Urban Neighborhood Context and Change in Depressive Symptoms in Late Life

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CCPR-026-08

December 2008
Latest Revised: December 2008

California Center for Population Research
On-Line Working Paper Series

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(Revision 1)

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RUNNING HEAD: Neighborhood Depressive Symptoms

Word Count Text: 2,540

Word Count References: 478

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ABSTRACT

Objectives. This study examines associations between urban neighborhood sociodemographic characteristics and change over time in late life depressive symptoms.

Methods. Survey data are from three waves (1993, 1995, and 1998) of the Study of Assets and Health Dynamics Among the Oldest Old (AHEAD), a U.S. national probability sample of noninstitutionalized persons aged 70 or older in 1993. Neighborhoods are 1990 U.S. Census tracts. Hierarchical linear regression is used to estimate multilevel models.

Results. The average change over time in depressive symptoms varies significantly across urban neighborhoods. Change in depressive symptoms is significantly associated with neighborhood-level socioeconomic disadvantage and ethnic composition in unadjusted models, but not in models that control for individual-level characteristics.

Discussion. Findings indicate that apparent neighborhood-level effects on change in depressive symptoms over time among urban-dwelling older adults reflect, for the most part, differences in characteristics of the neighborhood residents.

In 2007, Aneshensel and colleagues (Aneshensel et al., 2007) reported statistically significant variation in depressive symptoms across neighborhoods for a national sample of urban older adults. Although these differences were associated with living in a socioeconomically disadvantaged neighborhood, they proved to be entirely compositional in nature—due to the individual disadvantage of the persons comprising the neighborhoods. These findings are consistent with some other studies of older adults (e.g., Hybels et al., 2006; La Gory & Fitzpatrick, 1992), but inconsistent with still others that find neighborhood effects that persist net of individual characteristics (e.g., Kubzansky et al., 2005; Ostir et al., 2003). At least some of these discrepancies are likely methodological because extant studies differ widely in samples, methods, measures, and analytic techniques.

There are good reasons to expect that as adults age, they become increasingly vulnerable to the "press" of their neighborhood environments (Lawton 1982). Glass & Balfour (2003) describe four mechanisms of greater vulnerability: longer duration of exposure; increased biological, psychological and cognitive vulnerability; changing patterns of spatial use; and reliance on community sources of social integration. Cagney, Browning & Wen (2005) add that neighborhood is especially consequential to older persons who age in place.

Given these compelling reasons for expecting neighborhood effects and the inconsistent findings of previous studies, an additional examination of this topic is warranted. An overlooked factor is the cross-sectional design of these studies, which limits inferences about any causal impact of neighborhood. In this paper, we extend the Aneshensel et al. (2007) analysis, using the same sample, methodology and analytic techniques, to ask whether neighborhood context significantly influences *change* over time in late life depressive symptoms. This longitudinal design is a major strength because the unmeasured influences of unspecified etiologic factors

that occurred prior to baseline are partially controlled statistically via the inclusion of baseline values of depressive symptoms, enhancing internal validity. This feature is particularly important for older persons for whom there is a lifetime accumulation at baseline of individual-level etiologic factors that may obscure the contemporaneous impact of neighborhood-level factors. Thus, the present analysis is a more sensitive test of the impact of neighborhood context than previous cross-sectional analyses.

METHODS

Sample Derivation

Survey data are from the Study of Assets and Health Dynamics Among the Oldest Old (AHEAD), a U.S. national probability sample of noninstitutionalized persons born in 1923 or earlier, that is, people aged 70 or older in 1993 (Soldo, Hurd, Rodgers, & Wallace, 1997). The overall response rate of 80 percent yielded an interviewed baseline sample of 8,222 individuals from 6,047 households. For these analyses, the following were dropped: 775 age-ineligible spouses, 791 proxy interviews, 532 persons with missing or invalid data; 1,009 persons from multiple person households (to eliminate the household level of clustering), and 1,673 rural residents (because neighborhood theories typically assume an urban setting). The final analytic baseline sample size is 3,442 persons. Normalized sample weights adjust for differential probabilities of selection. Power calculations adjust for the design effect, which reduces the effective sample size to 2,790. There is excellent power (99%) to detect partial correlations as small as .10 at alpha of .05 (Hsieh et al., 2003).

At Time 2 (T2, 1995), 302 participants had died, 218 were lost to follow-up, and the following were dropped: 91 new proxy interviews, 125 who moved to a nursing home or assisted

living facility with unknown Census tract information, and 74 who changed Census tracts. The final T2 analytic sample size is 2,632. At Time 3 (T3, 1998), losses were 286 deaths, 133 lost to follow-up, 96 new proxy interviews, 95 nursing home or assisted living facility moves, and 151 changed Census tracts. The final analytic T3 sample size is 1,871.

A probit regression model indicated that non-responders at T2 were significantly ($p < 0.05$) more likely than responders to be older and in poorer health at baseline; non-responders at T3 additionally were significantly ($p < 0.05$) more likely to be male or Hispanic. Therefore, to adjust the weights for attrition, the inverse of the normalized predicted probability of participation was multiplied by the normalized sample weight. However, neither mortality nor other attrition varied significantly ($p > 0.05$) across neighborhoods when individual-level characteristics were taken into consideration.

Measures

The dependent variable is depressive symptoms measured with eight items (e.g., felt depressed, felt that everything I did was an effort) from the longer Center for Epidemiologic Studies-Depression Scale (CES-D; Radloff, 1977), with response codes of yes (1) or no (0) for experiencing the symptom during "much of the time in the past week" (Soldo et al., 1997). Positively worded items were reverse coded; items were summed. Reliability ($\alpha = .77$) and construct validity for the 8-item version of the CES-D have been documented (Steffick, 2000; Turvey, Wallace & Herzog, 1999).

Individual-level independent variables fall into two categories: 1) Demographic characteristics (educational attainment, household income [logged], household wealth [logged], gender, age, ethnicity, marital status, and religion; and 2) Health characteristics (assistance with

activities of daily living, heart problems, stroke, a count of other major medical conditions, and cognitive function). See Aneshensel et al. (2007) for a detailed description of variable operationalization.

Contextual-level constructs are operationalized with 1990 U.S. Census data for 1,217 tracts at baseline; the number of participants per tract ranges from 1 to 31 (see Aneshensel et al. 2007 for rationale behind selection of neighborhood-level variables). Neighborhood-level SES is assessed with two measures. First, socioeconomic disadvantage is operationalized with a principal component comprised of the proportion of: residents aged 25 or older without a high school degree; households receiving public assistance income; residents living below the poverty level; and residents aged 16 or older who are unemployed. Second, affluence is assessed as the proportion of households with incomes of $50,000 or more. Two indicators of racial/ethnic composition are used: proportion of residents who are African American; and proportion of residents who are Hispanic. Residential stability is the proportion of people age 5 or older who lived in the same house for the past five years. Finally, the proportion of older persons in the Census tract is the proportion of residents who are over the age of 65 years.

Analysis

Descriptive statistics are calculated with the Stata software package (StataCorporation, 2001) and hierarchical linear models are estimated with the HLM software, version 6.01 (Raudenbush, Bryk & Cheong, 2000) using full maximum likelihood estimation and robust standard errors. Select theory-based cross-level interactions were examined. Change in depressive symptoms is computed as T2 minus T1 and T3 minus T1. Previous values of depressive symptoms are controlled, so that the coefficients for independent variables are effects

on change in depressive symptoms between two time points. Statistical significance is at the 0.05 level.

In initial analyses, 3-level growth curve trajectories (i.e., time, person, neighborhood) were estimated, which resulted in extremely complex model specifications because of the non-linear time component across the three waves of data (see below). Findings were entirely consistent with analyzing change over time. We present the latter because the results can be interpreted more clearly than those of the complex growth curve trajectories.

(TABLE 1 ABOUT HERE)

RESULTS

Baseline Sample Characteristics

Baseline characteristics for the T1 sample and the T2 and T3 sub-samples are shown in Table 1 and have been discussed by Aneshensel et al. 2007. The follow-up samples are composed of slightly younger persons, with somewhat higher educational attainment and income, who are in somewhat better health, with lower levels of depressive symptoms. The age and health changes largely reflect losses due to mortality.

The mean change in depressive symptoms between T1 and T2 (unweighted) is -0.13 (SD = 1.83), and between T1 and T3 is 0.45 (SD = 1.94), indicating a slight average decrease over the shorter time interval and a sizable average increase over the longer time interval.

Census Characteristics

There is considerable variation in 1990 Census tract characteristics as described previously (Aneshensel et al. 2007). In brief, neighborhoods range from abject poverty to extreme affluence, and from ethnic minority-dominant to nearly exclusively non-Hispanic white.

Multilevel Analysis

We first estimated intercept-only or null models. There was statistically significant variation in change in depressive symptoms across Census tracts between T1 and T2 ($\tau = 0.212$, $p < .001$, T1 symptoms controlled) and between T1 and T3 ($\tau = 0.310$, $p < .001$, T1 symptoms controlled). The intra-class correlation, which is the ratio of between tract variation to total variation, however, is moderate (T1 to T2, $\rho = 0.107$; T1 to T3, $\rho = 0.117$), indicating that most of the variation in symptom change in the null model is at the individual level. This result is to be expected given the influence of genetic and other biological factors as well as the unique lifecourse experiences of each individual.

(TABLE 2 ABOUT HERE)

Next, we assessed whether there is any overall association between change in depressive symptoms and each of the tract-level variables. These multilevel regression coefficients are shown in the unadjusted models in Table 2. Between T1 and T2, symptoms increase significantly in tracts that are socioeconomically disadvantaged. Between T1 and T3, the effect of socioeconomic disadvantage is still significant, as is the effect of living in a tract with a high proportion of African American residents. Other tract-level variables are not significantly associated with change in depressive symptoms at either time.

We then regressed change in depressive symptoms on baseline individual-level demographic and health characteristics. The pattern of the individual-level results have been reported previously (Fonda & Herzog 2001). In general, an increase in symptoms over time is positively associated with age, being female, being African American (compared to non-Hispanic white), low socioeconomic status, ADL assistance, and poor health.

As shown in the adjusted models in Table 2, none of the significant associations of neighborhood characteristics with change in depressive symptoms observed in the unadjusted models are sustained once T1 individual-level demographic and health characteristics are controlled. Moreover, the addition of the neighborhood-level variables has essentially no impact on the amount of variation in change in depressive symptoms explained.

In a supplemental analysis (not shown), we removed the health variables from the adjusted models to investigate whether they were mediating the effects of either neighborhood disadvantage or proportion African American: No significant mediating effects were detected.

Cross-level interactions that operationalize three hypotheses also were tested: the ideas that the depressive impact of personal and neighborhood disadvantage is synergistic, that ethnic enclaves are protective, and that neighborhood disadvantage is most distressing among older persons in poor health. The fit of a composite model containing all interaction terms, estimated to reduce the risk of a Type I error due to multiple significance tests, was compared to the fit of a nested model without these terms. For T1 to T2, there was significant improvement in fit (χ^2 = 25.031, d.f. = 13; $p \leq .05$). Only one interaction term was statistically significant ($p \leq .05$): living in socioeconomically disadvantaged neighborhoods is associated with increasing depressive symptoms among the poorest residents, i.e., compound disadvantage. Interaction terms for proportion Hispanic by neighborhood disadvantage and for proportion Hispanic by

being Hispanic (versus non-Hispanic white) were statistically significant when considered individually, suggesting a potentially protective effect for Hispanics of living in high density Hispanic neighborhoods that also happen to be disadvantaged, a protective effect not observed for non-Hispanic whites. However, this result should be viewed as speculative because the terms were not significant in the composite model. For Time 1 to Time 3, the overall test of the set of interactions was not significant ($\chi^2 = 15.853$, d.f. = 13; $p \geq .25$)

DISCUSSION

This study addresses gaps in the empirical literature on aging and neighborhood context by using multilevel modeling techniques to study changes in depressed mood among older persons over time. Consistent with cross-sectional analyses of these data (Aneshensel et al. 2007), we find significant neighborhood variation in change in depressive symptoms over time. We also detect significant associations between change in depressive symptoms and both neighborhood disadvantage and neighborhood ethnic minority composition. However, also consistent with the earlier cross-sectional analyses, we find that most of the variation in change in depressive symptoms is explained by individual-level factors, and there are no statistically significant associations with neighborhood characteristics once individual-level characteristics are controlled. We therefore conclude that apparent neighborhood effects of neighborhood SES and ethnic composition on depressive symptoms *over time* are compositional in nature.

With extended aging, individual-level physical health and functional status become perhaps the most proximal catalysts for emotional well-being. That is, neighborhood conditions may be so distal to the individual's own health-related circumstances that they are subsumed by the myriad of life challenges older persons face. We submit that environmental "press" may

reach a type of plateau in late life at which point it ceases to matter to depressive symptomatology.

Alternately, neighborhood socioeconomic disadvantage may matter to emotional well-being, but only for some segments of the population, a possibility that may account for the discrepant findings in the literature. Although neighborhood disadvantage is not associated with depressive symptoms net of individual-level characteristics overall, its cross-level interaction with personal disadvantage indicates that it matters to one segment of the population, those whose lives are most weighed down by poverty. Had our sample been comprised largely of those living in poverty, we might well have found an overall effect of neighborhood disadvantage net of individual-level characteristics. That is, neighborhood-level mental health effects may be very sensitive to the composition of the sample *if* these effects are confined to select segments of society. In this regard, the nationally representative nature of the AHEAD sample provides a robust test of the overall effect of neighborhood disadvantage, which appears to be compositional, but with the caveat that this may be true for most but not all elderly persons.

General limitations of this study and associated qualifications are given by Aneshensel et al. (2007). Here we add that our analysis is limited to persons who may have successfully adapted to their neighborhoods because they did not change Census tracts over time, and we do not have information about how neighborhoods may have changed over the study period. Also, depressive symptoms were measured as snapshots at specific points in time and symptoms may have differed at other times. In addition, it is possible that the three significant unadjusted associations detected in Table 2 (out of 12 possible associations) represent Type I errors, but this possibility is of little consequence given that these associations are nonsignificant once individual-level characteristics are taken into consideration.

Notwithstanding these limitations, AHEAD is considered a "gold standard" dataset for studies of older adults, and the diversity of this nationally representative sample yields strong external validity, enhancing generalizability. The urban subsample utilized here is especially germane to the longitudinal study of depressive symptoms given estimates that 73% of older men and 77% of older women lived in metropolitan areas in 1990 (Fried & Barron, 2005). Thus, on a national level, the impact of urban neighborhood SES and ethnic composition on late life depressive symptoms over time is diminished once characteristics of individuals are adequately taken into consideration. We conclude that for the older population as a whole, changes in depressive symptoms are more a function of underlying individual-level demographic and aging processes than of the "press"—either positive or negative—of neighborhood context.

ACKNOWLDEGEMENTS

This research was supported by a grant from the National Institute on Aging (R01 AG022537, Carol S. Aneshensel, Ph.D., Principal Investigator).

R.G. Wight planned the study, supervised the data analysis, and wrote the paper. J.R. Cummings performed all statistical analysis and provided critical review of the manuscript. A.S. Karlamangla assisted with the data analysis plan and provided critical review. C.S. Aneshensel oversaw planning of the study, data analysis, and writing of the manuscript.

The authors wish to thank Teresa E. Seeman, Dana Miller-Martinez, Joshua Chodosh and three anonymous reviewers for their helpful suggestions regarding this manuscript.

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TABLE 1. Baseline characteristics of U.S. urban adults aged 70+ in 1993 (unweighted).

Demographic and Health Characteristics	T1 sample (N = 3,442) % or Mean (SD)	T2 sub-sample (N = 2,632) % or Mean (SD)	T3 sub-sample (N = 1,871) % or Mean (SD)
Gender			
Female	63.97	63.64	63.76
Male	36.03	36.36	36.24
Age (years)	77.20 (5.40)	76.57 (5.40)	75.88 (4.90)
Ethnicity			
Non-Hispanic White	75.25	76.63	76.43
African American	17.14	16.11	15.98
Hispanic	6.30	6.00	6.25
Other	1.31	1.25	1.34
Marital status			
Married	39.16	40.92	42.44
Widowed	48.78	47.07	45.22
Separated/Divorced	7.67	7.75	8.07
Never married	4.39	4.26	4.28
Education (years)	11.15 (3.61)	11.37 (3.54)	11.54 (3.47)
Income (thousands $)	25.57 (63.50)	26.46 (41.28)	27.81 (45.01)
Wealth (thousands $)	169.64 (392.19)	176.93 (312.62)	187.84 (329.96)

Religion			
Protestant	57.93	58.13	58.10
Catholic	30.45	29.64	29.82
Jewish	5.81	6.16	6.15
No religion	4.21	4.56	4.49
Other religion	1.60	1.52	1.44
ADL assistance (0 – 6)	0.54 (1.13)	0.43 (0.97)	0.33 (0.83)
Number of medical conditions (0-5)	1.08 (0.92)	1.04 (0.90)	1.01 (0.88)
Heart problems (yes)	28.24	26.33	25.12
Stroke (yes)	6.71	5.36	4.54
Cognition (1 – 35)	19.54 (5.83)	20.33 (5.43)	21.00 (5.23)
Depressive symptoms (0 – 8)	1.70 (2.03)	1.56 (1.95)	1.45 (1.89)

Notes: T1 = 1993, T2 = 1995, T3 = 1998.

TABLE 2. Weighted multilevel regressions of depressive symptoms over time among U.S. urban adults aged 70+ in 1993

	T1 to T2[a]		T1 to T3[b]	
Tract-Level Variables	Unadjusted[c] B (SE)	Adjusted[d] B (SE)	Unadjusted[c] B (SE)	Adjusted[d] B (SE)
Socioeconomic Disadvantage[e]	0.11 (0.04)*	-0.02 (0.05)	0.16 (0.05)**	0.01 (0.07)
Affluent[f]	-0.35 (0.20)	0.11 (0.23)	-0.48 (0.30)	0.01 (0.35)
African American[f]	0.25 (0.14)	0.04 (0.21)	0.38 (0.15)*	-0.11 (0.29)
Hispanic[f]	0.10 (0.19)	-0.43 (0.25)	0.39 (0.28)	-0.03 (0.33)
Residentially Stable[f]	0.35 (0.28)	0.30 (0.28)	0.32 (0.39)	0.04 (0.39)
Aged 65 and Older[f]	0.64 (0.58)	0.64 (0.56)	0.23 (0.50)	0.03 (0.50)

Notes: Depressive symptoms regressed separately on each Level 2 variable; T1 = 1993, T2 = 1995, T3 = 1998.

[a] N = 1,042 Census tracts, 2,632 individuals.

[b] N = 865 Census tracts, 1,870 individuals.

[c] Controlling for T1 depressive symptoms.

[d] Controlling for T1 depressive symptoms + demographic and health characteristics.

[e] Factor score.

[f] Proportion.

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.