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County and organizational predictors of depression symptoms among low-income nursing assistants in the USA

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Abstract

Low-wage workers represent an ever-increasing proportion of the US workforce. A wide spectrum of firms demand low-wage workers, yet just 10 industries account for 70% of all low-paying jobs. The bulk of these jobs are in the services and retail sales industries. In health services, 60% of all workers are low-paid, with nursing aides, orderlies, personal attendants, and home care aides earning an average hourly wage of just $7.97—a wage that keeps many of these workers hovering near or below the poverty line. Nursing assistants also tend to work in hazardous and grueling conditions. Work conditions are an important determinant of psychological well-being and mental disorders, particularly depression, in the workplace have important consequences for quality of life, worker productivity, and the utilization and cost of health care.

In empirical studies of low-wage workers, county-level variables are of theoretical significance. Multilevel studies have recently provided evidence of a link between county-level variables and poor mental health among low-wage workers. To date, however, no studies have simultaneously considered the effect of county-and workplace-level variables. This study uses a repeated measures design and multilevel modeling to simultaneously test the effect of county-, organizational-, workplace-, and individual-level variables on depression symptoms among low-income nursing assistants employed in US nursing homes. We find that age and emotional strain have a statistically significant association with depression symptoms in this population, yet when controlling for county-level variables of poverty, the organizational-level variables used were no longer statistically significant predictors of depression symptoms. This study also contributes to current research methodology in the field of occupational health by using a cross-classified multilevel model to explicitly account for all variations in this three-level data structure, modeling and testing cross-classifications between nursing homes and counties of residence.

Keywords: Depression; Socioeconomic position; Work organization; Cross-classified; Nurse assistants; Precarious work; USA

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Introduction

Due to dramatic political, economic and labor market changes that have occurred over the past 20 years, low-wage workers represent an increasing proportion of the US workforce. In 2001, 23.9% of the labor force or approximately 70 million workers held low-paying jobs (Mishel, Bernstein, & Boushey, 2003; Smith & Woodbury, 1999). The growth rate of these jobs is furthermore accelerating, with the number of low-wage jobs having increased 14% between 1992 and 1997, up from a 4% increase over the 1988–1992 period (Smith & Woodbury, 1999). Overall, low-wage workers still tend to be non-unionized (94%), disproportionately female (59%), white (63%), and non-college-educated (62%) (Bernstein & Hartmann, 1999), but declining economic returns to education and work experience, coupled with a long-term erosion of real wages, has significantly altered the occupational structure in America. Consequently, the likelihood of holding a low-wage job has increased for many subpopulations (Carnevale & Rose, 2001).

For empirical study, the low-wage job market can be defined in terms of hourly or annual earnings, reflecting that both the wage rate and degree of workforce attachment are important. A low-wage job is one in which a full-time worker earns an income insufficient to support a family of four above the official poverty line (Bernstein & Hartmann, 1999; Kim, 2000). In 2000 dollars, this means earning less than $8.20/h or $17,050/a (US Department of Health and Human Services, 2000). While not all low-paid workers are primary wage earners, one in three is the primary breadwinner in a low-income family and it is these workers who constitute the working poor in America (Lerman & Skidmore, 1999). A wide spectrum of firms demand low-wage workers, yet just 10 US industries account for 70% of all low-paying jobs (Longitudinal Employer-Household Dynamics, 2001). The bulk of these jobs are in the services industry (38.6%) and the retail sales industry (38.2%) (Andersson, Holzer, & Lane, 2003). These two industries also have the highest projected rate of growth, with the services industry projected to add 20.1% more jobs between 2002 and 2012 and the retail sales industry projected to add 12.9% more jobs (Hecker, 2004).

Within the services industry, health care jobs are among the fastest growing and perhaps the most hazardous for low-wage workers (Kim, 2000). Sixty percent of all health care workers hold low-wage jobs (Kim, 2000), with nursing aides, orderlies, personal attendants, and home care aides earning an average hourly wage of just $7.97 (Dawson, Kempski, & Tyler, 2001), a wage rate that keeps most of these workers hovering near or below the poverty line (Dawson et al., 2001). Nursing assistants represent the bulk of low-income health care workers and, due to dramatic restructuring of the health care industry and aging of the US population, the demand for nursing assistants is predicted to rise more than 25% by 2006 (Stone & Wiener, 2001). An expansive nursing home industry could also be a force driving worker shortages. Not only are nursing assistants low-paid, but they also have a very limited career path, are frequently required to do rotating shift work, and often work in conditions that are grueling, dangerous, emotionally taxing, and even humiliating. Furthermore, the employers of these workers—particularly nursing home and long-term care firms—are notorious for frequently violating federal wage and hour laws (US Department of Labor, 1997), and in 2003 alone were forced to pay more than $8 million in back wages to over 16,000 workers (US Department of Labor, 2003). Given that nursing assistant jobs are low-paid, offer few benefits, and are associated with harsh working conditions, it is little wonder that nursing home and home care agencies across the country are today experiencing the worst staffing shortages in the history of the industry (Dawson et al., 2001).

Working conditions have been shown to be an important determinant of physical and psychological well-being. Yet while much has been written on the low-wage labor market, particularly in relation to minimum wage laws and the impact of recent welfare reform measures, there is a notable dearth of empirical literature that addresses the health risks of these workers. Available research suggests that low-wage workers are at increased risk for injury and poor physical health outcomes (Brown & Moran, 1997; Dooley, Prause, & Ham-Rowbottom, 2000; Hamermesh, 1999). Research focused more specifically on nursing assistants and nursing home workers validates these findings. For example, both Myers, Silverstein, and Nelson (2002); Personick (1990) found that nursing home workers sustain a variety of serious disabling workplace injuries with increased frequency. In addition, the emotionally taxing work of these direct care givers has significant mental health implications (Foner, 1995). More empirical research is needed to document the

hazards that these low-wage workers face (Wunderlich, Sloan, & Davis, 1996).

Psychiatric symptoms figure prominently among the hazards of work organization (Karasek, 1979; Kohn & Schooler, 1973). Mental disorders in the workplace, particularly depression, have been found to have important consequences for quality of life, worker productivity, and the utilization and cost of health care (Keita & Sauter, 1992; Sauter, Murphy, & Hurrell, 1990). Depression has been found to be related to work organization (Grosch & Murphy, 1998; Karasek, 1979; Mausner-Dorsch & Eaton, 2000; Stansfeld, Head, & Marmot, 1998) and longitudinal evidence suggests that job demands, lack of autonomy, and monotony at work can be used to predict affective disorders (Eaton, Bovasso, & Smith, 2001; Stansfeld, Fuhrer, Shipley, Marmot, 1999). More recently, studies using multilevel models have found that workplace-and organizational-level characteristics are related to poor mental health (De Jonge, Van Breukelen, Landweerd, & Nijhuis, 1999; Elovainio, Kivimaki, Steen, & Kalliomaki-Levanto, 2000; Söderfeldt et al., 1997; Yperen & Snijders, 2000). Other multilevel studies are starting to provide evidence of a link between county-level variables and poor mental health outcomes (Jia, Muennig, Lubetkin, & Gold, 2004; Muramatsu, 2003). County-level variables are of theoretical significance for empirical studies that explore the health effects of low-wage work, because strong geographic patterns exist in the distribution of low-wage jobs, as Bureau of Labor Statistics data show, suggesting that important structural economic and social forces are at play in determining the industry-mix in low-wage counties. In addition, health services tend to be organized at the county-level and a number of relevant policy interventions, such as labor force retraining and living wage ordinances, tend to be 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 modeling to simultaneously test the effect of county-, organizational-, workplace-, and individual-level variables on symptoms of depression among low-income nursing assistants employed in US nursing homes. More specifically, we test the hypotheses that the individual-level variable of age, the individual variable of emotional demands, the organizational-level variables of nursing home ownership type and existence of a seniority wage benefit, and county-level indicators of poverty are all associated with symptoms of depression among low-income nursing 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 in 2000 and a follow-up survey 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 homes 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%. Questions were asked that related to aspects of the working conditions of the nursing assistants and their job stress, physical and mental health status, perceived treatment at work, individual and family health care needs, household economics and household strain. 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 a reduced number of demographic, psychosocial and labor market-related variables. 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 2-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 341 observations due to the missing values in some explanatory variables.

Variables

Depression was measured using a 35-item version of the RCES-D (Eaton, Muntaner, Smith, Tien, & Ybarra, 2004). 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 (details available upon request). Two subscales of the Symptom Checklist 90 (Godin & 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 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%).

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. The summed depression scores were further transformed to the normal scores (z-scores), which are normally distributed with mean equal to zero and a standard deviation of one. The change of the depression z-score reflects the change in proportion to the standard deviation of the z-scores.

Emotional demands were assessed with a 6-item scale (Ohlson, Söederfeldt, Söederfeldt, Jones, & Theorell, 2001; Söderfeldt et al., 1997) with items are 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 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), and 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 identified the type of unit where the nursing assistant worked (i.e., subacute, skilled nursing, standard/basic nursing, Alzheimer, rehabilitation, other). Pre-existing psychopathology was assessed with a question on past history of depression: "Have you ever had two weeks of more when nearly every day you felt sad, blue, depressed?" This question was adapted from the National Comorbidity Survey (Kessler et al., 1994). 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 (CMMS) 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 v. not-for-profit). We also administered the organizational survey, using an adaptation of a questionnaire used in a previous study of human service 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 relations violations, perceptions of labor management conflict, and seniority-based wage increases. These three indicators were combined into a single additive scale indicator of "managerial pressure". All organizational-level variables were operationalized as categories for the multivariate analyses.

Two county-level variables were used in this study: Gini index and proportion 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). County proportions of African Americans, a proxy for racial segregation, 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

Multi-level 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. Considering the repeated measures nested within each individual from multiple surveys, the repeated measurement model is used to fit the basic structure that two occasions (i.e., survey times in 2000 and 2002) are nested within subjects, and the subjects are nested within workplaces (a three-level hierarchy).

A statistical software package (Rasbash et al., 2000; Rasbash, Browne, Healy, Cameron, & Charlton, 2000) was used to fit the repeated measurement multilevel model, in which iterative generalized least squares (IGLS, see Goldstein, 1986) was used to find maximum likelihood estimates of the parameters. Data analyses were conducted in sequential steps including data linkage, exploratory analyses, and multi-level analyses. One particular feature of the multi-level 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 also a higher level above the level of subject. The levels of county and nursing home are cross-classified. 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. We consider the possibility of cross-classified level 3 contexts between nursing home and county. However, after conducting a cross-classified three-level variance components model without any explanatory variables, we found the estimated random effects variance at the level of county is almost zero, suggesting there are no cross-classified county effect. Thus, we reduced our model to the more appropriate three-level hierarchical model with the levels of survey, nursing assistant, and nursing home. The models were built in stages, starting from a simple variance components model, successively adding the fixed effects and random effects of the variables of interest from different levels. Diagnostic procedures were explored to test model assumptions and detect outliers and influence points on model fit. Random slope effect of explanatory variables and interactions between them were also considered. But none of them is statistically significant thus not shown in the final model. Accordingly, the improvement of model fit and the reduction of random effects variations in each level were used to determine the final model. Appendix B illustrates the process of model building.

Results

Descriptive statistics on selected variables for all the 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% 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 coefficient estimates of the explanatory variables from five nested three-level regression models. The definitions for the response and explanatory variables are given in Appendix A. The three levels in the model are survey (level 1), nursing assistant (level 2), and nursing home (level 3). The variance components model, with only factor being the intercept, was considered first followed by the models that successively add the explanatory variables, with random intercept effects, at different levels from the lowest to the highest. The addition of the explanatory variables improved the model fit as well as reduced the random effects variation.

Model I, the variance components model, shows the estimated fixed intercept is not statistically significant from zero, merely reflecting the expected fact that the average z-score for depression symptoms is approximately zero for all the observations

Table 1
Sample description ($N = 241$)

Variable	N	%
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	7.9
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	174	75.3
High	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	0.9
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

in the sample. The relative distribution of the random intercept variance at three levels suggests about 67% variation from the level 1, 24% variation from the level 2, and 9% variation from the level 3. Therefore, within-subject variation between surveys is the largest source of random intercept effects for the response; variations from the levels of between-subjects and above-subjects are relatively small, accounting for about one-thirds.

Model II adds the level 1 explanatory variable, age, which is the only available variable from both surveys. The coefficient estimate for age is statistically significant, −0.012 (0.005). It suggests that the average nursing assistant had about 0.01 units fewer depression symptoms between 2000 and 2002. Such age effect, however, contributes little on the reduction of the random effects variances at any of the three levels in the model.

Model III further adds the level 2 explanatory variables, including subject's race, marital status, and emotional demands based on measures from the baseline survey in 2000. The coefficient estimate of emotional demands is statistically significant, 0.31 (0.14). It suggests that the nursing assistants who had higher baseline emotional demands had about 0.3 units higher depression symptoms during the 2 years than those who had lower baseline emotional demands, controlling for age, race, and marital status. The age effect remains statistical significant after adjusting for the level 2 variables. Adding the level 2 variables greatly reduces the variance of the random effects in the model.

Model IV adds the level 3 variable: nursing home ownership into the model. The coefficient estimate for nursing home ownership is statistically significant, 0.36 (0.16). It suggests that the nursing assistants who worked in the for-profit nursing homes during the 2 years had about 0.36 units higher depression symptoms than those who worked in the non-profit nursing homes, controlling for subject's age, race, marital status, and baseline emotional demands. Both effects of age and baseline

Table 2
Regression coefficients estimates with standard errors for the multilevel repeated measurement model of depressive symptoms (341 observations)

Variables	Model I	Model II	Model III[b]	Model IV	Model V
Fixed effect					
Intercept	−0.02	0.52	0.47	0.16	−1.8
Age	(0.08)	(0.23)	(0.24)	(0.29)	(0.92)
		−0.012*	−0.012*	−0.012*	−0.011*
		(0.005)	(0.005)	(0.005)	(0.005)
Emotional strain			0.31*	0.32*	0.28*
(Nurse)			(0.14)	(0.14)	(0.14)
Ownership type				0.36*	0.20
(Nursing home)				(0.16)	(0.17)
Gini index					0.054*
(County)					(0.023)
Proportion of African Americans					−0.018
(County)					(0.011)
Random effect variances					
Level 1 intercept variance	0.67	0.66	0.66	0.66	0.66
(survey)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)
Level 2 intercept variance	0.24	0.24	0.24	0.25	0.24
(nurse assistant)	(0.08)	(0.08)	(0.08)	(0.08)	(0.07)
Level 3 intercept variance	0.09	0.08	0.04	0.006	0
(nursing home)	(0.05)	(0.05)	(0.04)	(0.03)	(0)
Model fit					
IGLS Deviance	941.3	935.2	926.6	922.2	916.0
ΔD[a]		6.1	8.6	4.4	6.2
Δdf		1	3	1	2
Prob. χ^2		0.01	0.04	0.04	0.05

*$p<0.05$.
[a]ΔD is the difference of IGLS deviance between adjacent models of Models I–V.
[b]Models III–V were also adjusted for nurse's marital status (married vs. non-married) and race (white vs. non-white). Neither is statistically significant (results not shown).

emotional demands remain statistically significant after adjusting for the higher level variable. Adding the level 3 variable further reduces the random effects variance, particularly the level 3 variance.

Model V further adds two higher level variables: county Gini index and county proportion of African Americans. Because the context of county and the context of nursing home are cross-classified above the level of nursing assistants, a cross-classified multi-level model is more appropriate than the pure hierarchical model. However, as mentioned earlier, we explicitly fitted a cross-classified three-level model to incorporate such complexity, but found there was no random effect of county context. Therefore, we used the current three-level hierarchal model and these two county-level variables can be equivalently treated as level 2 variable that varies across nursing assistants. The coefficient estimate of county Gini index is statistically significant, 0.054 (0.023). But the county proportion of African Americans is not statistically significant. It suggests that the nursing assistants who lived in a county with a 10% higher Gini index during the 2 years had about 0.5 units higher depression symptoms than those who lived in a reference county, controlling for subject's age, race, marital status, baseline emotional demands, and nursing home ownership. It is also worthy to notice that the coefficient estimate for nursing home ownership is no longer statistically significant in Model V. It may suggest that the county-level influence was the major driving force at the higher level context, operating indirectly through the level of nursing homes. The effects of age and emotional demands remain statistically significant, after adjusting for the higher level variables. Adding the county variables further

reduces the level 3 variation to a minimum. Comparing the reduction of model deviance between the five nested models, Model V is the best and final model.

Discussion

This study aimed to simultaneously test the effects of county-, organizational-, workplace-, and individual-level variables on symptoms of depression among low-wage workers in an important US industry. We found that age had a very small negative although statistically significant effect on symptoms of depression among nursing assistants employed in US nursing homes. Emotional strain, related to providing direct care to elderly and disabled clients, had a statistically significant association with symptoms of depression among nursing assistants. We found that subjects who had higher baseline emotional demands had more depressive symptoms compared to those who reported less emotional demands, even when controlling for subject age, race, marital status, and organizational- and county-level variables. Finally, when controlling for county level variables of poverty (Gini index and proportion of African Americans living in the county), the organizational-level variable of ownership type were not statistically significant associated with symptoms of depression.

Previous studies have found work organization in health care environments to be an important correlate of mental health (Landsbergis 1988, 2003; Rafnsdottir, Gunnarsdottier, & Tomasson, 2004), with the emotional labor involved in health care service occupations to be a particularly prominent stressor (Shuler & Davenport, 2000). Such findings continue to provide support for theoretically amending the demand/control model for human service organizations (De Jonge & Kompier, 1997; De Jonge et al., 1999; Söderfeldt et al., 1996). Studies have also found organizational-level variables to be correlated with worker health when using subjective as well as objective measures of organizational attributes (Elovainio et al., 2000; Söderfeldt et al., 1997; Yperen & Snijders, 2000). The mental health of workers, for example, has been found to be associated with worker perceptions of managerial pressure (Cooper & Earnshaw, 1998), though such studies have been critiqued as reflecting a ''sole source bias'' when they rely solely on subjective measures of organizational attributes (Macleod et al., 2002). This study used both subjective and objective measures of organizational attributes and did not find a statistically significant association with depression symptoms among low-income nursing assistants, particularly when controlling for county-level variables of poverty.

Research has also linked long-term financial strain to depression in US women (Eaton et al., 2001). Though this study did not find that lack of a seniority wage benefit among low-income health care workers—a factor that can conceivably exacerbate financial strain over time —was associated with symptoms of depression, it did find a statistically significant association between symptoms of depression and a county-level measure of income inequality (the 1990 Gini coefficient) when controlling for individual-, workplace-, and organizational-level variables. The methodological advantage of this study's use of longitudinal county-level measures of low-income as predictors of depression symptoms 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 income are thus better able to capture cumulative exposure to low-income, an exposure that can in turn be linked to social class. Indeed although 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 measures of social stratification such as education. Incorporating longitudinal county-level measures of cumulative exposure to or income inequality, as a proxy for measuring area social class, could enhance the integration of the demand-control model with class analysis. The demand-control model hypothesizes that high job demands (working hard and fast) and low control (lack of autonomy, learning and variety on the job) place workers at risk of several disorders, including depression (Eaton et al., 2001). This would be particularly timely given the global changes that are currently restructuring the US labor force (i.e., the accelerating growth of low-income jobs) and influencing work organization and labor processes (e.g., job strain).

This study makes a contribution to social epidemiology by explicitly accounting for variations among the related three-level structure, including work organization and county socioeconomic position indicators simultaneously. The adopted methodology gives adequate estimates of standard errors

for the estimated coefficients; it shows how the random variation is distributed among different levels and how it is reduced with the addition of 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). It suggests more work need to be done in future to investigate why there is so much variation within individuals and how to reduce it. One possibility for future studies would be to develop hypotheses such that the between-occasion variance is expected to be a function of explanatory variables.

The CES-D captures transient depressive symptoms. Such sensitivity to environmental circumstances is why it has been such a popular instrument in mental and social epidemiology (Eaton et al., 2004). Therefore, the CESD can capture the strength of environmental changes over time better than assessments of full-blown disorder (e.g., DSM-IV diagnoses). The study thus points to the need to collect more longitudinal information from individuals, beyond demographic variables.

Meanwhile, our results also show that about one-third variation is due to the level of individuals and their contexts. These variations can be effectively explained and reduced by relevant individual- and context-level variables. The results from the cross-classification in the county and nursing home levels show that context-level variation came primarily from the nursing homes, not counties. However, adding county-level variables did absorb much of the effect of nursing home-level variables.

One possible limitation of this study of depression symptoms among low-income health care workers is the use of self-reported assessments of job strain and workplace emotional demand. Shuler and Davenport (2000) argue, however, that the use of self-reported emotional labor demand is important when studying health care service occupations and previous research has demonstrated a high correlation between independent and self-reported ratings of job strain (Muntaner, Eaton, & Garrison, 1993). A second possible bias may have been introduced by studying nursing assistants in unionized nursing homes, given that the most hazardous workplaces tend to promote unionization (e.g., Bonfonbrenner's labor studies). Another limitation stems from limited generalization as only a small proportion of the US nursing homes are unionized. However, our findings on the effects of for-profit ownership on nursing home workers' health for example, are consistent with larger studies of unionized and non-unionized nursing homes in several states including West Virginia (Trinkoff, Johantgen, & Muntaner, Le, 2005). Therefore, it is reasonable to expect that our results would hold for non union shops as well.

The shortage of low-wage direct care givers in US nursing homes and long-term care settings has never been more pronounced in the history of the industry and is expected to grow even more severe as the "aging of America" progresses (Dawson et al., 2001). Government and private industry are both increasingly concerned about the workforce shortage and have implemented a variety of state, federal, and private sector initiatives to encourage development of a qualified and more stable frontline cadre of direct care givers (Lerman & Skidmore, 1999; Stone & Wiener, 2001). Yet while the work that these caregivers are expected to do is physically and emotionally demanding work, they are often paid minimum wage and typically have no access to affordable health insurance and other common work-related benefits. In addition, they tend to have little workplace control and lack any significant career track or earning advancement opportunities (Stone & Wiener, 2001). Relatively little empirical research has been done on the mental health hazards of low-wage direct care givers and the research that has been done tends to emphasize workplace-and organizational-level initiatives that could be pursued to reduce poor mental health outcomes for these workers (Keita & Sauter, 1992; Quick, Tetrick, & Levi, 2002). However, some studies have acknowledged that local economic conditions may have an even stronger effect on the health status and workplace turnover rates of nursing assistants and suggest that the correlates of low wage labor market areas call for a broad social investment intervention strategy (Lerman & Skidmore, 1999; Stone & Wiener, 2001). Sectoral-wide training partnerships with labor unions and the (re)design of social programs to help low-wage workers move into and stay in the workforce have also been suggested (Lerman & Skidmore, 1999; Stone & Wiener, 2001). Thus, our study found that workplace- and organizational-level variables could be modest determinants of depression among low-wage nursing assistants once county of residence measures of income inequality are controlled for. Most variation, however, remains at the individual level (Söderfeldt et al., 1997). Therefore, our findings cautiously suggest that more distal upstream determinants of workplace mental health

problems, such the determinants of residential area economic inequality, may be also at play.

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Appendix A. Definitions of variables used in the multilevel model

Variables	Type	Value
Normal scores for depressive disorder	Scale	−1.31 to 3.03
Normal scores for depressive symptoms	Scale	−1.31 to 2.80
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, −23.3 to 28.7
Nursing home ownership type	Binary	1 = for profit 0 = non profit
County Gini index	Scale	31.28–47.67%
County proportion of African American	Scale	0–23.39%

Appendix B. Multilevel modeling

In the following multilevel modeling presentation, we follow the notations of Rasbash and Browne (2001). We start with a three-level *variance components model* with no explanatory variables, allowing the outcome (depression scale) varies across survey times in the lowest level (subscript i), nursing assistants in the second level (subscript j), and nursing homes (subscript k) in the highest level. It corresponds to the Model I as shown in the Table 2.

$$D_{ijk} = \beta_0 + v_k + u_j + e_{ijk},$$
$$v_k \sim N(0, \delta_v^2), \quad u_j \sim N(0, \delta_u^2), \quad e_{ijk} \sim N(0, \delta_e^2),$$

D_{ijk} is the observed depression scale measured at the ith survey time for the jth nursing assistant in the kth nursing home. ß$_0$ is the average depression scale across all lowest level units. V_k is the random effect of nursing homes. U_j is the random effect of nursing assistants. e_{ijk} is the lowest level residual of the ith survey for the jth nursing assistant in the kth nursing home. All the random effects (u, v, e) are assumed to follow a normal distribution with mean zero and a unknown constant variance. The variation of all the random effects indicates the amount of variability across survey times, nursing assistants, nursing homes. MLwiN simultaneously estimates all the fixed effects β's, and the variance of random effects (u, v, e).

Explanatory variables at the different levels, from the lowest to the highest level, are added subsequently. Random slope effect of explanatory variables and interactions between them are considered. None of them are statistically significant thus not shown in the models. Accordingly, the improvement of model fit and the reduction of random effects variations in each level are used to determine the final model.

Model II adds the level 1 variable AGE across surveys:

$$D_{ijk} = \beta_0 + \beta_1 \mathrm{AGE}_{ijk} + v_k + u_j + e_{ijk},$$
$$v_k \sim N(0, \delta_v^2), \quad u_j \sim N(0, \delta_u^2), \quad e_{ijk} \sim N(0, \delta_e^2).$$

Model III further adds the level 2 variable *emotional demands* (ED) across nursing assistants:

$$D_{ijk} = \beta_0 + \beta_1 \mathrm{AGE}_{ijk} + \beta_2 \mathrm{ED}_{jk} + v_k + u_j + e_{ijk},$$
$$v_k \sim N(0, \delta_v^2), \vdots u_j \sim N(0, \delta_u^2), \quad e_{ijk} \sim N(0, \delta_e^2).$$

Model IV further adds the level 3 variable *ownership* (OT) across nursing homes:

$$D_{ijk} = \beta_0 + \beta_1 \mathrm{AGE}_{ijk} + \beta_2 \mathrm{ED}_{jk} + \beta_3 \mathrm{OT}_k + v_k + u_j + e_{ijk},$$
$$v_k \sim N(0, \delta_v^2), \quad u_j \sim N(0, \delta_u^2), \quad e_{ijk} \sim N(0, \delta_e^2).$$

Model V further adds the variable *Gini index* (GI) across counties, i.e. across level 2 nursing

assistants:

$$D_{ijk} = \beta_0 + \beta_1 \mathrm{AGE}_{ijk} + \beta_2 \mathrm{ED}_{jk} + \beta_3 \mathrm{OT}_k + \beta_4 \mathrm{GI}_{jk} + v_k + u_j + e_{ijk},$$

$$v_k \sim N(0, \delta_v^2), \quad u_j \sim N(0, \delta_u^2), \quad e_{ijk} \sim N(0, \delta_e^2).$$

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