicaid	7.95		
Private insurance	Covered by private insurance	79.13		
Health measures				
Medical comorbidity	Number of medical conditions	2.20		
Functional limitation	Number of difficulty in Nagi activities	1.90		
Functional dependency	Number of ADLs/IADLs with difficulty	1.17		
Self-rated health	Ranging from <i>poor</i> (1) to <i>excellent</i> (5)	3.34		
Outcome		Wave 1	Wave 2	Wave 3
Depression	1 = None of the time	40.93	38.95	35.53
	2 = Little of the time	37.53	39.84	41.87
	3 = Some of the time	19.15	19.30	20.94
	4 = All of the time	2.39	1.90	1.66

Notes: ADLs = activities of daily living; IADLs = instrumental activities of daily living.

^aThe 17th category of income ranges from \$17,000 to \$17,999.

model (LGCM) also used the extended multiple data sets.

2004; McKenzie & Marks, 1999; Williams et al., 1999; Zimmerman et al., 2006).

Measurement

Depression.—The study participants were asked how often they felt sad or depressed in the past 12 months using a 4-point scale (Table 1). A single item for measuring depression clearly is not the gold standard (Corson, Gerrity, & Dobscha, 2004; Mitchell & Coyne, 2007). However, several researchers report that a single item can be reliable and sensitive in assessing depression (Corson et al.,

Social Activities and Their Class.—The LSOA study measured whether the older adults participated in eight social activities at baseline: working, volunteering, attending religious services, exercising regularly, getting together with others (e.g., family, friends, and neighbors), talking on the telephone with others, going to movies or sports events, and eating out. Table 1 shows the frequency of each activity performed over the previous

2 weeks. Although more than 90% of all study participants had recently gotten together with friends or family or talked to them on the phone, a somewhat lower percentage (32%) had recently gone out to movies or sporting events. Volunteering (22%) was comparable to a 2006 sample (23.8%) from the Bureau of Labor Statistics (2007). Given the age of our sample (70 years and older), a low percentage (12%) were working. Finally, older adults' self-perception of social activity was measured by asking whether they "want to do more activities," "do enough," or "do too much." Because older adults have large variations in rates of involvement, more information can be gained by classifying each person's type of activity. We developed three homogenous subgroups using the latent class analysis (LCA; McCutcheon, 2002).

Health Status and Insurance.—Considering comorbidities between depression and physical health, we controlled four health measures: medical comorbidities, functional limitation, functional dependency, and self-rated health. These variables were time invariant, as we used only the baseline measures. *Medical comorbidities* counted for a total number of 12 medical conditions that the participants self-reported: cataracts, glaucoma, broken hip, osteoporosis, diabetes, arthritis, chronic bronchitis or emphysema, asthma, hypertension, heart disease, stroke or cerebrovascular accident, and cancer. *Functional limitation* was measured by Nagi's scale, which captures upper and lower body limitations with seven items: walking a quarter mile; walking 10 steps without resting; reaching up over one's head; stooping, crouching, or kneeling; reaching out as if to shake hands; using one's fingers to grasp or handle; and lifting or carrying 10 pounds. *Functional dependency* was quantified by combining both activities of daily living (ADLs) and instrumental activities of daily living (IADLs). The summative scales included the following—(a) ADLs: bathing, dressing, eating, getting in or out of bed or a chair, walking, getting outside, and toileting; and (b) IADLs: preparing meals, shopping for groceries, managing money, using the telephone, doing heavy housework, doing light housework, and managing medication. *Self-rated health* was measured with a Likert-type scale ranging from *excellent* (1) to *poor* (5). *Access to health care services* was assessed by Medicaid or private insurance coverage.

Other Control Variables.—*Residential relocation* has been found to be significant in many aspects of older adults' lives (Chen & Wilmoth, 2004; Golant, 2003). We identified those who had lived in their current home for less than 1 year. Age, gender, race, education, marital status, and family income were included to control for socioeconomic and demographic factors.

Statistical Analyses

Latent Class Analysis.—Question 1 was answered by classifying homogenous subgroups across eight social activities at baseline. Latent class prevalence and response probabilities are two key parameters (McCutcheon, 2002). Latent class prevalence indicates the proportion of older adults who participated in various social activities and is based on the co-occurrence and interrelations of various social activities. Response probabilities are calculated by using the probabilities of performing social activities within a certain social activity class. These class memberships are mutually exclusive. To maximize an optimal class solution with exploratory LCA, a model-fitting procedure through stepwise addition of classes was conducted. The best-fitting model was determined on the basis of the Akaike information criterion (AIC), Bayesian information criterion (BIC), and entropy as a global fit index (McCutcheon).

Latent Growth Curve Model.—The LGCM captures longitudinal trajectories of depression and examines whether older adults have different initial statuses (intercept) and longitudinal changes (slope) in depression (Question 2). As a family of structural equation modeling, LGCM provides statistical advantages in estimating longitudinal patterns in outcome measures (Bollen & Curran, 2006). A well-fitting LGCM requires that an outcome variable is measured with the same units in at least three equal time intervals to account for the lack of independence from panel data. Furthermore, previous studies indicated nonlinear growth curves in depression (Mojtabai & Olsson, 2004); thus, we freed the third factor loading to capture this nonlinear growth curve (Kline, 2005). Overall model fit should be interpreted prior to reporting the results of LGCM. A nonsignificant chi-square, the critical values (e.g., greater than .90) of model fit indexes such as comparative fit index (CFI), incremental fit index (IFI), and adjusted goodness-of-fit index (AGFI) indicate acceptable fits. For the root mean square error of

approximation (RMSEA), criteria lower than .05 represent good model fit (Hoyle, 1995).

For an unconditional model of depression, this study estimates a two-latent factor model using the indicators of three waves. The first factor, the initial level of growth curve, is defined by fixing all three parameters of the loadings to 1.0, which represents no growth across three waves at each initial point. The second factor (slope) fixes the first loading to 0.0 and does not allow the indicator at Wave 1 to load on this factor. Then, the second loading is fixed at 1.0 and the third factor loading is freed (Chassin, Curran, Hussong, & Colder, 1996).

Weighted least squares (WLS) were used to estimate more accurate parameter estimates by avoiding bias resulting from the violation of the normality assumption—which was due to the ordinal measures of depression having skewed distributions at each wave (0.78, 0.66, and 0.65). When using a large sample size (e.g., greater than 1,000 cases), WLS can offer more reliable parameter estimates (Olsson, Foss, Troye, & Howell, 2000).

In the second stage of model development (Question 3), we incorporated specific social activity predictors in a conditional LGCM, so we could analyze the impact of time-invariant baseline predictors on depression trajectories. For the final model analyzing whether the social activity patterns were associated with significant levels and changes in depression over time, we added the social activity classification estimated by LCA (Question 4). Mplus 3.0 statistical software was used to analyze both LCA and LGCM.

Results

Descriptive Statistics

As shown in Table 1, the study participants at baseline ($N=5,294$) ranged in age from 69 to 97 years (M age, 75.52 years) and were highly skewed by race (89% White), were predominately women (63%), and were nearly evenly divided by marital status (55% married). Despite the relatively high level of education (78% high school graduate or higher), the annual average family income of nearly 63% of participants was less than \$20,000. At baseline, approximately 6% had moved within the last year. Although only 8% were covered by Medicaid, most participants (79%) were covered by private insurance.

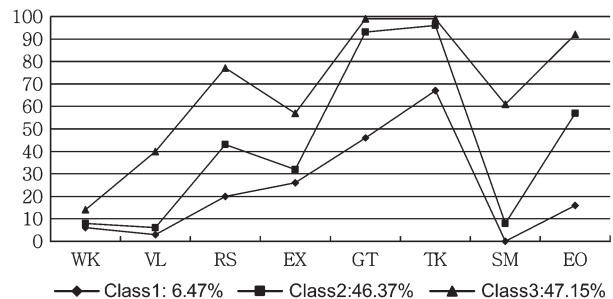


Figure 1. Response probability of participation in each class of social activities. *Notes.* WK = working; VL = volunteering; RS = religious services; EX = exercise; GT = getting together; TK = talking; SM = sports & movies; EO = eating out.

LCA of Social Activities

Theoretical fit of each model was examined for visual clarity and practical implications (McCutcheon, 2002). Figure 1 shows the overall pattern of participation in social activities in three classes. The social activities data clustered around seven, not eight, activities because working has almost no variation between classes. Consistent with statistical model fits, we found that a three-class solution was the best fit among the two- through five-class solutions according to the lowest scores in AIC (198,582.31) and BIC (198,795.09), and it had the highest score in entropy (0.877).

Class 1 is characterized by consistently lower levels of participation across all activities and contained 6.47% of older adults. In this class, the conditional probability of talking on the phone was the highest (67%) and going to the movies or sports events was zero. *Class 2*, representing 46.37% of the sample, is characterized by more moderate levels of eating out (58%), attending religious services (43%), exercising regularly (32%), and attending movies and sports events (9%). These moderate social activity participants were intensively engaged in getting together and talking on the phone with others, which was similar to *Class 3*. *Class 3* had the highest activity levels in the sample (47.15%). Overall, these participants were involved in more leisure activities (getting together, talking on the phone with others, going to sports or movies, and eating out) than productive activities (working, volunteering, attending religious services, and exercising). This trend was similar to the low and moderate classes of social activity.

Bivariate tests (Table 2) indicate the differences in demographics, residential relocation, and health

Table 2. Descriptive Statistics of Independent Variables by Each Class of Social Activities

Independent variables	Social activity patterns		
	Class 1	Class 2	Class 3
Sociodemographics			
Age in years, M	77.0	76.2	74.6
Race (White), %	75.8	86.8	92.9
Gender (female), %	57.7	65.6	61.3
Education, M	1.73	1.94	2.36
Marital status (married), %	47.3	51.8	60.1
Income, M	13.9	14.7	17.7
Residential relocation, %	3.82	6.21	6.03
Health measures			
Medical comorbidity	2.27	2.45	2.11
Functional limitation	3.12	2.44	1.33
Functional dependency	2.74	1.59	0.54
Self-rated health	2.86	3.15	3.59

Note: All *p* values were lower than .001, which means that the associations or differences were statistically significant.

status by those who were participating to a greater or lesser extent in social activities, which were all statistically significant. Overall, those who were younger, White, highly educated, and married were more engaged in social activities. Higher income and better health status contributed to higher probabilities of participation in multiple social activities. Compared with the low-social activity class, moderate- and high-activity classes were more likely to be women and have recently moved.

Unconditional LGCM

The mean depression scores at each wave consistently and slightly increased over time (1.83 at Wave 1, 1.84 at Wave 2, and 1.89 at Wave 3). Although the group means exhibit relatively small changes, the results of a multivariate analysis of variance indicate that the changes were statistically significant over time ($F=161401$, $p<.001$). Because group means do not adequately measure individual trajectories, we used the LGCM to capture individual variations in trajectories (Bollen & Curran, 2006). Overall, model fit statistics of the unconditional LGCM of depression are acceptable. The chi-square value was significant, indicating an inappropriate model fit ($\chi^2=32.08$, $df=1$, $p<.001$); however, considering that the significance of chi-square is sensitive to sample size, especially in large samples, differences of trivial size may be found to be significant (Bollen & Curran). In contrast, other indexes suggested a good model fit (CFI=.998, IFI=.997, and AGFI=.998). Also,

RMSEA showed an adequate fit (0.034) at less than .05.

Two factors of intercept and slope explained approximately 52%, 50%, and 53% of the variances in depression at Waves 1, 2, and 3, respectively, indicating that a substantial amount of the variance is explained at each wave. Specifically, a covariance matrix of intercept and slope of depression indicated that individuals have differing initial status (0.519, $p<.01$) and change rates of depression (0.142, $p<.01$). Furthermore, the intercept of depression is negatively associated with its slope (-0.086 , $p<.01$), which means that older adults having higher levels of depression are less likely to change over time. The unstandardized factor loading of the slope on Wave 3 was 1.25 ($p<.001$), indicating a nonlinear growth curve across three waves. That is, unconditional LGCM indicates that the study sample was not homogenous in either the initial levels or nonlinear growth patterns of depression.

Conditional LGCM of Specific Social Activities

A conditional model was developed with single social activities as main predictors of depression trajectories while controlling for residential relocation, health status, insurance, and sociodemographics. Overall, the model fits were good (RMSEA=0.047, CFI=0.998, IFI=0.997, and AGFI=0.987) except for the chi-square model fit ($\chi^2=1414.06$, $df=24$, $p<.001$). All variables included in the LGCM conditional model of depression explained approximately 30% of the inter-individual variability in baseline depression levels and 21% of the variability in change rates of depression.

As shown in Table 3, significant relationships between various social activities and the two latent constructs of depression trajectories—intercept and slope—were identified. Specifically, those who volunteered reported lower levels of depression and had stable rates in the growth curve of depression. Similarly, regularly exercising at baseline was associated with lower initial status of depression and a more stable trajectory of depression over time. Older adults who talked with others exhibited lower initial depression, but their depression increased at a steeper rate. Unexpectedly, working was associated with higher depression at baseline. Eating out was associated with an increase in depression across the three waves. Attending sport events or movies was associated with a lower change rate of depression, although

Table 3. Latent Growth Curve Model Analysis of Specific Social Activities on Depression Trajectories

Variables	Initial status and longitudinal changes in depression	
	Intercept factor ($\hat{\gamma}$)	Slope factor ($\hat{\gamma}$)
Sociodemographics		
Age	-0.06*	0.05*
Race (White)	-0.01	0.01
Gender (female)	0.22***	-0.01
Education	-0.01	-0.01
Marital status (married)	-0.04**	-0.05***
Income	-0.06	
Specific social activities		
Working	0.02***	0.01
Volunteering	-0.01*	-0.01***
Going to religious services	-0.01	-0.01
Exercise	-0.01**	-0.02***
Getting together	0.01	-0.01
Talking on phone	-0.10***	0.06***
Going to sport events/movies	-0.01	-0.03***
Eating out	-0.01	0.02**
Self-perceived social activity		
Do enough ^a	-0.06***	0.02**
Want to do more ^a	0.04***	0.01
Residential relocation	0.06***	-0.08***
Access to health care		
Medicaid	0.03***	0.03***
Private health insurance	-0.02	-0.02*
Health measures		
Medical comorbidity	0.09***	0.01
Functional limitation	0.04*	0.03*
Functional dependency	0.04*	-0.01
Self-rated health	-0.17***	-0.01

^aNotes: “Do too much” is a reference group for “do enough” and “want to do more.”

* $p < .05$. ** $p < .01$. *** $p < .001$.

no impact was present at baseline. Older adults who self-perceived that they wanted more social activities reported a higher level of depression; those who stated that their current social activities were enough reported lower levels of depression at baseline and a slight decrease in the growth curve of depression.

Regarding the covariates, higher levels of medical comorbidity, higher levels of functional limitation and dependency, and lower levels of self-rated health predicted higher levels of baseline depression. Of these, functional limitations predicted higher change rates of depression. In addition, older adults who had recently relocated to new residences had higher levels of depression, but the changes were more stable over time. Those who were covered by Medicaid showed both higher levels of depression initially and a steeper increasing

rate of depression. In contrast, private insurance was related to reductions in the growth curve of depression. For sociodemographic factors, those who were older experienced lower levels of depression at baseline as well as a steeper change rate of depression. Women appeared more depressed at baseline, as were unmarried older adults; the latter exhibited a significant increase in depression trajectories over time.

Conditional LGCM of Social Activity Class

We then developed the final model using the patterns of social activities—as defined by our classes estimated from LCA—as predictors for the longitudinal trajectories of depression. We used the same control variables as in the previous model. Although the model’s chi-square fit was highly significant at the .001 level ($\chi^2 = 420.54$, $df = 17$, $p < .001$), other model fit indexes support an overall good model fit (RMSEA = 0.030, CFI = 0.999, IFI = 0.998, and AGFI = 0.994). The variables included in the LGCM of depression explained 28% of participants’ intercept and 17% of the slope of depression (Table 4). As main predictors, we used their social activity class and whether they perceived themselves as “active enough.”

As the primary finding, those who are socially more engaged in various activities are less likely to be depressed initially, and their longitudinal trend in depression decreased across the three waves. Other control variables regressed on the levels and slopes of depression are also presented in Table 4. Gender, education, and marital status significantly predicted changes in depression. Again, higher levels of medical comorbidity and functional dependency and lower levels of self-rated health predicted higher intercepts of depression.

Discussion

By using newer modeling techniques, this study clarifies how patterns of social activities are related to trajectories of depression over time. Furthermore, a strength of this study is that the analytic methods did not rely on scales arbitrarily summed across conceptually dissimilar activities, which has resulted in clarifying patterns and interrelations among social activities. By including predictor variables of both specific individual activities and patterns of activities, we found support for activity theory, in that specific activities are interrelated and are significantly associated with lower levels of depression.

Table 4. Latent Growth Curve Model Analysis of Patterns of Social Activities on Depression Trajectories

Variables	Initial status and longitudinal changes	
	Intercept factor ($\hat{\gamma}$)	Slope factor ($\hat{\gamma}$)
Sociodemographics		
Age	-0.05	0.04
Race (White)	-0.01	0.01
Gender (female)	0.18***	0.03**
Education	-0.02*	-0.01
Marital status (married)	-0.03	-0.06***
Income	-0.02	0.01
Social activity		
Social activity class	-0.02*	-0.04*
Self-perceived social activity		
Do enough ^a	-0.05***	-0.01*
Want to do more ^a	0.04***	0.00
Residential relocation	0.05***	-0.08***
Access to health care		
Medicaid	0.03***	0.03***
Private health insurance	-0.03*	-0.02
Health measures		
Medical comorbidity	0.07***	-0.01
Functional limitation	0.04	0.03
Functional dependency	0.07***	-0.03
Self-rated health	-0.16***	-0.01

^aNotes: “Do too much” is a reference group for “do enough” and “want to do more.”

* $p < .05$. ** $p < .01$. *** $p < .001$.

Our use of LCA identified theoretical classes of activities that actually occur within the data and show significant relationships with depression over time. Thus, these classes can serve as meaningful categorizations for activity participation in future research and practice. Especially because practitioners and researchers alike are constrained when conducting evaluations by needs for data reduction and competing demands, these categories are beneficial.

Thus, although older adults engage in social activities at different rates, we found distinct classes of participation, with those in Class 3 being significantly more likely to participate in religious services, exercise, sports, movies, and eating out (see Figure 1). Across all three classes, productive activities such as working, volunteering, and exercising were generally lower than were informal leisure activities such as talking on the phone, getting together with others, and eating out. In addition, the classes were most distinct for the probabilities of engaging in religious services and eating out, indicating the need for further study. The final LGCM model also indicated that the classes differed sig-

nificantly in their associations with depression over time, with Class 3 showing the most protective effects of activity participation against depression. Of note, low-activity class participants did have significantly poorer health status, so these medical and functional comorbidities, which are themselves strongly associated with depression, may further create barriers to engaging in activities.

Although the patterns of activities are highly informative, it is also important to highlight that several individual activities were shown to have protective effects. Talking on the phone with family, friends, or others was the most consistent activity, which supports the notion that intimacy is a paramount need for well-being (Maier & Klumb, 2005). Our results also are consistent with research that identifies the positive effects of volunteering on the well-being of older adults (Morrow-Howell, Hinterlong, Rozario, & Tang, 2003). Exercise, which 43% of our sample reported, acted as a protective factor, thus replicating previous studies (Blumenthal & Gullette, 2005). In contrast to our expectations, work was associated with higher depression. The reasons for working were not measured in this study, but those who work to meet their basic needs may experience more stress than those deriving psychological benefits from work.

Furthermore, participants who perceived they had “enough” activity had lower depression levels at baseline and decreasing change rates in depression over time. Thus, assessing self-perceptions of what is enough, instead of using a threshold of how many activities, may be important in tailoring activity-based interventions to individual preferences for the amount or type of activity. Questions measuring person-level qualities, such as personality and lifestyle, may also help to account for the variations in levels of participation (Ritche et al., 2001).

Certain older adults in this study appear at higher risk for depression. Female, low-educated, unmarried, recently relocated, and Medicaid recipient participants had higher levels of baseline depression. Although a baseline association existed between residential relocation and depression, this relationship was not significant when considering the time-varying level of depression, indicating a temporary effect on depression. Moving closer to relatives or environments with more support may actually increase activity over time, leading to lower depression.

One exception to the activity findings is that although women participated in more activities,

their depression was higher than men, suggesting the need for further inquiry. Some investigators found that although women more frequently participate in leisure activities than do men, women tend to be more physically inactive, and they suggest that women's social connections may be better predictors of well-being than activity participation (Lampinen, Heikkinen, Kauppinen, & Heikkinen, 2006). Kendler, Gardner, and Prescott (2005) are developing a broad-spectrum model for the etiology of major depression in women. They have identified several gender-related risks, including childhood sexual abuse and lifetime trauma, and these risks may partially account for the higher initial rates and chronic courses of depression for women in this study.

This research study has several limitations. First, the sample was composed predominately of White women who had a high school or greater education. Thus, ethnically or racially diverse groups are not adequately represented. A bias may exist toward higher levels of activity participation when compared with older adults with lower socioeconomic means (Kelly, 1995). In addition, we did not include those who died or dropped out of the study, which may underestimate the extent of depression due to selection bias.

Second, concerns about measurement occurred with both social activities and depression. Like Betts Adams and Leibbrandt (2007), we found the literature replete with different ways of conceptualizing social activities, and the LSOA questions did not fit neatly into any theoretical domains. Furthermore, we are unclear whether one question accurately captured the relationship between religion and depression. In a recent meta-analysis of 147 studies, Smith, McCollough, and Poll (2003) found evidence that religious participation protects against depression, despite our lack of findings in this area. Additionally, a one-item question measured depression. This is clearly not ideal, although some relationships were detected.

Third, the analysis would have been more informative if activities had been measured across time, instead of just at baseline. Time-varying measures capturing longitudinal changes in each activity should be developed. Change rates of engagement as people age could then be considered. Likewise, a more meaningful picture would probably emerge when other control variables, such as health status, economic, and environmental factors, were measured longitudinally.

As a fourth limitation, given the large sample size, it is also likely that some findings may show statistical significance at the $p < .05$ level when there are no clinically important relationships. That is, the large sample size of this study may magnify specification errors by leading to rejection of the null hypothesis. Especially, most activities showed trivial effect sizes (e.g., less than .08) except talking on phone with others (.15; Cohen, 1988). This consideration must be balanced with the argument that even small or trivial effect sizes may have powerful practical significance, especially in depression outcomes (Rutledge & Loh, 2004).

Future research needs to uncover the elemental pathways for conserving and bolstering the well-being of older adults—including depression outcomes. Fundamental pathways underlying activity participation may include receiving or exchanging social support, experiencing a sense of belonging, having familiarity with an activity, developing a sense of accomplishment, and deriving a sense of personal meaning. Thus, the specific activities that make patterns of activity participation distinct, such as religious services and eating out, may be a starting point to understand why certain classes have differential impacts on depression.

From this study, we conclude that a pattern of higher participation across different types of activities and involvement in certain individual activities offers some protection against depression for older adults. Correspondingly, these results provide a rationale for using behavior activation treatments (Cuijpers et al., 2006). This research lends support to practitioners committing time and resources to facilitating older adults' participation in a broad range of personally meaningful activities, thus promoting well-being and likely protecting them against depression.

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