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County level socioeconomic position, work organization and depression disorder: A repeated measures cross-classified multilevel analysis of low-income nursing home workers

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Abstract

This study simultaneously tests the effect of county, organizational, workplace, and individual level variables on depressive disorders among low-income nursing assistants employed in US nursing homes. A total of 482 observations are used from two waves of survey data collection, with an average two-year interval between initial and follow-up surveys. The overall response rate was 62 percent. The hierarchically structured data was analyzed using multilevel modeling to account for cross-classifications across levels of data. Nursing assistants working in nursing homes covered by a single union in three states were asked about aspects of their working conditions, job stress, physical and mental health status, individual and family health-care needs, household economics and household strain.

Participants: The 241 nursing assistants who participated in this study were employed in 34 nursing homes and lived in 49 counties of West Virginia, Ohio and Kentucky.

Main results: The study finds that emotional strain, related to providing direct care to elderly and disabled clients, is associated with depressive disorder, as is nursing home ownership type (for-profit versus not-for-profit). However, when controlling for county level socioeconomic variables (Gini index and proportion of African Americans living in the county), neither workplace nor organizational level variables were found to be statistically significant associated with depressive disorder.

Conclusions: This study supports previous findings that emotional demand in health-care environments is an important correlate of mental health. It also adds empirical evidence to support a link between financial strain and depression in US women. While this study does not find that lack of a seniority wage benefits—a factor that can conceivably exacerbate financial strain over time—is associated with depressive disorder among low-income health-care workers, it does find county level measures of poverty to be statistically significant predictors of depressive disorder. Longitudinal county level measures of low-income as predictors of depression may even offer a methodological advantage in that they are presumably more stable indicators of cumulative exposure of low income than are more transient workplace indicators.

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Incorporating measures of cumulative exposure to low income into empirical studies would be particularly timely given the global changes that are currently restructuring the labor force and influencing work organization and labor processes—most notably the growth in low income jobs and the deskilling of labor. Though this study provides evidence that workplace and organizational level variables are associated with depressive disorder among low-wage nursing assistants in US nursing homes, the fact that these relationships do not hold once county level measures of poverty are controlled for, suggests that more distal upstream determinants of workplace mental health problems, such economic inequality, may be at play in determining the mental health of low wage workers.
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Introduction

Over the past two decades, the number of workers holding low-wage jobs as a proportion of the total US workforce has risen. Low-wage work includes jobs that do not enable a full-time worker to support a family of four above the official poverty line (amounting to 17,050 US Dollars; Federal Register, 2000)—or jobs for which workers are paid no more than $8.20 per hour in 2000 dollars (US Department of Health and Human Services and Office of the Secretary, 2000). While not all low-wage workers are primary wage earners, it has been found that one in three low-wage workers in low-income families earn all or most of the family income (Lerman and Skidmore 1999). The low-wage workforce is characterized as tending to be non-unionized (94 percent), disproportionately female (59 percent), white (63 percent), and non-college-educated (62 percent), though recent labor market trends such as educational upgrading and the long-term decline of wages among non-college graduates means that other subpopulations are also increasingly more likely to hold low-wage jobs (Bernstein and Hartmann 1999).

Working conditions are an important determinant of employee physical and psychological well-being. Research has found that low-wage workers, who often do rotating shift work and whose work conditions are often dangerous, hazardous, and even humiliating, are at greater risk for injuries and for poor physical and mental health outcomes (Personick 1990; Myers et al. 2002; Hamermesh, 1999; Brown and Moran 1997; Dooley et al., 2000). In the United States, 70 percent of all low-wage workers are employed in just 10 industries (LEHD, 2001), with low-wage work increasingly concentrated in retail trade (38 percent) and services (39 percent) (Andersson et al., 2003). Today, one of the fastest growing and perhaps most hazardous industries for low-wage workers in the US is the health services industry, in which nearly 60 percent of workers hold low-wage jobs (Kim, 2000). Within the health services industry, the homecare and long-term care divisions are experiencing the most rapid growth in demand for low-wage workers—particularly for personal aides and nurse assistants. In nursing homes, nurse assistants make up the bulk of direct-care support staff and this workforce is expected to increase more than 25 percent by 2006 (Stone and Wiener, 2001). Recently, the US Department of Labor acknowledged not only that this segment of the labor force is generally low-paid, but that frequent violations of federal wage and hour rules occur in nursing home and long-term care work settings (US Department of Labor, 1997). Nursing assistants are thus an appropriate focus for social science research that explores the health effects of low-wage work.

An increased risk of injury among nurse assistants (Personick, 1990) and the physical hazards of nursing home work (Myers et al., 2002) are well established, yet little research has been done to explore the mental health hazards for direct-care nursing home workers (Wunderlich et al., 1996). Nurse assistants employed in nursing homes and other long-term care settings provide direct care for elderly and disabled persons who tend to be very old, cognitively impaired, and functionally dependent in several activities of daily living, such as bathing, feeding, dressing, toileting, and even basic mobility. Many nursing home residents also lack social support networks and thus may further depend on direct-care givers for their social interaction needs. Providing direct care to such a dependent population and establishing emotional attachments to persons who may be either quite ill or near death creates an emotionally demanding work environment for nursing assistants, an environment that is likely to have significant implications

for the mental health of these workers (Foner, 1995).

Psychiatric symptoms have been found to figure prominently among the hazards of work organization (Kohn and Schooler, 1973; Karasek, 1979). Mental disorders in the workplace, particularly depression, have important consequences for quality of life, worker productivity, and the utilization and costs of health care (Keita and Sauter, 1992; Sauter et al., 1990). Several studies have found depression to be related to work organization (Karasek, 1979; Mausner-Dorsch and Eaton, 2000; Muntaner et al., 1998; Stansfeld et al., 1998; Grosch and Murphy, 1998). There is also longitudinal evidence linking job demands, lack of autonomy, and monotony at work to affective disorders (Stansfeld et al., 1999; Eaton et al., 2001). More recently, some multilevel studies have found workplace and organizational level characteristics to be related to poor mental health (Söderfeldt et al., 1997; De Jonge et al., 1999; Yperen and Snijders, 2005; Elovainio et al., 2000), while others have begun to provide evidence supporting the link between county level variables and poor mental health outcomes (Jia et al. 2004). For studies exploring the health effects of low-wage work, county level variables are also of theoretical significance because, as Bureau of Labor Statistics data indicate, strong geographic patterns exist in the distribution of low-wage employment, suggesting that important structural economic and social forces are at play in determining the industry-mix of low-wage counties. Furthermore, the organization of health services, including mental health, home care, and long-term care services, is largely organized at the county level and a number of relevant policy interventions such as labor force retraining and living wage ordinances are coordinated at the county level. To date, however, no studies have simultaneously considered the effect of both workplace and county level variables on the mental health outcomes of low-wage workers.

This study uses multilevel analysis to simultaneously test the effect of county, organizational, workplace, and individual level variables on depressive disorders among nursing assistants employed in US nursing homes. More specifically, we test the hypotheses that the individual level variable of age, workplace emotional demands, organizational level variables such as type of nursing home ownership type and seniority wage benefit, and county level indicators of poverty are all associated with depressive disorder among nurse assistants.

Methods

Sample and setting

The data used in this study come from two waves of data collection across three US states—a cross-sectional survey done in 2000 and a follow-up survey done in 2002. The cross-sectional data were collected between winter 1999 and spring 2001 from 868 nursing assistants working in 55 nursing homes covered by a single union in three states: West Virginia, Ohio, and Kentucky. Nursing home site-specific lists were obtained from local bargaining unit representatives and all nursing assistants currently working at each nursing home were invited to participate ($n = 1391$). The overall response rate was 62 percent. Questions were asked that related to aspects of the working conditions of the nursing assistants, mental health status, and socio-demographic indicators. A follow-up survey was conducted in the summer of 2002 and included 252 nursing assistants who were randomly selected from the 868 previously surveyed nursing assistants. The shorter follow-up questionnaire included questions relating to mental health status and individual and family health care needs. After data processing, 241 nursing assistants were matched and their information from two waves of surveys was used in data analysis. In sum, a total of 482 observations were collected in two waves of surveys with an average two-year interval (2000–2002) from 241 nursing assistants working in 34 nursing homes and living in 49 counties of three states: West Virginia, Ohio and Kentucky. Our data analysis used 347 observations due to the missing values in some explanatory variables.

Variables

Depression was measured using a 35-item version of the RCES-D (Eaton et al., 2003). Two levels of depression were scored: depressive symptoms and depressive disorder. Depressive symptoms were classified dichotomously using the original 20 items of the original CES-D scale with a standard cutoff score of 16 (Radloff, 1977). As the original version of the CES-D failed to capture important aspects of the domain of depression (psychomotor retardation/agitation, suicidal ideation) and represented

depression using symptoms that are not aspects of the current DSM criteria, the 35-item RCES-D was used to dichotomously define a depressive disorder. This involved classifying symptoms into subscales, and matching the subscale scores to the criterion for depressive disorder in the DSM-IV (Muntaner and Barnett, 2000) (details available upon request). Two subscales of the Symptom Checklist 90 (Godin and Kittel, 2004) were used to generate anxiety and somatization scores. These asked for level of distress in the past week on a 5-point Likert scale (not at all to extreme) for a variety of somatic perceptions (headaches, faintness or dizziness, soreness of your muscles, a lump in your throat, etc) and anxiety symptoms (trembling, feeling fearful, heart pounding or racing, etc). Items were summed and empirically dichotomized so that the lower two-thirds of the scores for each subscale represented the reference group. The proportion of respondents presenting scores above the traditional 16+ cut-off score indicating risk of depression were lower for the revised scale than for the original CES-D scale (54.2 vs. 56.8 percent).

Instead of using a dichotomized depression classification, a continuous depression score was used in this study. The score of depression symptoms was summed from the original 20 items of the original CES-D scale. The score of depression disorder was summed from the revised 35 items of the RCES-D scale. To have a straightforward interpretation of the longitudinal change of depression symptoms, this study re-scaled the summed depression scores to a scale between 0 and 100. The re-scaled depression symptoms and depression disorder were then used in data analysis. By re-scaling, the changes of depression can be explained as the percentage change of depression between survey times in one subject, or between subjects in one nursing home/county, or between nursing homes/counties.

Emotional demands were assessed with a 6-item scale (Söderfeldt et al., 1997; Ohlson et al., 2001) with items designed to capture the workplace emotional demands experienced as a result of providing direct care to clients (i.e., not enough time to provide emotional support to clients). We also assessed demographic, psychosocial, behavioral, health, and labor market related potential confounders. These included age of respondent (continuous), gender of respondent (male, female), race/ethnicity (white, black, Hispanic, Native American, and other), health insurance (availability as well as type), length of employment at that nursing home measured in months. Social support was measured with marital status (married, cohabitating, separated, divorced, and single/never married) and weekly hours of housework. A question assessed current general physical health: "Thinking of your physical health would you say that, in general, it is excellent, very good, good, fair or poor". Measures of social stratification included education (in years as well as highest degree held using the question: "What is the highest grade in school or year of college that you completed?") and income (determined with two questions on total annual personal and household income).

Two sources of data, one secondary and one primary source, were integrated into an organizational characteristics database and linked to individual nursing assistant records using nursing home as the linkage variable. The Nursing Home Compare Database based on the Center for Medicare and Medicaid Services (CMS) On-Line Survey Certification of Automated Records (OSCAR) and Minimum Data Set (Centers for Medicare and Medicaid Services, 2004) provided information on type of ownership (for-profit vs. not-for-profit). We also administered the organizational survey, using an adaptation of a questionnaire used in a previous study of human services organizations (Söderfeldt et al., 1997), to key informants in each nursing home during the data collection period. Questions asked about presence in the nursing home of a bureaucratic management style (i.e., "by the book"), labor-relation violations, perceptions of labor management conflict, and seniority-based wage increases. These three indicators were combined into a single additive scale "managerial pressure" indicator. All organizational level variables were operationalized as categories for the multivariate analyses.

County variables

A county is a division of local government in the United States. The major functions of county governments include law enforcement, the recording of deeds and other documents, and the provision of and maintenance of public works such as roads and parks (Duncombe, 1966). Counties are the primary legal divisions of most states, whose powers and functions vary from state to state. Legal changes to county boundaries or names are typically infrequent. (US Census Bureau, 2005). There are

currently 3066 counties in the United States, which vary in size and population. The geographical area covered by a county ranges from 67 km^2 (Arlington County, Va.) to 227,559 km^2 (North Slope Borough, Alaska). The population of counties varies from Loving County, Texas, with 140 residents to Los Angeles County, California, which is home to 9.2 million people.'' (National Association of Counties, 2005).

Two county level variables were used in this study: Gini index and percentage of African Americans living in a county. Gini indices were available for all the 49 counties where surveyed nursing assistants lived. Gini indices were calculated based on the 1990 US Census (Nielsen, 2002). Percentages of African Americans living in the county were also available for all 49 counties and were retrieved from the US Census Bureau website. Both county level variables are scale variables.

Data analysis

Multilevel models were adopted in this study because the measurement of nursing assistant's depression within nursing homes has a hierarchical structure (Söderfeldt et al., 1997). Multilevel models take into account this natural clustering, allow the impact of individual level variables on depression to vary across nursing homes, and use organizational level variables to explain the difference in individuals' baseline risk and the differential impact of individual level variables on depression. A statistical software package MlwiN (Rasbash et al., 2004) was used to implement the model, in which iterative generalized least squares (IGLS) was used to find maximum likelihood estimates of the parameters. Data analyses were conducted in sequential steps including data linkage, exploratory analyses, and multilevel analyses.

The repeated measurement model in MLwiN was adopted as the appropriate analysis methodology. The rationale of using the repeated measurement model is that the basic structure is observed on two occasions (i.e., survey times in 2000 and 2002) nested within subjects, and the subjects nested within workplaces (a three-level hierarchy). An advantage of using the repeated measurement model in MLwiN is that multilevel structures do not require balanced data to obtain efficient estimates. For repeated measured data it is permissible to have missing occasions per subject. Thus, all of the available data can be incorporated into the analysis under the assumption that the probability of being missing is independent of any random variable in the model, known as completely random dropout (Rasbash et al., 2000, p. 129–130).

One particular feature of the multilevel models in MLwiN is to allow modeling cross-classified levels. If taking survey time as level 1, subject as level 2, and nursing home as level 3, then the county in which the nursing assistants live is another level 3 unit above the level 2 unit of subject and cross-classified with the level of nursing home. It shows the fact that nursing assistants reside in different counties and work in different nursing homes, and the nursing home in which a nursing assistant works may not be within the county where the nursing assistant resides. For instance, a nursing assistant may work in a nursing home located in a neighboring county. MLwiN allows one to explicitly account for these two different contexts, workplace of nursing home and county of residency, above nursing assistants. Ignoring the cross-classification effect would underestimate the standard error of the estimates. Thus, a three-level model with cross-classification in level 3 was implemented in this study.

The models were built in stages, starting from a simple variance components model, and successively adding to the model the fixed effects and random effects for the variables of interest at different levels. Diagnostic procedures were explored to test model assumptions and detect outliers and influence points on model fit. Appendix B illustrates how we built our mixed-effects three-level model with cross-classification in level 3.

Results

Descriptive statistics on selected variables for all followed 241 nursing assistants are presented in Table 1. These subjects are mostly women, less than 45 years of age, high school educated, white non-Hispanic, with household incomes less than 200 percent of the poverty line, who work in for-profit nursing homes that do not provide seniority wage increases. Approximately half of these subjects are married, self-report good health, but present symptoms of major depressive disorder.

Table 2 lists the regression estimates for five nested three-level models. The definitions of the variables are given in Appendix A. The three levels are level 1 between survey times; level 2 between nursing assistants; and level 3 between

Table 1
Sample description ($N = 241$)

	Variable	*N*	Percentage
Individual			
Age ($n = 241$)	Less than 45	129	53.5
	45 and over	112	46.5
Gender ($n = 241$)	Female	234	97.1
	Male	7	2.9
Marital status ($n = 240$)	Married first time	98	40.8
	Married with previous marriage	44	18.3
	Divorce/separated	29	12.1
	Widowed	9	3.8
	Never married	49	20.4
	Living as if married	11	4.6
Education ($n = 239$)	Elementary school	0	0
	Junior school	19	8.0
	High school	165	69.0
	Junior college or 1–2 years college	43	18.0
	College graduate	7	2.9
	Graduate school	5	2.1
Hispanic ($n = 237$)	Yes	6	2.5
	No	231	97.5
Race ($n = 234$)	American Indian or Alaska native	8	3.4
	Asian	0	0
	Black or African American	31	13.2
	Native Hawaiian or other pacific islander	3	1.3
	White	192	82.1
Overall health ($n = 239$)	Excellent	13	5.4
	Very good	66	27.6
	Good	96	40.2
	Fair	48	20.1
	Poor	16	6.7
Emotional strain ($n = 231$)	Low emotional strain	174	75.3
	High Emotional Strain	57	24.7
Household income for past year ($n = 219$)	$\leqslant$\$10,000	13	5.9
	$\leqslant$\$15,000	34	15.5
	$\leqslant$\$20,000	37	16.9
	$\leqslant$\$25,000	41	18.7
	$\leqslant$\$35,000	42	19.2
	$\leqslant$\$50,000	34	15.5
	$\leqslant$\$60,000	9	4.1
	$\leqslant$\$75,000	7	3.2
	$\geqslant$\$75,000	2	1.0
Organizational			
Ownership type ($n = 241$)	For profit	174	72.2
	Non profit	67	27.8
Seniority wage increase ($n = 189$)	Yes	63	33.3
	No	126	66.7
Managerial pressure ($n = 153$)	Yes	32	20.9
	No	121	79.1

Table 2
Regression coefficients with standard errors for the multilevel repeated measurement model of depressive disorder scale in percentage (347 observations)

Variables	Model I (null model)	Model II	Model III	Model IV	Model V (full model)
Fixed effect:					
Intercept	29.53(1.86)	29.68(1.85)	28.25(1.92)	20.26(3.04)	−16.75(19.79)
Age group		−0.11(0.11)	−0.13(0.11)	−0.11(0.11)	−0.09(0.11)
Emotional strain			6.43(3.13)*	6.42(3.09)*	5.66(3.07)+
Ownership Type (nursing home)				8.00(3.69)*	3.84(3.96)
Seniority wage benefit (nursing home)				6.31(3.34)+	3.58(3.11)
Gini Index (county)					1.13(0.52)*
Proportion of African Americans (county)					−0.51(0.22)*
Random effect variances					
Level 1 intercept variance (survey times)	369(40.0)	367(39.7)	367(39.7)	366(39.6)	366(39.6)
Level 2 intercept variance (nurse assistants)	101(39.6)	104(39.6)	101(39.3)	106(39.5)	105(37.0)
Level 3 intercept variance (nursing homes)	54(28.2)	52(27.7)	44(25.6)	11(16.5)	0(0.0)
Level 3 intercept variance (counties)	0 (0.0)	0(0.0)	0 (0.0)	0(0.0)	0(0.0)
Model fit					
−2*loglikelihood (IGLS) Deviance	3134	3133	3129	3118	3112
ΔD		1	4	11	6
Δdf		1	1	2	2
Prob. χ^2		0.317	0.046	0.004	0.049

Note: Also controlled for race and marital status (results not shown); * indicates significance at the 0.05 level; + indicates significance at the 0.1 level.

cross-classified nursing homes and residence counties. The variance components model was examined first with random intercepts only, then successively adding fixed and random effects for the variables of interest to improve model fit and reduce the random effect variation.

Model I, the variance component model, shows the estimated fixed intercept with standard error is 29.53(1.86). It shows the average scale of depression disorder is about 30 percent among 241 nursing assistants during the two years of 2000–2002 assuming maximum depression is 100 percent. The distribution of random variation from the variance components model also suggests that the lowest level between survey times accounts for the most variation followed by level 2 between nursing assistants, and level 3 between nursing homes. The variation within level 1 between survey times accounts for 70 percent of total variation. The variation within level 2 between nursing assistants accounts for 20 percent. The variation within level 3 between nursing homes accounts for 10 percent and the variation within level 3 between residence counties is zero. The zero variation between counties indicates that there is no county level random variation, thus for the cross-classified level 3 nursing homes and residence counties there is no difference from the single level 3 unit of nursing home only. Consequently, the cross-classified multilevel model can be reduced to the simple three-level model.

Model II adds the level 1 variable age, which is the only available level 1 variable varying between surveys. The estimate for age (−0.11(0.11)) was not statistically significant. Compared to Model I, Model II does not show improvement of model fit. All estimated variances at three levels show little change.

Model III adds one level 2 variable: emotional demand measured in the baseline survey in 2000. The estimated coefficient of emotional demands was statistically significant 6.43(3.13). It shows that during 2 years those nursing assistants who had higher baseline emotional demands were on average about 6 percent higher on the depression disorder scale than those who had lower baseline emotional demands, controlling for subjects' age, marriage status and race. The estimated age effect was not statistically significant −0.13(0.11). Adding the individual variables reduced both the level 2 random variance and level 3 random variances indicating improved model fit.

Model IV adds two level 3 variables: ownership type and seniority wage benefit of the nursing home

where the nursing assistant works. The estimated coefficient for nursing home ownership type was statistically significant 8.00(3.69) and seniority wage benefit was marginally statistically significant 6.31(3.34). The results show that during the 2 years those nursing assistants who worked in for-profit nursing homes were on average 8 percent higher on the depression disorder scale than those who worked in a non-profit nursing home, and those who worked in nursing home without a seniority wage benefit were on average 6 percent higher on the depression disorder scale than those who worked in nursing homes with a seniority wage benefit, both controlling for subject age, race, marital status, and emotional demands. It also shows that controlling for nursing home level variables, the effect of emotional demands remained statistical significance 6.42(3.09). The age effect was not statistically significant. As expected, adding nursing home level variables greatly reduced the level 3 variance.

The full model, which is Model V, adds two county level variables: Gini index and the proportion African Americans living in the county. The estimated coefficient of the Gini index was statistically significant 1.13(0.52). The estimated coefficient of proportion of African Americans was also statistically significant −0.51(0.22). The SE results suggest that during 2 years those nursing assistants who lived in a county with a 10 percent higher Gini index were on average 11 percent higher on the depression disorder scale compared to those who lived in a reference county, and those who lived in a county with a 10 percent higher proportion of African Americans were on average 5 percent lower on the depression disorder scale compared to those who lived in a reference county, both controlling for subject age, race, marital status, ownership type and seniority wage benefit of the nursing home. The results also show that controlling for the county level variables, ownership type and seniority wage benefit of the nursing homes were no longer statistically significant. The age effect was still not statistically significant. The effect of emotional demands shifted from being statistically significant in Model IV to being marginally statistically significant after controlling for county level variables. Adding the two county level variables further reduced the level 3 random variation to a minimum. Model fit comparison between the five nested models shows that the improvement in model fit was statistically significant from Models II to V.

Discussion

The aim of this study was to simultaneously test the effects of county, organizational, workplace, and individual level variables on poor mental health outcomes among low-wage workers in an important US industry. We found that age was not associated with depressive disorder among nursing assistants employed in US nursing homes. Emotional strain, related to providing direct care to elderly and disabled clients, was associated with depressive disorder, as was nursing home ownership type (for-profit vs. not-for-profit). However, when controlling for county level variables of poverty (Gini index and proportion of African Americans living in the county), neither workplace nor organizational level variables had a statistically significant association with depressive disorder.

Previous studies have found that work organization in health-care environments is an important correlate of mental health (Landsbergis, 1988, 2003; Rafnsdottir et al., 2004), with the emotional labor involved in health care service occupations being a particularly prominent stressor (Shuler and Davenport, 2000). Such findings continue to provide support for theoretically amending the demand/control model for human service organizations (Soderfeldt et al., 1996; De Jonge and Kompier, 1997; De Jonge et al., 1999). Organizational level variables have also been found to be correlated with worker health in studies that use subjective as well as objective measures of organizational attributes (Söderfeldt et al., 1997; Yperen and Snijders, 2005; Elovainio et al., 2000). Worker mental health, for example, has been found to be associated with worker perceptions of managerial pressure (Cooper and Earnshaw, 1998), though studies that rely solely on subjective measures of organizational attributes have been critiqued as reflecting a ''sole source bias'' (MacLeod et al., 2002). This study used both subjective and objective measures of organizational attributes and found nursing home ownership type to be a statistically significant predictor of depressive disorder among nursing assistants.

Research has also linked long-term financial strain to depression in US women (Eaton et al., 2001). Though this study did not find the lack of a seniority wage benefit among low-income health-care workers—a factor that can conceivably exacerbate financial strain over time—to be associated with depressive disorder, it did find county level measures of poverty to be statistically significant

predictors of depressive disorder among nursing assistants. The methodological advantage of this study's use of longitudinal county level measures of low-income as predictors of depression is that county level markers are likely to be more stable over time than are more transient workplace indicators of low income. Presumably, county level measures of poverty can thus better capture cumulative exposure to low income, an exposure that can in turn be linked to social class. Though the demand-control model remains the dominant model used to explain the link between workplace organization and health, it has been critiqued for isolating itself from class analysis by relying on more Weberian measures of social stratification such as education (Muntaner and O'Campo, 1993). Incorporating longitudinal county level measures of cumulative exposure to low income, as a proxy for measuring "social class", could enhance use of the demand-control model for class analysis. This would be timely given the global changes that are currently restructuring the labor force (i.e., growth in low income jobs) and influencing work organization and labor processes (i.e., precarious labor).

This study makes a contribution to current methodology research in the field of occupational health by explicitly accounting for all variations among the related three-level structure, especially modeling and testing the cross-classification in the highest level between nursing homes and residence counties. The adopted methodology gives better estimates of standard errors for the estimated coefficients; it also shows how random variation is distributed among different levels, and how it decreases when adding different sets of level-specific variables of interest. The results clearly show that most random variation comes from the lowest level (i.e., between survey times within a single nursing assistant) and suggests that more work still needs to be done in future to investigate why there is so much variation within individuals and how to reduce it. The results also points to the need to collect more longitudinal information from within individuals, perhaps beyond the usual demographic variables.

Meanwhile, our results also show that about one third of the variation is due to the individual level and its contexts. This variation can be effectively explained and reduced by relevant individual and context level variables. Multilevel methodology enables us to better understand what we can do to improve expected change on outcomes of interest. The results from cross-classification in the county and nursing home levels show that context level variation came primarily from the nursing homes, not the counties. However, adding county level variables absorbed much of the effect of the nursing home level variables, indicating that the county of residence influences the outcome over and above the environment of the nursing homes.

A limitation of this study of depressive disorder among low-wage health-care workers is possibly the use of self-report to assess job strain and workplace emotional demand. Shuler and Davenport (2000) nonetheless argue that self-reports of emotional labor are important to use for health-care service occupations and previous research has demonstrated a high correlation between independent and self-reported ratings of job strain (Muntaner et al., 1993). A second possible bias may have been introduced by studying nursing assistants in unionized nursing homes, given that the most hazardous workplace environments appear to attract unionization.

We obtained a small sample size in this study due to various financial and operational constraints exposed on the longitudinal survey. However, we are confident in our statistical methodology and appropriate interpretation of results based on their level of statistical significance. Our results are consistent with findings from other studies in the field (Söderfeldt et al., 1997) but with more explicit consideration of the variance composition from multiple contexts. The relative impact of fixed effects is more robust than the relative impact of random effects in our results. Furthermore, we think that the explicit consideration of random effects from multiple levels will strengthen the validity and reliability of fixed effects in our model.

Governments and private industry alike have become increasingly concerned about the growing workforce shortage of low-wage caregivers in nursing homes and long-term care settings, a shortage that will likely only grow more severe as the "aging of America" (and the EU) progresses. A variety of state, federal, and private sector initiatives have been implemented to encourage development of a qualified and stable frontline workforce of caregivers (Lerman and Skidmore, 1999; Stone and Wiener, 2001). Yet while these workers engage in physically and emotionally demanding work, they rarely earn more than the minimum wage, they typically have no access to affordable health

insurance and other common work-related benefits, they do not enjoy any reasonable measure of workplace control, and they tend to lack significant career or earning advancement opportunities (Stone and Wiener, 2001). While there has been relatively limited empirical research done on the mental health predictors of low-wage direct caregivers in nursing homes and long-term care settings in the US, the empirical work that has been done tends to emphasize workplace and organizational level initiatives to prevent poor mental health outcomes among these workers (Keita and Sauter, 1992; Quick et al., 2002). Some studies, however, have determined that local economic conditions may have an even stronger effect on nursing assistant health status and workplace turnover rates and suggest that the correlates of low education and high functional illiteracy rates may necessitate an even broader retraining and human capital investment intervention strategy (Stone and Wiener, 2001; Lerman and Skidmore, 1999). Sectoral-wide training partnerships with labor unions and the (re) design of public programs to help workers move into and stay in the workforce may also be considered (Stone and Wiener, 2001; Lerman and Skidmore, 1999). However, this study finds that while workplace and organizational level variables are associated with depressive disorder among low-wage nursing assistants in US nursing homes, the relationships do not hold once county level measures of economic inequality are controlled for. This study thus supports that more distal upstream determinants of workplace mental health problems, such as the political economy of residential areas, may be at play in determining the mental health of low-wage workers.

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Appendix A. Definitions of the variables used in the multilevel model

Variables	Type	Value
Percent scale of depressive disorder	Scale	Range 0–100%
Percent scale of depressive symptoms	Scale	Range 0–100%
Emotional-strain	Binary	1 = upper-tertile of psychological and emotional demands and lower-tertile of decision authority 0 = all other
Age	Scale	Centered at mean Range: −23.3–28.7
Nursing home ownership type	Binary	1 = for profit 0 = non profit
Nursing home seniority-based wage benefit	Binary	1 = No 0 = Yes
County Gini index	Scale	Range: 31.28–47.67%
County proportion of African Americans	Scale	Range: 0–23.39%

Appendix B. Multilevel modeling

B.1. Variance components model

We start with a three-level variance components model with no explanatory variables, allowing the outcome (depression scale) to vary across survey times in level 1 (subscript i), nursing assistants in level 2 (subscript j) and nursing homes (subscript k), and counties (subscript l) cross-classified in level 3.

Model I in Table 2 can be expressed in three levels:

The 1st level model is

$$D_{ij(kl)} = \beta_{0j(kl)} + e_{0ij(kl)},$$

where $D_{ij(kl)}$ represents the observed continuous depression scale measured at the ith survey time for the jth nursing assistant in combination with the kth nursing home and lth residence county; $\beta_{0j(kl)}$ represents the average depression scale across surveys for the jth nursing assistant in combination with the kth nursing home and lth resident county;

$e_{0ij(kl)}$ represents level 1 residuals (i.e., the random deviation of the ith survey for the jth nursing assistant in combination with the kth nursing home and lth residence county from the average of all surveys for the same nursing assistant).

The 2nd level model is

$$\beta_{0j(kl)} = \alpha_{0(kl)} + u_{0j(kl)},$$

where $\alpha_{0(kl)}$ represents the average depression scale across the nursing assistants within the same level 3 unit (combination of nursing homes and counties); $u_{0j(kl)}$ represents the level 2 residual (i.e., the random deviation of the jth nursing assistant from the average for all the nursing assistants in the same combination of nursing home and county).

The 3rd level model is

$$\alpha_{0(kl)} = \gamma_{00} + v_{0(kl)},$$

where γ_{00} represents the grand average depression scale across all the lowest level units; $v_{0(kl)}$ represents the level 3 residuals (i.e., the random deviation from the (kl)th unit of nursing home and counties from the grand average).

All the random effects (u, v, e) are assumed to follow a normal distribution with mean zero and an unknown constant variance. The variation of all the random effects indicates the amount of variability across survey times, nursing assistants, nursing homes and counties. MLwiN simultaneously estimates all the fixed effects γ's, and variances of random effects (u, v, e)'s.

Model II in Table 2 adds one level 1 variable to Model I and was developed as follows:

Based on Model 1 and to allow depression to vary with the variables in level 1 (survey times), we include the level 1 variable of individual age in the 1st level of the model:

$$D_{ij(kl)} = \beta_{0j(kl)} + \beta_{lj(kl)}\mathrm{AGE}_{ij(kl)} + e_{0ij(kl)}.$$

To allow the change on the depression scale associated with AGE to vary across nursing assistants and units of nursing homes and counties, we have the 2nd level model:

$$\beta_{0j(kl)} = \alpha_{0(kl)} + u_{0j(kl)},$$

$$\beta_{1j(kl)} = \alpha_{1(kl)} + u_{1j(kl)},$$

where $\alpha_{(kl)}$ is the average change on the depression scale associated with a one unit change of AGE (the fixed effect of AGE) across all nursing assistants in the combination of kth nursing home and lth residence county and $u_{1j(kl)}$ represents the random deviation of jth nursing assistant from the average. The random effect (u_0, u_1) is assumed to follow a multivariate normal distribution with zero mean and an unknown variance–covariance matrix.

The 3rd level model is

$$\alpha_{0(k1)} = \gamma_{00} + v_{0(k1)},$$

$$\alpha_{1(k1)} = \gamma_{10} + v_{1(k1)}.$$

In Model II presented in Table 2, the random effect of AGE (i.e., u_1) is not statistically significant and thus not shown.

Model III in Table 2 adds one level 2 variable to Model II and was developed as follows:

Based on model 2 and to allow depression to vary with the variables in level 2 (nursing assistants), we include the individual variable of emotional demands (ED) as measured on the baseline survey in the 2nd level of the model:

The 1st level model is:

$$D_{ij(kl)} = \beta_{0j(kl)} + \beta_{1j(kl)}\mathrm{AGE}_{ij(kl)} + e_{0ij(kl)}.$$

The 2nd level model is

$$\beta_{0j(kl)} = \alpha_{00(kl)} + a_{01(kl)}\mathrm{ED}_{j(kl)} + u_{0j(kl)},$$

$$\beta_{1j(k)} = \alpha_{1(kl)} + u_{1j(kl)}.$$

To allow the interaction effect of the level 1 variable AGE with the level 2 variable ED, we have: $\beta_{1j(kl)} = \alpha_{10(kl)} + \alpha_{11(kl)}\mathrm{ED}_{j(kl)} + u_{1j(kl)}$ where $\alpha_{11j(kl)}$ is the coefficient for the interaction between AGE and ED. The interaction was not significant and therefore is not included here.

The 3rd level model is

$$\alpha_{00(kl)} = \gamma_{00} + v_{00(kl)},$$

$$\alpha_{01(kl)} = \gamma_{01} + v_{01(kl)},$$

$$\alpha_{1(kl)} = \gamma_{10} + v_{1(kl)},$$

where γ_{01} is the average change on the depression scale associated with one unit change of ED (fixed effect) and $v_{01(kl)}$ represents the random deviation from the average change of depression associated with ED within the same level 3 unit (random effect of ED). The random effect (v_0, v_1) is assumed to follow a multivariate normal distribution with zero mean and an unknown variance-covariance matrix.

In Model III presented in Table 2, the random effect of AGE and ED is not statistically significant and thus is not shown.

Model IV in Table 2 adds one level 3 variable to Model III and was developed as follows:

Based on model 3 and to allow depression to vary with the variables in level 3 (cross-classified nursing home and county of residence), we include level 3 variables, such as nursing home ownership type (OT) and Gini index of county (GI), in the 3rd level of model:

The 1st level model is

$$D_{ij(kl)} = \beta_{0j(kl)} + \beta_{1j(kl)}\mathrm{AGE}_{ij(kl)} + e_{0ij(kl)}.$$

The 2nd level model is

$$\beta_{0j(kl)} = \alpha_{00(kl)} + a_{01(kl)}\mathrm{ED}_{j(kl)} + u_{0j(kl)},$$

$$\beta_{1j(k1)} = \alpha_{1(k1)} + u_{1j(k1)}.$$

To further allow the average depression level to vary by level 3 variables OT and GI, we construct the following 3rd level model:

The 3rd level model is

$$\alpha_{00(kl)} = \gamma_{000} + \gamma_{001}\mathrm{OT}_k + +\gamma_{002}\mathrm{GI}_1 + v_{00(kl)},$$

$$\alpha_{01(kl)} = \gamma_{01} + v_{01(kl)},$$

$$\alpha_{1(kl)} = \gamma_{10} + v_{1(kl)}.$$

Furthermore, to allow the effect of age to vary by level 3 variables OT and GI, we model $\alpha_{1(kl)} = \gamma_{10} + \gamma_{11}\mathrm{OT}_k + +\gamma_{12}\mathrm{GI}_l + v_{1(kl)}$. Since the effect of age was not shown to be significantly affected by OT and GI (i.e., no interaction between age and OT and age and GI), we do not consider this model.

The construction of successive multilevel models was based on improvements of model fit and the reduction of random effects variations in each level.

References

Andersson, F., Holzer, H.J., Lane, J.I., 2003. Worker advancement in the low-wage labor market: the importance of 'good jobs'. [online] Oct 2003. [cited 2004 Feb 5]. Available from: URL: www.brookings.edu/es/urban/publications/200310_holzer.htm

Bernstein, J., Hartmann, H., 1999. Defining and characterizing the low-wage labor market. In: Kaye, K., Nightingale, D.S. (Eds.), The Low-Wage Labor Market: Challenges and Opportunities for Economic Self-Sufficiency. Urban Institute Press, Washington, DC [online] 1999. [cited 2004 Feb 5]. Available from: URL: http://aspe.hhs.gov/hsp/lwlm99/bernhart.htm#Characteristics.

Brown, G.W., Moran, P.M., 1997. Single mothers, poverty, and depression. Psychological Medicine 27, 21–33.

Centers for Medicare and Medicaid Services, 2004. Nursing Home Compare. CMS, Washington, DC [online] 2004. [cited 2004 Jan 10]. Available from: URL: www.medicare.gov/nhcompare/home.asp.

Cooper, C.L., Earnshaw, J., 1998. The price of stress. Nursing Standard 12 (25), 11–17.

De Jonge, J., Kompier, M.A.J., 1997. A critical examination of the demand-control-support model from a work psychological perspective. International Journal of Stress Management 4 (4), 235–258.

De Jonge, J., Van Breukelen, G.J.P., Landweerd, J.A., Nijhuis, F.J.N., 1999. Comparing group and individual level assessments of job characteristics in testing the job demand-control model: a multilevel approach. Human Relations 1, 95–122.

Dooley, D., Prause, J., Ham-Rowbottom, K.A., 2000. Underemployment and depression: longitudinal relationships. Journal of Health and Social Behavior 41 (4), 421–436.

Duncombe, H.S., 1966. County Government in America. National Association of Counties Research Foundation, Washington, DC.

Eaton, W.W., Muntaner, C., Smith, C., Tien, A., Ybarra, M., 2003. The revised center for epidemiologic studies depression scale (RCES-D). In: Maruish, M.E. (Ed.), The Use of Psychological Assessment for Treatment Planning and Outcome Assessment, third ed [online] 2003. [cited 2004 Feb 17]. Available from: URL: http://www.mdlogix.com/cesdrpaper.pdf.

Eaton, W.W., Muntaner, C., Bovasso, G., Smith, C., 2001. Socioeconomic status and depression. Journal of Health and Social Behavior 42, 277–293.

Elovainio, M., Kivimaki, M., Steen, N., Kalliomaki-Levanto, T., 2000. Organizational and individual factors affecting mental health and job satisfaction: a multilevel analysis of job control and personality. Journal of Occupational Health and Psychology 5 (2), 269–277.

Federal Register, 2000. Vol. 65, No. 31, February 15, pp. 7555–7557.

Foner, N., 1995. The Caregiving Dilemma: Working in an American Nursing home. University of California Press, Berkeley, California.

Godin, I., Kittel, F., 2004. Differential economic stability and psychosocial stress at work: Associations with psychosomatic complaints and absenteeism. Social Science and Medicine 58 (8), 1543–1553.

Grosch, J.W., Murphy, L.R., 1998. Occupational differences in depression and global health: results from a national sample of US workers. Journal of Occupational and Environmental Medicine 40 (2), 153–164.

Hamermesh, D.S., 1999. Changing inequality in work injuries and work timing. Monthly Labor Review Online 122 (10) [online] 1999 [cited 2004 Feb 17]. Available from: URL:www.bls.gov/opub/mlr/1999/10/art3abs.htm.

Jia, H., Muennig, P., Lubetkin, E.I., Gold, M.R., 2004. Predicting geographical variations in behavioral risk factors: an analysis of physical and mental healthy days. Journal of Epidemiology and Community Health 58 (2), 150–155.

Karasek, R.A., 1979. Jobs demands, job decision latitude and mental strain—implications for job redesign. Administrative Science Quaterly 24, 285–307.

Keita, G.P., Sauter, S.L., 1992. Work and Well Being: An Agenda for the 1990s. American Psychological Association, Washington, DC.

Kim, M., 2000. Women paid low wages: who they are and where they work. Monthly Labor Review 123 (9), 26–30 [online] 2000 [cited 2004 Feb 17]. Available from: URL:http://www.bls.gov/opub/mlr/2000/09/art3full.pdf.

Kohn, M., Schooler, C., 1973. Occupational experience and psychological functioning: an assessment of reciprocal effects. American Sociological Review 38, 97–118.

Landsbergis, P.A., 1988. Occupational stress among health care workers: a test of the job demands-control model. Journal of Organizational Behavior 9, 217–239.

Landsbergis, P.A., 2003. The changing organization of work and the safety and health of working people: a commentary. Journal of Occupational and Environmental Medicine 45 (1), 61–72.

LEHD. Longitudinal Employer-Household Dynamics Program, 2001. Low Wage Fact Sheet. US Census Bureau Demographic Survey Division, Washington, DC [online] 2001 [cited 2004 Feb 17]. Available from: URL:http://lehd.dsd.census.gov/factsheet/factsheet_Low_Wage_Work.pdf.

Lerman, R.I., Skidmore, F., 1999. Helping Low-Wage Workers: Policies for the Future. Urban Institute, Washington, DC [online] 1999 [cited 2004 Feb 16]. Available from: URL:www.dol.gov/asp/programs/history/herman/reports/futurework/conference/low-wage.pdf.

Mausner-Dorsch, H., Eaton, W.W., 2000. Psychosocial work environment and depression: epidemiologic assessment of the demand-control model. American Journal of Public Health 90 (11), 1765–1770.

Macleod, J., Davey Smith, G., Heslop, P., Metcalfe, C., Carroll, D., Hart, C., 2002. Psychological stress and cardiovascular disease: empirical demonstration of bias in a prospective observational study of Scottish men. British Medical Journal 25; 324(7348):1247-1251.

Muntaner, C., Barnett, E., 2000. Depressive symptoms in rural West Virginia: labor market and health services correlates. Journal of Health Care for the Poor and Underserved 11 (3), 284–300.

Muntaner, C., Eaton, W.W., Garrison, R., 1993. Dimensions of the psychosocial work environment in a sample of the US metropolitan population. Work and Stress 7 (4), 351–363.

Muntaner, C., Eaton, W.W., Sorlie, P., Diala, C., Kessler, R.C., 1998. Social class, assets, organizational control and the prevalence of common psychiatric disorders. Social Science and Medicine 47 (12), 2043–2053.

Muntaner, C., O'Campo, P., 1993. A critical appraisal of the demand/control model of the psychosocial work environment: epistemological, social, behavioral and class considerations. Social Science and Medicine 36 (11), 1509–1517.

Myers, D., Silverstein, B., Nelson, N.A., 2002. Predictors of shoulder and back injuries in nursing home workers: a prospective study. American Journal of Industrial Medicine 41 (6), 466–476.

National Association of Counties [cited August 2005]. Available from URL: http://www.naco.org/PrinterTemplate.cfm?Section=About_Counties

Nielsen, F., 2002. Gini indices for US counties based on 1999 US Census. [online] [cited 2004 April 14]. Available from: URL: http://www.unc.edu/~nielsen/data/data.htm

Ohlson, C.G., Soederfeldt, M., Soederfeldt, B., Jones, I., Theorell, T., 2001. Stress markers in relation to job strain in human service organizations. Psychotherapy and Psychosomatics 70 (5), 268–275.

Personick, M.E., 1990. Nursing home aides experience increase in serious injuries. Monthly Labor Review Online 113 (2) [online] 1990. [cited 2004 Feb 9]. Available from: URL:http://www.bls.gov/opub/mlr/1990/02/art4full.pdf.

Quick, J.C., Tetrick, L.E., Levi, L., 2002. Handbook of Occupational Health Psychology. American Psychological Association.

Radloff, L.S., 1977. The CES-D scale: a self-report depression scale for research in the general population. Applied Psychological Measurement 1, 385–401.

Rafnsdottir, G.L., Gunnarsdottier, H.K., Tomasson, K., 2004. Work organization, well-being and health in geriatric care. Work 22 (1), 49–55.

Rasbash, J., Browne, W., Goldstein, H., Yang, M., Plewis, I., Healy, M., Woodhouse, G., Draper, D., Langford, I., Lewis, T., 2000. A user's Guide to MLwiN, Version 2.1 b. Multilevel Models Project, Institute of Education, University of London.

Rasbash, J., Browne, W., Healy, M., Cameron, B., Charlton, C., 2004. MLwiN v2.00. Institute of Education, London.

Sauter, S.L., Murphy, L.R., Hurrell, J.J., 1990. Prevention of work-related psychological disorders: A national strategy proposed by the National Institute for Occupational Safety and Health (NIOSH). American Psychologist 45, 1146–1158.

Shuler, S., Davenport, S.B., 2000. Seeking emotional labor. Management Communication Quarterly 14 (1), 50–89.

Soderfeldt, B., Soderfeldt, M., Muntaner, C., O'Campo, P., Warg, L.E., Ohlson, C.G., 1996. Psychosocial work environment in human service organizations: a conceptual analysis and development of the demand-control model. Social Science and Medicine 42 (9), 1217–1226.

Söderfeldt, B., Söderfeldt, M., Jones, K., O'Campo, P., Muntaner, C., Ohlson, C.G., Warg, L.E., 1997. Does organization matter? A multilevel analysis of the demand-control model applied to human services. Social Science and Medicine 44 (4), 527–534.

Stansfeld, S.A., Head, J., Marmot, M.G., 1998. Explaining social class differences in depression and well-being. Social Psychiatry and Epidemiology 33, 1–9.

Stansfeld, S.A., Fuhrer, R., Shipley, M.J., Marmot, M.J., 1999. Work characteristics predict psychiatric disorder: prospective results from the Whitehall II study. Occupational and Environmental Medicine 48, 302–307.

Stone, R.I., Wiener, J.M., 2001. Who will care for us? Addressing the long-term care workforce crisis. [Executive Summary]. Department of Health and Human Services and the Urban Institute, US Washington, DC [online] May 2001 [cited 2004 Feb 2]. Available from: URL:http://aspe.hhs.gov/daltcp/reports/ltcwfes.htm.

US Census Bureau [cited August 2005] Available from URL: http://census.gov/popest/geographic/estimates_geography.html

US Department of Health and Human Services, Office of the Secretary, 2000. Annual update of the HHS poverty guidelines. Federal Register 65 (31) [online] Feb 2000 [cited 2004 Feb 9]. Available from: URL:http://aspe.hhs.gov/poverty/00fedreg.htm.

US Department of Labor. 1997. Nursing and Other Personal Care Facilities 1997 Compliance Survey Fact Sheet. [online] 1997 [cited 2004 Feb 9]. Available from: URL: http://www.dol.gov/esa/healthcare/surveys/nursing.htm

Wunderlich, G.S., Sloan, F.A., Davis, C.K., 1996. Nursing Staff in Hospitals and Nursing Homes: Is it Adequate? Institute of Medicine, National Academy Press, Washington, D.C.

Yperen, N.W., Snijders, T.A., 2005. A multilevel analysis of the demands-control model: Is stress at work determined by factors at the group level or the individual level? Journal of Occupational Health and Psychology 5 (1), 182–190.