

Workplace Assaults on Nursing Assistants in US Nursing Homes: A Multilevel Analysis

SangWoo Tak, ScD, MPH, Marie Haring Sweeney, PhD, MPH, Toni Alterman, PhD, Sherry Baron, MD, MPH, and Geoffrey M. Calvert, MD, MPH

As life expectancy increases, the need for long-term care services provided both in the recipient's home and in institutional settings such as assisted-living facilities and nursing homes is projected to more than double by 2050.¹ In 2006, nursing assistants (including orderlies and attendants) made up approximately 72% of the direct care workforce in nursing homes.² As the main provider of hands-on care in these institutional settings, nursing assistants help residents with their activities of daily living and keep records of services delivered and changes in the patient's condition. It is projected that the number of nursing assistants, orderlies, and attendants will need to increase by 18% by 2016 (from 1.45 million in 2006 to 1.71 million in 2016).² To meet this increasing demand for long-term care providers, it has become a major policy priority for nursing homes to improve nursing assistant retention rates.¹

Nursing assistants are at high risk of injury from violent assault at work,³ and their risk exceeds that of other health care workers.⁴ Nursing personnel who were subjected to work-related violence on at least a monthly basis reported higher intent both to leave the nursing profession and to change institutions.⁵ The organizational characteristics of nursing homes, including facility ownership and chain membership, turnover of top management and registered nurses, and staffing patterns and levels, influence nursing assistants' perceptions of job satisfaction as well as their turnover and retention.⁶

Research on organizational characteristics associated with workplace violence among nursing assistants is lacking. We attempted to fill this gap by examining both individual and organizational factors associated with assault injuries experienced by nursing assistants by using data from the 2004 National Nursing Assistant Survey (NNAS) that were linked to facility information from the 2004 National Nursing Home Survey (NNHS). Both surveys

Objectives. We examined risk factors for injuries to nursing assistants from assaults by nursing home residents at both the individual and the organizational level.

Methods. We analyzed data from the 2004 National Nursing Assistant Survey that were linked to facility information from the 2004 National Nursing Home Survey by use of multilevel modeling that accounted for the complex survey design effect.

Results. Thirty-four percent of nursing assistants surveyed reported experiencing physical injuries from residents' aggression in the previous year. Mandatory overtime (odds ratio [OR]=1.65; 95% confidence interval [CI]=1.22, 2.24) and not having enough time to assist residents with their activities of daily living (OR=1.49; 95% CI=1.25, 1.78) were strongly associated with experiencing injuries from assaults. Nursing assistants employed in nursing homes with Alzheimer care units were more likely to experience such injuries, including being bitten by residents.

Conclusions. Reducing mandatory overtime and having a less demanding workload may reduce the risk of workplace violence. In particular, prevention activities should be targeted at those nursing homes that care for cognitively impaired patients. (*Am J Public Health.* 2010;100:1938–1945. doi:10.2105/AJPH.2009.185421)

were conducted by the National Center for Health Statistics. By linking these 2 surveys, we intended to avoid the potential bias that can arise from collecting self-reported organizational-level information from individuals who might be affected by the health outcomes of interest.

METHODS

The NNAS was conducted as a supplement to the 2004 NNHS, a continuing series of nationally representative sample surveys of US nursing homes, their services, staff, and residents. The NNAS is the first large, nationally representative statistical sample of nursing assistants employed in nursing homes and was conducted to better understand their health and other work-related issues. The NNHS data were collected via on-site interviews with facility administrators and designated staff that used administrative records to answer survey questions. For the NNAS, nursing assistants were sampled from a subset of nursing homes participating in the NNHS. The survey was

administered by a telephone interview. The NNAS sample design was developed with the primary goal of preparing nationally representative and reliable estimates of nursing assistants. The NNAS survey instrument consisted of sections on recruitment, training and licensure, job history, family life, management and supervision, client relations, organizational commitment and job satisfaction, workplace environment, work-related injuries, and demographics.⁷ The procedures to select the sample and collect information have been described in detail elsewhere.⁷

Study Population

Only nursing assistants who were certified by their state were eligible to participate in the NNAS. Contract workers and nursing assistants who worked fewer than 16 hours per week were excluded from the survey to ensure that respondents would have had enough exposure and experience in the sampled nursing homes to accurately report on their work experience. From each facility, 1 to 9 randomly selected nursing assistants were interviewed. Of the

4274 nursing assistants who were eligible, 3017 nursing assistants from 582 nursing homes completed interviews (average of 5.0 nursing assistants per facility), which yielded a response rate of 70.6% among eligible nursing assistants. Included in this analysis were 2888 nursing assistants (67% of eligible nursing assistants) who were both working at the time of survey and missing no information on demographics, work-related assaults, and other work factors.

Covariates

All measures at the individual level were self-reported. Physical injuries from assaults by nursing home residents were defined as any physical injuries reported by nursing assistants at work as the result of aggression, violence, or abuse by residents in the past year or since the nursing assistant started working at the facility if their job tenure was less than 12 months. As a specific type of assault, human bite was defined as human bites experienced by nursing assistants at the nursing home facility during the same period. Human bite was 1 of several work-related injuries for which a separate question was asked. Thus, we can assume that the general question on aggression, violence, or abuse by residents captured most injuries from human bites. Except for human bites, we were unable to tease out any other specific types of assault injuries.

Other variables included age, gender, education (less than 12 years vs 12 years or more), race/ethnicity, job tenure (less than 1 year vs 1 year or more), hours worked per week, mandatory overtime, lack of health insurance, and wage type (hourly or salaried). Nursing assistants were also asked whether they had enough time to assist residents with all necessary activities of daily living.

Information on facility characteristics obtained from the NNHS included ownership (for-profit vs nonprofit), facility size (dichotomized as fewer than 100 beds vs 100 beds or more), staffing, specialty care, existence of a waiting list for placement, existence of special units (Alzheimer, hospice, and rehabilitation wards), existence of mechanical lifting devices (a surrogate measure of management commitment to employee safety and health), and consistent assignment of the same patients.

Statistical Analysis

Descriptive analyses were completed by using the Software for the Statistical Analysis of Correlated Data (SUDAAN version 9.0; Research Triangle Institute, Research Triangle Park, NC) package to take into account sample weights and design effects that were due to the complex sample survey design.⁸ Variance estimates were adjusted for the population survey units, strata, and sampling weights assigned by the National Center for Health Statistics. Independent variables in simple associations with physical assaults and human bite were examined by using the Rao–Scott design-adjusted χ^2 test.

The structure of this combined NNAS and NNHS data set was basically hierarchical (individual nursing assistants nested within nursing homes). In such samples, the individual observations are generally not completely independent.⁹ For instance, nursing assistants in the same nursing home may be similar to each other because of the common skills and socioeconomic status they share by taking the same training or participating in the same benefits program. As a result, the average correlation between variables measured on nursing assistants from the same nursing home will be higher than the average correlation between variables measured on nursing assistants from different nursing homes. To prevent this bias, we applied multilevel modeling.^{10–12} All multilevel analyses were performed with hierarchical linear modeling (HLM), which provides a package for multilevel modeling analysis of population sampling survey data.¹³

In the overall model, the dependent variable was a dichotomous variable indicating whether a nursing assistant had injuries from assaults or human bites by a resident within the past 12 months. Using a log-link function for binomial data, we generated a generalized multilevel model to estimate the odds ratios (ORs) of work-related assaults for independent variables (fixed effects) at the individual level as well as the nursing home characteristics (fixed effects) at the facility level (random effect). The empirical 2-level model is illustrated for a basic case involving 2 levels with both the intercept and the slope (regression coefficient) at the individual level that is modeled to vary randomly at the facility level. In this model, the probability of experiencing a work-related

assault injury depends on the individual and facility variables, such as the facility size (i.e., number of beds). We write

$$(1) \Pr_{\text{work-related assault} | \text{covariates, facility}} = \pi_{ij} \\ \pi \sim \text{Binomial}(\mu)$$

$$(2) \text{Logit}(\pi_{ij}) = \text{Log}\{\pi_{ij}/(1 - \pi_{ij})\} \\ = M + \beta_1 \text{sex}_i + \beta_2 \text{age}_i \\ + \beta_3 \text{facility size}_j + E_j \\ E_j \sim N(0, V_j)$$

where β_1 and β_2 are parameter estimates for the individual covariates, β_3 is a parameter estimate for the facility size (i.e., a facility-level variable for the number of beds), and E_j is a facility-level residual. The facility-level residuals are on the logistic scale and are normally distributed with a mean of 0 and variance V_j , where V_j is facility residual variance expressed on the logistic scale.

We compared 3 consecutive models. The first model included the individual-level variables, such as age category, gender, race/ethnicity, job tenure, and education, without a multilevel consideration. The second model included a random effect term of nursing home level (random intercept) in addition to the variables in the first model, and the third model included the nursing home characteristics variables as fixed effects at the upper level in addition to the second model. By this strategy, we tried to quantify the effect of the individual differences (model 1) and also to appreciate how much of the effect was because of the differences in nursing homes, the so-called facility effect (model 2). The last model (model 3) provided information on a possible association between physical injuries from assaults among nursing assistants and nursing home characteristics after adjustment for individual-level variables.

The nursing home effects on the experience of physical injuries from assault and human bites were evaluated by the median odds ratio (MOR).^{14–17} The MOR is a simple function of the cluster variance and therefore directly depends on the facility-level variance as follows:

$$(3) \text{MOR} = \exp(\sqrt{2 \times \sigma^2} \times \Phi^{-1}(0.75)),$$

where σ^2 is the facility-level variance and $\Phi^{-1}(0.75)$ is the 75th percentile of the normal

distribution with a mean of 0 and variance of 1, which equals 0.6745.

The MOR translates the facility-level variance into the widely used OR scale. If the MOR is equal to 1, there is no facility variance. By contrast, the higher the MOR, the more important are the nursing home effects for understanding the individual probability of experiencing an assault injury. The MOR is defined as the median value of the OR between the nursing home at highest risk and the nursing home at lowest risk when randomly picking out 2 nursing homes. As such, questions of whether a nursing assistant would have a similar probability of assault injury and human bite beyond their occupational and individual characteristics (model 2) and nursing home characteristics (model 3) can be investigated.

RESULTS

The total number of nursing assistants working at nursing home facilities in the United States was estimated at 677103 in 2004. Overall, 92% of nursing assistants participating in the NNAS were female, their weighted average age was 38.5 years, and 37% were non-Hispanic Black (Table 1). Nearly a quarter had less than 12 years of education, and 36% reported an annual household income of less than \$20 000. The weighted proportion of nursing assistants who reported having no health insurance was 29%. Ten percent of nursing assistants reported having to work overtime even if they did not want to (Table 1). Forty-one percent of nursing assistants were employed in not-for-profit nursing homes, and 71% of nursing assistants were employed in nursing homes where managers assigned nursing assistants to the same residents over time (Table 2). A total of 34% of nursing assistants reported experiencing physical injuries from assaults by residents during the year before their interview, including 12% who reported injuries from human bites during the past year (Tables 1 and 2). Non-Hispanic White nursing assistants reported the highest proportion of physical assault injuries (43.5%) and human bites (15.6%). The proportion of nursing assistants employed in nursing homes with Alzheimer care units was 39%, of which 37% reported experiencing physical injuries from assaults by residents and 13% reported

TABLE 1—Weighted Percentage of Nursing Assistants Reporting Injuries From Assaults and Human Bites by Residents in Nursing Homes in the Past 12 Months: National Nursing Assistant Survey, 2004

Characteristics of Nursing Assistants	Weighted Percentage of Total	Incidence of Assault Injuries, % (95% CI)	Incidence of Human Bites, % (95% CI)
Gender			
Women	92.3	35.2 (33.2, 37.2)	11.7 (10.6, 12.7)
Men	7.7	27.0 (20.1, 33.9)	9.2 (0.7, 17.8)
Age, y***			
18–24	17.0	53.8 (48.5, 59.0)	17.7 (13.7, 21.7)
25–34	23.5	37.6 (33.6, 41.5)	11.0 (9.2, 12.9)
35–44	24.6	27.2 (20.6, 33.7)	9.7 (7.8, 11.8)
45–54	22.6	30.5 (26.8, 34.3)	11.2 (7.2, 15.1)
≥55	12.3	24.7 (18.1, 31.3)	7.8 (3.3, 12.3)
Education, y			
<12	70.8	34.9 (33.3, 36.5)	11.6 (10.7, 12.5)
≥12	29.2	33.8 (28.6, 39.0)	11.2 (9.3, 13.2)
Race/ethnicity***			
Non-Hispanic White	46.9	43.5 (41.1, 46.0)	15.6 (13.6, 17.6)
Non-Hispanic Black	37.0	23.2 (20.3, 26.1)	7.0 (5.6, 8.5)
Hispanic	9.5	34.6 (27.0, 42.2)	11.2 (8.7, 13.7)
Other	6.6	34.6 (27.2, 42.1)	7.6 (4.9, 10.3)
Health insurance ^a			
Yes	71.5	33.5 (30.6, 36.3)	10.8 (9.9, 11.7)
No	28.5	37.3 (33.3, 41.3)	13.2 (10.3, 16.1)
Annual household income			
≥\$20 000	63.9	34.7 (33.5, 36.0)	11.2 (10.2, 12.2)
<\$20 000	36.1	34.3 (31.1, 37.5)	12.0 (10.0, 14.0)
Mandatory overtime ^b ***			
No	90.0	33.3 (31.4, 35.1)	10.6 (9.8, 11.5)
Yes	10.0	46.4 (39.8, 53.1)	19.0 (15.5, 22.4)
Job tenure at current facility*			
≥12 mo	70.6	33.0 (31.7, 34.3)	11.4 (10.4, 12.3)
<12 mo	29.4	38.3 (36.2, 40.4)	11.8 (10.5, 13.1)
Time for ADL***			
Enough	57.3	30.3 (28.1, 32.5)	8.4 (6.8, 10.0)
Not enough	42.7	40.3 (37.3, 43.3)	15.6 (13.0, 18.2)
Wage type			
Hourly	92.3	34.1 (31.8, 36.3)	11.4 (10.7, 12.1)
Monthly or salaried	7.7	40.4 (28.7, 52.2)	12.4 (7.0, 17.7)
Work hours per week			
<40	90.5	34.8 (33.7, 35.8)	11.4 (10.7, 12.1)
≥40	9.5	32.7 (24.0, 41.3)	11.8 (7.3, 16.2)
Speak same language as residents**			
Yes	57.4	34.2 (32.2, 36.1)	12.6 (11.2, 14.0)
No	42.6	35.1 (32.5, 37.7)	10.0 (8.4, 11.6)
Total	100.0	34.6 (32.8, 36.4)	11.5 (10.1, 12.9)

Note. ADL = activities of daily living; CI = confidence interval. The sample size was n = 2888.

^aDefined as those who had no health insurance coverage available at their current job or through a spouse or partner's job and did not participate in any government programs that pay for medical care such as Medicare or Medicaid.

^bDefined as those who reported that they were required to work overtime even if they did not want to.

* $P < .05$, by the χ^2 test comparing proportions of physical assaults; ** $P < .05$, by the χ^2 test comparing proportions of human bite.

TABLE 2—Weighted Percentages of Nursing Assistants Reporting Injuries From Assaults and Human Bites in the Past 12 Months: National Nursing Assistant Survey, 2004

Characteristics of Nursing Home Facilities	Weighted Percentage of Total	Incidence of Assault Injuries, % (95% CI)	Incidence of Human Bites, % (95% CI)
Alzheimer disease wards*			
Yes	39.1	37.4 (33.3, 41.4)	13.3 (10.8, 15.9)
No	60.9	32.8 (28.6, 37.0)	10.3 (8.9, 11.6)
Hospice wards			
Yes	5.7	38.2 (28.2, 48.3)	9.1 (2.5, 15.7)
No	94.3	34.4 (33.2, 35.5)	11.6 (10.9, 12.3)
Rehabilitation wards			
Yes	12.5	36.1 (24.8, 47.3)	10.5 (6.9, 14.2)
No	87.5	34.4 (33.4, 35.3)	11.6 (10.9, 12.4)
Ownership			
For profit	58.6	35.4 (34.5, 36.4)	10.7 (9.2, 12.1)
Not for profit	41.4	33.3 (30.4, 36.3)	12.6 (10.8, 14.4)
Waiting list			
Yes	38.2	35.3 (33.1, 37.5)	12.0 (10.4, 13.6)
No	61.8	34.1 (32.0, 36.2)	11.1 (10.4, 11.9)
Any lifting device*			
Yes	35.1	35.2 (32.9, 37.6)	13.5 (11.8, 15.1)
No	64.9	34.2 (32.6, 35.8)	10.4 (9.5, 11.3)
Assigns NAs to same residents			
Yes	70.9	34.5 (33.1, 36.0)	11.9 (11.0, 12.8)
No	29.1	34.6 (32.1, 37.2)	10.5 (9.0, 12.0)
Facility size			
≥ 100 beds	67.1	34.3 (32.5, 36.1)	11.6 (10.7, 12.5)
<100 beds	32.9	35.1 (33.4, 36.7)	11.2 (9.9, 12.4)
Total	100.0	34.6 (32.8, 36.4)	11.5 (10.1, 12.9)

Note. CI = confidence interval; NA = nursing assistant. The sample size was $n = 2888$.

* $P < .05$, by the χ^2 test comparing proportions of human bite.

injuries from human bites (Table 2). The proportions of both physical assaults and human bites were significantly higher among those nursing assistants who reported mandatory overtime and not having enough time for assisting residents with activities of daily living. The proportions also differed among racial/ethnic groups and age categories (χ^2 test, $P < .05$). Reports of physical assaults were significantly higher among those with job tenure of less than 12 months (χ^2 test, $P < .05$).

In model 1 in Table 3, all variables except job tenure, education, and low income were significantly associated with a report of work-related assault injury. Age was associated with a report of work-related assault, indicating that older nursing assistants (aged 55

years or older) were least likely to report an injury from a resident's assault. Working longer than 40 hours per week was negatively associated with injury from assault in model 1. When the facility effect term (random intercept) was included in models 2 and 3, this association disappeared. Working more than 40 hours may be associated with facility characteristics.

We found a great deal of variation between nursing homes in the experience of physical injuries from assaults and human bites among nursing assistants, yielding an MOR of 1.76 for work-related assaults and an MOR of 2.28 for human bites (Tables 3 and 4). Inclusion of facility-level covariates (model 3) did not noticeably change the size

of these between-home variations, whereas the facility effect term (model 2) reduced the strength of the association of a few individual-level variables, such as wage type and gender. In both model 2 and model 3, variables for age, mandatory overtime, and not having enough time for residents' activities of daily living appeared to be significantly associated with reports of work-related assault injuries after adjustment for the facility effect. Regardless of nursing home characteristics, nursing assistants who worked mandatory overtime and who did not have enough time for residents' activities of daily living reported more assault injuries and human bites. Non-Hispanic Black nursing assistants were significantly less likely to report physical injuries from assaults and human bites (Table 3 and 4). Nursing homes with specialized units for Alzheimer patients were positively associated with nursing assistant reports of physical injuries from assaults and human bites, whereas having a waiting list of residents or for-profit facilities were not.

DISCUSSION

Workplace violence ranges from offensive or threatening language to homicide. The National Institute for Occupational Safety and Health defines workplace violence as violent acts (including physical assaults and threats of assaults) directed toward persons at work or on duty.¹⁸ Work-related injuries from assaults, many of which reflect the presence of adverse working conditions, are commonly reported among nursing assistants in the United States.¹⁹ Our study provided results from the first large, nationally representative sample of nursing assistants and confirmed their high rate of work-related physical injuries from assault. The key findings of our study were that, overall, 35% of nursing assistants reported physical injuries resulting from aggression by residents and 12% reported experiencing a human bite within the previous 12 months while working at their current facility. Mandatory overtime, not having enough time to assist residents with their activities of daily living, and race/ethnicity were highly associated with reports of assault injuries and human bites from residents. Older nursing assistants tended to experience fewer

TABLE 3—Results of Multilevel Models for the Effect of Facility Characteristics on Nursing Assistants' Experience of Injuries From Assaults With Adjustment for Individual-Level Risk Factors: National Nursing Assistant Survey, 2004

Variable	Model 1, OR (95% CI)	Model 2, OR (95% CI)	Model 3, OR (95% CI)
Individual-level fixed effects			
Intercept	0.39 (0.33, 0.46)	0.40 (0.28, 0.58)	0.33 (0.21, 0.52)
Age slope (per y)	0.97 (0.97, 0.98)	0.97 (0.97, 0.98)	0.97 (0.97, 0.98)
Female vs male	1.45 (1.24, 1.70)	1.27 (0.90, 1.81)	1.29 (0.91, 1.83)
Education, ≤12 y vs higher	0.99 (0.91, 1.08)	1.04 (0.85, 1.28)	1.03 (0.84, 1.28)
Annual household income, ≤\$20 000 vs higher	1.02 (0.93, 1.11)	0.94 (0.77, 1.15)	0.93 (0.76, 1.13)
Work hours per week, ≥40 h vs <40 h	0.84 (0.74, 0.97)	0.95 (0.68, 1.33)	0.94 (0.68, 1.30)
Having health insurance, yes vs no	1.12 (1.02, 1.23)	1.12 (0.92, 1.36)	1.09 (0.90, 1.33)
Mandatory overtime, yes vs no	1.57 (1.38, 1.78)	1.66 (1.22, 2.26)	1.65 (1.22, 2.24)
Time for ADL, not enough vs enough	1.50 (1.38, 1.62)	1.50 (1.25, 1.79)	1.49 (1.25, 1.78)
Job tenure, <1 y vs ≥1 y	1.02 (0.93, 1.12)	1.04 (0.85, 1.27)	1.04 (0.85, 1.27)
Wage type, salary vs hourly	1.39 (1.21, 1.61)	1.18 (0.84, 1.67)	1.19 (0.84, 1.68)
Speak same language as residents, no vs yes	1.16 (1.07, 1.26)	1.17 (0.97, 1.42)	1.17 (0.97, 1.42)
Race/ethnicity, Black vs White	0.41 (0.38, 0.45)	0.46 (0.37, 0.57)	0.44 (0.35, 0.56)
Race/ethnicity, Hispanic vs White	0.72 (0.62, 0.82)	0.76 (0.53, 1.07)	0.74 (0.53, 1.05)
Race/ethnicity, other vs White	0.76 (0.65, 0.89)	0.90 (0.61, 1.33)	0.90 (0.60, 1.34)
Facility-level fixed effects			
Alzheimer disease wards, yes vs no	...	...	1.34 (1.08, 1.67)
Hospice wards, yes vs no	...	...	0.96 (0.64, 1.46)
Rehabilitation wards, yes vs no	...	...	0.88 (0.61, 1.28)
Any lifting device, yes vs no	...	...	0.93 (0.75, 1.15)
Ownership, for-profit vs not-for-profit	...	...	1.16 (0.94, 1.42)
Assign NAs to same residents, yes vs no	...	...	1.05 (0.84, 1.30)
Waiting list, yes vs no	...	...	1.10 (0.90, 1.36)
Facility size, ≥100 beds vs <100 beds	...	...	1.02 (0.83, 1.27)
Median odds ratio	...	1.76	1.77

Note. ADL = activities of daily living; CI = confidence interval; NA = nursing assistant; OR = odds ratio. Odds ratios were adjusted for all other variables in the model.

assault injuries and human bites from residents. Older nursing assistants, who are likely to have more experience (both in life and at work) in dealing with residents prone to violence, may use this experience to prevent or defuse hostile situations before violence erupts. Nursing assistants employed at nursing homes with special units for Alzheimer patients had a significantly elevated risk for assault injuries and human bites after adjustment for other individual factors.

To our knowledge, this is the first study examining the effect of facility characteristics on the occurrence of work-related physical injuries from assaults and human bites by

nursing home residents against nursing assistants. Because working overtime and not having enough time to assist residents with their activities of daily living were both associated with a higher probability of injuries from assaults, improving staffing levels may reduce the risk of assault. Improving staffing levels may reduce workload demands by allowing staff more time to spend with each resident and avoiding the need to rush care, which is a risk factor for assault.²⁰

Our finding of a high rate of physical injuries resulting from residents' aggression, which agrees with the results of other recent studies,^{3,21} is of concern. Behavioral and

psychological symptoms, such as combative behavior, are common in the course of dementia of the Alzheimer type.^{22,23} One would expect that patients with these characteristics are likely to be found in nursing homes, thus putting nursing assistants employed at these facilities at risk. Maas et al.²⁴ reported that dementia-specific training can reduce the risk of exposure to disruptive behavior from dementia patients. They found that such training can decrease absenteeism and increase job satisfaction among nursing personnel. In addition, there is some indication that empowerment of nursing assistants by acknowledging that the nursing assistants are trusted, valued, and respected, as well as adopting programs for stress reduction and prevention of worker burnout, can improve job satisfaction, reduce worker turnover, and perhaps decrease the burden of work-related assaults arising from residents' aggression.²⁵ However, this empowerment requires an enlightened facility management willing to adopt innovative measures to control hazardous working conditions. Existing recommendations to prevent workplace violence in the health care setting can provide guidance to nursing homes. Such recommendations include providing training on how to safely provide care to cognitively impaired residents; using case management conferences to discuss ways to manage potentially violent residents; maintaining records on injuries, assaults, and hazards that can be used to help identify problems and solutions; and evaluating the facility's current workplace violence prevention program.²⁶

Our study findings were somewhat contradictory compared with the findings of a previous study of nursing assistants working in small nursing homes (≤100 beds) with dementia special care units in rural Saskatchewan, Canada. The Canadian nursing assistants had a lower risk of assault from nursing home residents than did nursing assistants working in nursing homes without special care units (65% vs 73% in the past year, respectively).²² Information on whether the assaults resulted in injuries was not available. In addition, the nursing assistants working in rural nursing homes with special care units reported lower job demands and less frequent exposure to aggressive behavior. Risk of assault was associated with dissatisfaction with access to

TABLE 4—Results of Multilevel Models for the Effect of Facility Characteristics on Nursing Assistants' Experience of Injuries From Human Bites With Adjustment for Individual-Level Risk Factors: National Nursing Assistant Survey, 2004

Variable	Model 1, OR (95% CI)	Model 2, OR (95% CI)	Model 3, OR (95% CI)
Individual-level fixed effect			
Intercept	0.10 (0.08, 0.12)	0.11 (0.07, 0.18)	0.09 (0.05, 0.16)
Age slope (per y)	0.99 (0.98, 0.99)	0.99 (0.98, 1.00)	0.99 (0.98, 1.00)
Female vs male	1.25 (1.06, 1.47)	1.03 (0.63, 1.68)	1.03 (0.63, 1.67)
Education, ≤12 y vs higher	0.93 (0.85, 1.02)	1.15 (0.88, 1.49)	1.14 (0.88, 1.50)
Annual household income, ≤\$20 000 vs higher	1.17 (1.07, 1.28)	0.94 (0.72, 1.21)	0.95 (0.73, 1.23)
Work hours, ≥40 h vs <40 h	0.96 (0.83, 1.10)	1.23 (0.80, 1.90)	1.23 (0.81, 1.88)
Having health insurance, yes vs no	1.24 (1.13, 1.36)	1.16 (0.91, 1.47)	1.17 (0.92, 1.50)
Mandatory overtime, yes vs no	1.70 (1.52, 1.90)	1.73 (1.25, 2.39)	1.75 (1.26, 2.42)
Time for ADL, not enough vs enough	1.91 (1.76, 2.07)	1.86 (1.45, 2.38)	1.90 (1.48, 2.42)
Job tenure, <1 y vs ≥1 y	0.90 (0.82, 0.99)	1.08 (0.83, 1.40)	1.08 (0.84, 1.41)
Wage type, salary vs hourly	1.12 (0.96, 1.29)	1.30 (0.83, 2.03)	1.27 (0.81, 1.98)
Speak same language as residents, no vs yes	0.81 (0.74, 0.88)	0.79 (0.60, 1.04)	0.80 (0.61, 1.05)
Race/ethnicity, Black vs White	0.45 (0.41, 0.49)	0.51 (0.37, 0.71)	0.52 (0.37, 0.73)
Race/ethnicity, Hispanic vs White	0.75 (0.65, 0.86)	0.92 (0.61, 1.40)	0.95 (0.63, 1.44)
Race/ethnicity, other vs White	0.53 (0.43, 0.64)	0.82 (0.50, 1.34)	0.84 (0.51, 1.38)
Facility-level fixed effects			
Alzheimer disease wards, yes vs no	...	...	1.37 (1.03, 1.82)
Hospice wards, yes vs no	...	...	0.79 (0.47, 1.36)
Rehabilitation wards, yes vs no	...	...	0.88 (0.54, 1.42)
Any lifting device, yes vs no	...	...	1.20 (0.92, 1.58)
Ownership, for-profit vs not-for-profit	...	...	0.97 (0.75, 1.27)
Waiting list, yes vs no	...	...	1.00 (0.75, 1.35)
Facility size, ≥100 beds vs <100 beds	...	...	1.09 (0.82, 1.47)
Median odds ratio	...	2.28	2.30

Note. ADL = activities of daily living; CI = confidence interval; NA = nursing assistant; OR = odds ratio. Odds ratios were adjusted for all other variables in the model.

training programs and dementia care resources, perceived lack of preparation to care for individuals with dementia, and high job strain. In this study, an additional measure to reduce assault injuries involved letting nursing assistants choose whether to care for dementia patients. The findings from this Canadian study support the need for dementia care education for nursing assistants and for increasing nursing home staffing levels to reduce job strain and job demands.

The importance of the facility-level characteristics in our study is supported by the large variances across facility, hence the high MORs in our analyses. The MORs remained high even after adjustment for facility-level characteristics (model 3) of a priori interest.

This suggests that other facility-level characteristics not included in this analysis, such as the facility management's commitment to safety, could be explored in future studies for predicting injuries from physical assault.

Strengths and Weaknesses

A major strength of this analysis was the combination of data from the NNHS and the NNAS, which permitted us to estimate the incidence proportion of work-related physical injuries from assaults among nursing assistants linked to nursing home types and characteristics. In addition, the large sample size in the linked NNAS and NNHS data sets allowed us to determine the role of organizational variables while controlling for other

individual and work environment variables. Although human bite is one of many types of assault confronting nursing assistants in nursing homes, no study has examined this specific outcome in an observational study. We chose to use human bite because we believed this experience to be so specific that nursing assistants would have less difficulty in recollecting and reporting the experience during an interview.

Our study also had limitations. First, we relied on self-reported experience of work-related physical injuries from assault on the basis of each nursing assistant's recall of a 12-month time window. A previous report involving the National Health Interview Survey showed that memory recall of even a 3-month time window introduced errors in estimating actual injury incidence.²⁷ However, it is conceivable that assault injuries, such as human bite, may be more easily recalled by nursing assistants. It was impossible to examine whether accuracy of injury recall differentially biased the findings in our study. Also, some nursing assistants may be less likely to report sensitive data because they think this information will lead to negative consequences (e.g., employer retaliation). According to the National Center for Health Statistics, only 3% of contacted nursing assistants refused to participate in the NNAS. One of several reasons given for refusal was concern over confidentiality, even after the nursing assistants were assured in the introduction packet that no personal information would be released.⁷

Information was not available on the severity of the assault injuries reported by the nursing assistants. This is a likely reason for the difference between our findings and those of the Bureau of Labor Statistics. In 2000, the Bureau of Labor Statistics reported an annual incidence rate among nursing and personal care facility workers of 0.25% for lost-time injuries resulting from assault or violent acts.²⁶ By contrast, we found an annual incidence rate among nursing assistants of 34% for physical injuries arising from assaults by nursing home residents. These findings suggest that either the vast majority of assault injuries experienced by nursing assistants do not result in lost time or that many assault injuries are never reported. Others estimate that the Bureau of

Labor Statistics may miss at least 60% of occupational injuries²⁸ as the result of barriers faced by employees for reporting injuries to supervisors (e.g., risk for job loss or disciplinary actions), barriers to taking time off from work owing to illness or injury (e.g., fear of lost wages), and barriers among employers to recording incidents (e.g., employer desire to avoid workplace inspections).²⁹ Therefore, the true magnitude of assault injuries among nursing assistants that resulted in lost work days is likely to be much higher than the rate reported by the Bureau of Labor Statistics.

Another limitation of our study was the lack of details on the work characteristics experienced by nursing assistants (e.g., the type of residents that nursing assistants deal with on a daily basis). For example, although we may have known whether a nursing assistant worked at a nursing home with a specialized wing or ward for the care of patients with Alzheimer disease, we did not know whether the nursing assistant worked on that specialized ward. Similarly, we lacked data on assaults from aggressive relatives of residents, and this lack of data could result in an underestimation of the risk of work-related assault. Finally, agency nursing assistants who work for outside contractors who provide particular services to nursing homes and other health care facilities (i.e., home care facility) were excluded from the survey. It is possible that such nursing assistants may experience a higher rate of work-related assaults than those nursing assistants who participated in the NNAS. It is impossible to predict the effect on our findings if contracted nursing assistants were included in the survey.

Conclusions and Recommendations

We found a high rate of work-related physical injuries from assault among nursing assistants. This large, nationally representative survey of nursing assistants showed that reports of work-related assault injury were significantly associated with measures of excessive workload such as mandatory overtime and not having enough time to assist residents with all necessary activities of daily living. Being subjected to workplace violence at least monthly has been shown to be related to a nursing assistant's intention to leave the

nursing profession or to change employers.⁵ As the baby boom generation continues to age, the population in nursing homes and other related facilities is expected to grow substantially. Therefore, ensuring the safety of the workforce employed in long-term care is very important in providing high-quality care to America's nursing home residents. We attempted to elucidate the associations between facility characteristics and work-related assault injuries among nursing assistants while simultaneously examining other related individual factors. Nursing homes with specialized wings or wards for Alzheimer patients showed a strong association with reporting work-related assault injuries and human bites among US nursing assistants. Workplace violence prevention efforts that focus on nursing home settings with specialized wings or wards for Alzheimer disease should be developed. In addition, nursing home managers should maintain appropriate staffing levels to reduce the workload of their nursing assistants. ■

About the Authors

The authors are with the Division of Surveillance, Hazard Evaluations, and Field Studies, National Institute for Occupational Safety and Health, Centers for Disease Control and Prevention, Cincinnati, OH.

Correspondence should be sent to SangWoo Tak, ScD, MPH, National Institute for Occupational Safety and Health, Centers for Disease Control and Prevention, 4676 Columbia Parkway, R-17, Cincinnati, OH 45226 (e-mail: STak@cdc.gov). Reprints can be ordered at <http://www.ajph.org> by clicking the "Reprints/Eprints" link.

This article was accepted January 28, 2010.

Note. The findings and conclusions in this article are those of the authors and do not necessarily represent the views of the National Institute for Occupational Safety and Health.

Contributors

S. Tak led the design, analyses, and article development. M.H. Sweeney and G.M. Calvert directly participated in the planning and execution of this study. All authors contributed to the writing of the article.

Acknowledgment

We thank Jane Lipscomb, PhD, David Utterback, PhD, and Jarvis Chen, ScD, for their helpful comments.

Human Participant Protection

We analyzed public health surveillance data that are available at the National Center for Health Statistics Web site. These data did not require protocol approval, nor was informed consent required or obtained.

References

1. The Future Supply of Long-Term Care Workers in Relation to the Aging Baby Boom Generation: Report to Congress. Washington, DC: Department of Health and Human Services & Department of Labor; 2003.
2. Bureau of Labor Statistics. *National Industry-Occupation Employment Matrix: 2006–2016*. Washington, DC: Bureau of Labor Statistics; 2008.
3. Estry-Behar M, van der Heijden B, Camerino D, et al. Violence risks in nursing—results from the European 'NEXT' Study. *Occup Med (Lond)*. 2008;58(2):107–114.
4. Gerberich SG, Church TR, McGovern PM, et al. An epidemiological study of the magnitude and consequences of work related violence: the Minnesota Nurses' Study. *Occup Environ Med*. 2004;61(6):495–503.
5. Jackson D, Clare J, Mannix J. Who would want to be a nurse? Violence in the workplace—a factor in recruitment and retention. *J Nurs Manag*. 2002;10(1):13–20.
6. Castle NG, Engberg J. Organizational characteristics associated with staff turnover in nursing homes. *Gerontologist*. 2006;46(1):62–73.
7. Squillace MR, Remsburg RE, Bercovitz A, Rosenoff E, Branden L. An introduction to the National Nursing Assistant Survey. *Vital Health Stat 1*. 2007;44:1–54.
8. Research Triangle Institute. *SUDAAN Language Manual, Release 9.0*. Research Triangle Park, NC: Research Triangle Institute; 2004.
9. Searle S. *Linear models for unbalanced data*. New York, NY: John Wiley & Sons; 1987.
10. Hox JJ. *Multilevel Analysis. Techniques and Applications*. Mahwah, NJ: Lawrence Erlbaum Associates; 2002.
11. Kreft I, Leeuw JD. *Introducing Multilevel Modeling*. London, United Kingdom: SAGE Publications Ltd; 1998.
12. Goldstein H. *Multilevel Statistical Models*. London, United Kingdom: Edward Arnold; 1995.
13. Raudenbush SW, Bryk AS, Cheong YF, Congdon R. *Hierarchical Linear and Nonlinear Modeling*. Lincolnwood, IL: Scientific Software International; 2004.
14. Larsen K, Merlo J. Appropriate assessment of neighborhood effects on individual health: integrating random and fixed effects in multilevel logistic regression. *Am J Epidemiol*. 2005;161(1):81–88.
15. Merlo J, Chaix B, Ohlsson H, et al. A brief conceptual tutorial of multilevel analysis in social epidemiology: using measures of clustering in multilevel logistic regression to investigate contextual phenomena. *J Epidemiol Community Health*. 2006;60(4):290–297.
16. Merlo J, Lynch JW, Yang M, et al. Effect of neighborhood social participation on individual use of hormone replacement therapy and antihypertensive medication: a multilevel analysis. *Am J Epidemiol*. 2003;157(9):774–783.
17. Larsen K, Petersen JH, Budtz-Jorgensen E, Endahl L. Interpreting parameters in the logistic regression model with random effects. *Biometrics*. 2000;56(3):909–914.
18. National Institute for Occupational Safety and Health (NIOSH). *Violence: Occupational Hazards in Hospitals*. Cincinnati, OH: Centers for Disease Control and Prevention/NIOSH; 2002. Report no. DHHS (NIOSH) 2002-101.

19. Bureau of Labor Statistics. *Nonfatal Occupational Injuries and Illnesses Requiring Days away from Work, 2006*. Washington, DC: Bureau of Labor Statistics; 2007.
20. Morgan DG, Semchuk KM, Stewart NJ, D'Arcy C. Job strain among staff of rural nursing homes. A comparison of nurses, aides, and activity workers. *J Nurs Adm*. 2002;32(3):152–161.
21. Morgan DG, Stewart NJ, D'Arcy C, Forbes D, Lawson J. Work stress and physical assault of nursing aides in rural nursing homes with and without dementia special care units. *J Psychiatr Ment Health Nurs*. 2005;12(3):347–358.
22. Lyketsos CG. Aggression in dementia. In: Vellas B, Fitten LJ, eds. *Research and Practice in Alzheimer's Disease*. New York, NY: Springer Publishing Company; 2000:169–175.
23. Somboontanont W, Sloane PD, Floyd FJ, Holditch-Davis D, Hogue CC, Mitchell CM. Assaultive behavior in Alzheimer's disease: identifying immediate antecedents during bathing. *J Gerontol Nurs*. 2004;30(9):22–29, quiz 55–56.
24. Maas M, Buckwalter KC, Swanson E, Mobily PR. Training key to job satisfaction. *J Long Term Care Adm*. 1994;22(1):23–26.
25. Coogle CL, Parham IA, Young KA. Job satisfaction and career commitment among nursing assistants providing Alzheimer's care. *Am J Alzheimers Dis Other Demen*. 2007;22(4):251–260.
26. US Department of Labor & Occupational Safety and Health Administration. *Guidelines for Preventing Workplace Violence for Health Care & Social Service Workers*. Washington, DC: US Department of Labor & Occupational Safety and Health Administration; 2004. OSHA 3148-01R 2004. Available at: <http://www.osha.gov/Publications/OSHA3148/osha3148.html>. Accessed June 17, 2010.
27. Warner M, Schenker N, Heinen MA, Fingerhut LA. The effects of recall on reporting injury and poisoning episodes in the National Health Interview Survey. *Inj Prev*. 2005;11(5):282–287.
28. Rosenman KD, Kalush A, Reilly MJ, Gardiner JC, Reeves M, Luo Z. How much work-related injury and illness is missed by the current national surveillance system? *J Occup Environ Med*. 2006;48(4):357–365.
29. Azaroff LS, Levenstein C, Wegman DH. Occupational injury and illness surveillance: conceptual filters explain underreporting. *Am J Public Health*. 2002;92(9):1421–1429.