Worker Injuries and Safety Equipment in Ohio Nursing Homes

ABSTRACT

A survey of Ohio nursing homes was conducted in 2007 to examine whether injury rates were related to facility characteristics and availability of safety equipment. The median rate of injury in the 898 facilities was 5.7 injuries per 100 workers per year. Although 95% of the facilities had written resident lifting policies, only 22% of these were zero-lift policies. Gait transfer belts (99%) and portable total-lift hoists (96%) were common, whereas ceiling-mounted total-lift hoists were rarely reported (7%). In a multivariable analysis, injury rate ratios increased with the proportion of residents using wheelchairs and were lower in smaller facilities. Facilities without a lifting policy had a higher estimated injury rate than facilities without such a policy; however, none of the safety equipment was associated with significant changes in injury rates. More information, such as frequency of use and access to versus availability of equipment, may be needed to better understand the impact of safety equipment on nursing home worker injury rates.

More than two thirds of nursing home workers engage in direct resident care, which often involves back-stressing and heavy-lifting tasks. These activities may increase the risk of injury. In 2010, workers in the nursing and residential care facilities industry had a rate of recordable cases of nonfatal occupational injuries and illnesses of 8.3 per 100 full-time workers—the second-highest among private industries (Bureau of Labor Statistics, 2011). To give a context for this rate, consider that the overall rate (per 100 full-time workers) across all industries was 3.2, and the rates for

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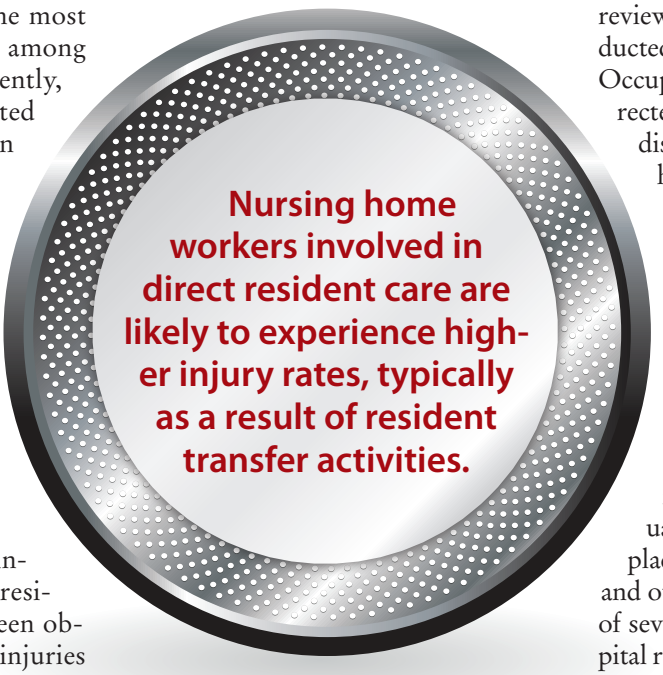
construction (overall), hospitals, and air transportation were 4.0, 7.0, and 8.1, respectively.

LITERATURE REVIEW

Nursing home workers involved in direct resident care are likely to experience higher injury rates, typically as a result of resident transfer activities. Musculoskeletal injuries are the most common type of injury that would result from frequent lifting and repositioning of residents (Myers, Silverstein, & Nelson, 2002; Trinkoff, Johantgen, Muntaner, & Le, 2005). Sprains and strains to the back and shoulder are the most common type of injuries among nursing home staff. Recently, Ngan et al. (2010) investigated musculoskeletal injuries in health care workers in British Columbia, Canada. Direct care aides had a musculoskeletal injury rate almost four times higher than RNs. They further reported that 60% of musculoskeletal injuries that occurred in direct care occupations were associated with patient handling activities.

A number of factors—including organizational and resident characteristics—have been observed to impact the rate of injuries in nursing home workers. Organizational characteristics include inclusion in a multifacility chain, profit/not-for-profit status, staffing levels, quality indicators, occupancy, and availability of transfer/patient-handling equipment and related policies. Castle, Engberg, Mendeloff, and Burns (2009) merged three cross-sectional data sources that allowed them to investigate workplace injuries as a function of organizational factors, staffing levels, and facility quality characteristics. Among their reported findings, they noted higher injury rates in nursing homes that were part of chains, were not-for-profit facilities, had higher occupancy, had lower nurse aide staffing levels, had higher RN staffing levels, and/or had lower quality scores.

In contrast to organizational and staff characteristics, Myers et al. (2002) noted that resident characteristics do not affect injury rates as much as work organization issues. Resident characteristics leading to greater direct care needs would be most relevant as predictors of nursing home worker injuries. In particular, transfer-related care needs would be of particular concern. These could be reflected in measures such as activities of daily living (ADLs), as done by Castle et al. (2009), or in the proportion of residents who are bedbound or use wheelchairs. Finally, a subcategory of organizational characteristics is the availability of equipment to assist in the lifting and transfer of residents, along with policies in support of its use. Collins, Wolf, Bell, and Evanoff (2004) and Garg (1999) demonstrated that mechanical lifts and repositioning aids, zero-lift or safe-lifting policies, and employee training significantly reduce injuries for full-time and part-time nursing home workers regardless of their age or experience. (As an aside, the term *safe-lifting policy* has been promoted as a more informative and relevant alternative to *zero-lift policy*.)



A number of studies have investigated interventions designed to reduce injury rates of nursing home workers. These interventions have included substituting portable hoists and transfer devices for manual lifting and transfer, ergonomic training for lifting and transfer, and employee participation in care planning. Waters, Collins, Galinsky, and Caruso (2006) reviewed the breadth of research conducted at the National Institute for Occupational Safety and Health directed at reducing musculoskeletal disorders and related injuries in health care workers and found injury incidence decreased with use of mechanical lifting equipment. Further, a zero-lift program reflecting sound ergonomic principles resulted in a reduction in injury rates, lost work days, and worker compensation costs. Collins et al. (2004) evaluated zero-lift programs where manual lifting and transfer were replaced by modern portable hoists and other transfer devices. This study of seven nursing homes and one hospital reported numerous benefits after program implementation, including a reduction in all injuries and in lost-workday injuries, coupled with nursing staff members' perceptions that their backs were less sore and they were less tired after work.

Fujishiro, Weaver, Heaney, Hamrick, and Marras (2005) studied interventions (consulting and equipment purchases) by the Ohio Bureau of Workers' Compensation (BWC) in 86 primarily nursing home facilities and compiled a detailed inventory of equipment purchased for addressing bending, lifting, and carrying. The median rate of musculoskeletal disorder injuries was reduced by half with the sponsored interventions, particu-

TABLE 1

CHARACTERISTICS OF THE RESPONDING FACILITIES (*N* = 898)

Variable	*n*	Minimum	Quartile 1	Median	Quartile 3	Maximum
ORGANIZATIONAL CHARACTERISTIC						
Licensed beds	898	12	64	100	123	427
Admissions in 2007 per licensed bed	771	0	1	1.4	2.2	10.8
Average number of employees	792	15	80	117	165	440
Average number of hours per employee per month	583	50	113.7	127.4	141.7	196.1
Number of days of job transfer or restriction per employee	742	0	0.1	0.3	1	18.6
Number of days away from work per employee	754	0	0.01	0.12	0.50	7.01
OUTCOME VARIABLE						
Injury rate[a]	791	0	2.9	5.7	9.2	40
Missing 1 day from work rate[a]	758	0	0.5	1.6	3.2	23.3
Other recordable cases rate[a]	754	0	0	1.4	3.8	97.5
Job transfer or restriction rate[a]	749	0	0	0.7	3.9	122.1
Other illnesses rate[a]	727	0	0	0	0	37.5
Injury rate per 2,000 working hours	582	0	0.04	0.08	0.12	0.80

[a] *Rate per 2,000 working hours.*

larly those focused on patient handling. Park, Bushnell, Bailer, Collins, and Stayner (2009) analyzed Ohio workers' compensation records in relation to intervention programs sponsored by the BWC in nursing homes and found a net benefit of expenditures for ergonomic improvements. Evanoff, Bohr, and Wolf (1999) observed that training and work practices supervised by an ergonomics team improved safety in the nursing homes. Regardless of the local economic conditions, job design, and other organizational factors, employee participation in interdisciplinary care plan meetings (Banaszak-Holl & Hines, 1996) was also a factor in reducing injury rates.

STUDY PURPOSE

This study examined factors associated with worker injury rates in Ohio nursing homes. This study simultaneously considered the availability of any of nine types of safety equipment along with other factors that might impact nursing home worker injury rates. This investigation of factors influencing nursing home worker injury rates was complemented by the first comprehensive description of safety equipment available in Ohio nursing homes. Ohio is an ideal state to study injuries among direct care nursing home workers, as it is the state with the second-highest number of nursing home residents in the nation. Ohio has nearly 1,000 nursing homes, which serve more than 75,000 residents on a typical day. The current nursing home workforce of RNs, licensed practical nurses, and nurse aides includes more than 65,000 workers. Ohio's population growth is below the national average due to outmigration, and this may affect employers' ability to attract and keep qualified workers (Manning & Mehdizadeh, 2008). Some nursing homes experience more than 100% annual turnover of workers (Straker, Applebaum, & Mehdizadeh, 1997), which shows how vital the issue of reducing workplace injuries is for Ohio to be able to care for its aging population.

METHOD

Data Source

A survey of Ohio nursing homes was conducted for the 2007 calendar year. At the beginning of 2007, 958 Ohio nursing homes were inspected as part of the Medicare/Medicaid certification program. Responding to this survey was mandatory and enforced by the state Department of Aging; 950 nursing homes responded. A safety module was included with other questions related to nursing home characteristics. The workplace safety questions were based on the Occupational Safety and Health Administration (OSHA, 2004) Form 300A.

Outcome Variable

The total number of injuries and injury rates (number of injuries per 100 employees per year) at each nurs-

TABLE 2

TRENDS IN FACILITY CHARACTERISTICS BY INJURY RATE GROUP

	Injury Rate Group[a]			
Variable[b]	**Low (0 to <3.92)**	**Medium (3.92 to 7.67)**	**High (>7.67)**	***p* Value[c]**
ORGANIZATIONAL CHARACTERISTICS				
Mean number of beds (*n* = 264, 263, 264)	95	104	106	[+] 0.0305
Mean number of employees (*n* = 264, 263, 264)	148	135	130	[–] 0.0215
Mean number of admissions per licensed beds in 2007 (*n* = 253, 260, 253)	1.6	2	1.9	0.2245
Percentage of facilities part of a multifacility chain (*n* = 259, 261, 259)	47	64	59	[+] 0.0045
Percentage of for-profit facilities (*n* = 256, 261, 258)	76	80	76	0.9548
RESIDENT CHARACTERISTICS				
Mean percentage of residents using wheelchairs (*n* = 226, 240, 248)	46	51	54	[+] 0.0414
Mean percentage of residents who are bedfast all or most of the time (*n* = 227, 238, 249)	3.7	3.6	4.4	0.2475
SAFETY EQUIPMENT AND POLICIES				
Percentage of facilities with written lifting policies (*n* = 252, 255, 259)	96	95	94	0.2427
Percentage of facilities with zero-lift policies (*n* = 246, 249, 245)	18	24	23	0.1474
Percentage of facilities with portable total-lift hoist (*n* = 260, 261, 262)	97	96	96	0.6494
Percentage of facilities with gait transfer belts (*n* = 260, 261, 262)	99	99	99	0.9934
Percentage of facilities with friction-reducing lateral aids (*n* = 260, 261, 262)	32	39	37	0.1921
Percentage of facilities with mechanical lateral transfer aids (*n* = 260, 261, 262)	23	32	31	[+] 0.0472
Percentage of facilities with toilet seat adjusted to wheelchair height (*n* = 260, 261, 262)	79	82	79	0.9646
Percentage of facilities with ceiling-mounted total-lift hoist (*n* = 260, 261, 262)	6	8	8	0.3240
Percentage of facilities with bath lift/easy-access bath tubs (*n* = 260, 261, 262)	53	54	56	0.4870
Percentage of facilities with powered sit-to-stand devices (*n* = 260, 261, 262)	55	70	65	[+] 0.0247
Percentage of facilities with electric beds (*n* = 260, 261, 262)	88	91	89	0.7511

*[a] Injury rate category = injuries per 100 workers per year. [b] The sample (*n*) for each injury rate group (low, medium, and high, respectively) is provided in parentheses after each variable description. [c] p values < 0.05 are preceded by [+] for positive trends or [–] for negative trends. Trend test of whether a particular characteristic increases or decreases across the nursing homes in the three injury rate groups is based on simple linear regression for continuous measured characteristics (e.g., mean number of beds) or a Cochran-Armitage trend test for proportions for dichotomous characteristics (e.g., percentage of facilities part of a multifacility chain).*

ing home were the primary outcomes of interest in this analysis. Other injury-related measures included the number of days away from work due to injury and number of days of job transfer or restriction per year.

Predictor Variables

Safety Equipment and Policies. The survey questions addressing safety program and equipment were designed to assess (a) the current availability of safety equipment and (b) strategies used to reduce on-the-job injuries in nursing homes. Facilities were also asked to report which kinds of safety equipment were available (e.g., electric beds, lift hoists, transfer belts), although the extent of utilization of such equipment was not reported. The most common 23

safety equipment profiles constructed for the nine possible types of safety equipment were also modeled. In addition, facilities reported whether they had a zero-lift policy in place.

Organizational Variables. Nursing home characteristics examined included: total number of licensed beds, admissions in 2007 per licensed bed, average number of employees (both nursing and non-nursing employees), and average number of hours per employee per month. Whether a nursing home was part of a chain and whether a facility was operated as for profit or not for profit were also recorded for each facility.

Resident Characteristics. The proportion of residents using wheelchairs and the proportion of bedfast residents are surrogates for the level of care required of facility residents. A more disabled resident population may require more lifting and transfer, which may increase risk of injury. By considering the number of residents using wheelchairs and bedfast residents, the care needs of residents are indirectly assessed.

Statistical Methods

Basic summary statistics were constructed (minimum, quartiles, maximum) for numeric organizational characteristics and the outcomes variables. Summary statistics for numeric and nominal variables (means for numeric variables and percentages for nominal variables) were constructed for nursing homes divided into three (approximately) equal-sized subgroups based on injury rates. The trend in values of each variable across these three groups was evaluated using simple linear regression for numeric variables and Cochran-Armitage trend test for proportions for nominal variables. A table identifying the different combinations/profiles of safety equipment found at nursing facilities was constructed and annotated with the median injury rate for the nursing homes included in each profile. Finally, a multiple predictor model for injury rates was developed. Here, Poisson regression was used to model injury rates (per 100 workers per year) as a function of one or more predictor variables (Bailer, Reed, & Stayner, 1997; Frome, 1983).

In these models, the log rate of injury was expressed as a linear function of predictor variables, assuming the count of the number of injury cases had a Poisson distribution and with the observation time on which the rate is based used as an offset in the model. (Here, total hours worked was divided by 2,000 to represent a full-time worker and then scaled to represent the rate for 100 such workers). Rate ratios were constructed as summary measures of the multiplicative impact of predictor variables on injury rates. The analysis and model fits described in this article were generated using SAS/STAT software, version 9.1.3.

RESULTS

A descriptive summary of several key variables characterizing nursing homes in the survey is presented in **Table 1.** Of the 950 facilities that responded, 52 were part of a hospital and were dropped from the analysis because these care environments and work life are considered to be substantially different from nursing homes. Eliminating these resulted in an analysis data set of 898 facilities. Those nursing homes were split into an approximately three-to-one ratio of for-profit versus not-for-profit organizations and an approximate six-to-five ratio of homes that were part of a chain versus independent. The median size of these facilities was 100 beds, with a range from 12 to 427. The median number of employees at these facilities was 117, with a range from 15 to 440. The median reported injury rates was 5.7 per 100 workers, and the median rate of injuries resulting in missing at least 1 day of work was 1.6 per 100 employees.

The nursing homes were stratified into three equivalently sized groups based on injury rate. Each group included 264 or fewer nursing homes. Note that the sample size in each group varies, depending on the number that answered each question ($n \geqslant 226$). Nursing homes in the low-injury group had injury rates of fewer than 3.92 injuries per 100 workers, those in the middle group had injury rates between 3.92 and 7.67, and those in the high-injury group had injury rates in excess of 7.67 per 100 workers.

The characteristics of interest that increased in value over the injury categories were the mean number of beds, percentage of facilities belonging to a chain, percentage of residents using wheelchairs, percentage of facilities with mechanical lateral transfer aids, and percentage of facilities with powered sit-to-stand devices (**Table 2**). The characteristic of interest that decreased over injury categories was mean number of employees (**Table 2**). One caution when looking at **Table 2** is that these are marginal comparisons that do not include any information related to the care needs in a particular facility. Patterns in analyses that consider the effect of a variable controlling for other factors in a model may result in directions that differ from this simple one-variable-at-a-time summary.

As previously mentioned, nursing homes were asked whether they had any of nine different types of safety equipment in their facilities. The top 23 safety equipment profiles are displayed in **Table 3** in descending order of median injury rate. Toilets seats adjusted to wheelchair height, friction-reducing lateral aids, mechanical lateral transfer aids, and bath lift/easy-access bath tubs were found in nursing homes with a range of worker injury rates. Nursing homes without powered sit-to-stand devices exhibited lower unadjusted injury rates. These 23 different profiles of safety equipment accounted for more than 80% of the total number of nursing homes participating in the survey. Notably, the facilities with the greatest number of safety equipment did not necessarily have lower injury rates. Portable

TABLE 3

PROFILES OF SAFETY EQUIPMENT[a] AVAILABLE IN FACILITIES IN DESCENDING ORDER BY INJURY RATE[b]

Equipment Profile	Portable Total-Lift Hoist	Gait Transfer Belts	Electric Beds	Toilet Seat Adjusted to Wheelchair Height	Friction-Reducing Lateral Aids	Mechanical Lateral Transfer Aids	Bath Lift/ Easy-Access Bath Tubs	Powered Sit-to-Stand Devices	Ceiling-Mounted Total-Lift Hoist	No. of Safety Equipment Available	No. of Facilities	Median Injuries per 100 Employees
Safety equipment combination	X	X	X				X			4	10	8.33
	X	X	X	X	X	X		X		7	23	7.02
	X	X	X	X	X	X				6	9	6.97
	X	X	X	X		X	X	X		7	25	6.96
	X	X	X	X	X	X	X			7	13	6.96
	X	X	X	X	X			X		6	29	6.67
	X	X								2	10	6.64
	X	X	X				X	X		5	27	6.35
	X	X	X					X		4	66	6.30
	X	X	X	X		X		X		6	14	6.06
	X	X		X						3	16	5.98
	X	X	X	X	X					5	14	5.83
	X	X	X	X	X		X	X		7	43	5.71
	X	X	X	X			X	X		6	80	5.53
	X	X	X					X		4	19	5.43
	X	X	X	X	X	X	X	X		8	64	5.33
	X	X	X	X	X	X	X	X	X	9	11	5.01
	X	X	X							3	32	4.73
	X	X	X	X						4	56	4.67
	X	X	X	X		X	X			6	11	4.26
	X	X	X	X			X			5	42	3.63
	X	X		X			X			4	9	3.51
	X	X	X	X	X		X			6	19	3.23
Other combinations											150	5.88
Total											793	5.68
Missing data											105	

[a] These top 23 profiles represented more than 80% of facilities. [b] Per 100 employees.

TABLE 4

RESULTS FROM THE MULTIVARIABLE MODEL FOR PREDICTING INJURY RATES

Parameter		Estimate	Standard Error	*p* Value	Rate Ratio (95% CI)
Constant		–1.82	0.30	<0.0001	
Facility part of multifacility chain	No	–0.11	0.07	0.13	0.90 (0.78, 1.03)
	Yes[a]				
Type of organization	For profit[a]	0.10	0.10	0.27	1.11 (0.91, 1.34)
	Not for profit				
Ratio of number of residents using wheelchairs to number of licensed beds		0.89	0.26	0.0006	2.44 (1.46, 4.05)
Ratio of number of bedfast residents to number of licensed beds		0.95	1.70	0.57	2.59 (0.09, 72.39)
Facility has written lifting policy	No	–0.01	0.08	0.90	0.99 (0.85, 1.16)
	Yes[a]				
Facility has zero-lift policy	No	0.35	0.18	0.05	1.42 (1.00, 2.02)
	Yes[a]				
Mean number of employees for all pay periods		–0.0007	0.0006	0.25	1.00 (0.998, 1.000)
Number of licensed beds	<51	–0.90	0.19	<0.0001	0.41 (0.28, 0.59)
	51 to 100	–0.50	0.13	<0.0001	0.61 (0.47, 0.78)
	101 to 125	–0.42	0.10	<0.0001	0.66 (0.54, 0.80)
	>125[a]				
Portable total-lift hoist available	No	0.12	0.19	0.52	1.13 (0.78, 1.64)
	Yes[a]				
Gait transfer belts available	No	–0.29	0.27	0.28	0.75 (0.44, 1.27)
	Yes[a]				
Friction-reducing lateral aids available	No	–0.09	0.08	0.23	0.91 (0.78, 1.07)
	Yes[a]				
Mechanical lateral transfer aids available	No	0.05	0.08	0.51	1.05 (0.90, 1.23)
	Yes[a]				
Toilet seats adjusted to wheelchair height available	No	–0.09	0.10	0.35	0.91 (0.75, 1.11)
	Yes[a]				

total-lift hoists and gait transfer belts were available in all of the top 23 profiles, and electric beds were available in 20 of the 23 most common profiles. The least common piece of safety equipment was the ceiling-mounted total-lift hoist, which was available in only 1 of the top 23 profiles (11 nursing homes).

At a very simple level, one might expect that injury rates would be lowest in facilities with the most safety equipment in their profile. This would translate into an expectation that top rows in **Table 3** (highest median injury rates) would have the lowest number of pieces of safety equipment available and that lower rows (lowest median injury rates) would have the highest; however, this is not observed. The availability of safety equipment at a facility does not mean it is easily accessible on all floors or that staff are using it. Further, the purchase of equipment might be in response to an excess of worker injuries. This cannot be disentangled with these data.

The coefficients from the multivariable model for predicting injury rates are presented in **Table 4.** In this analysis, the effect of each variable is interpreted in light of controlling for all other factors in the model. The injury rate is predicted to increase by a factor of 1.25, rate ratio (RR) = *exp* (0.89×[0.50 – 0.25]) = 1.25, as the

TABLE 4 (CONTINUED)

RESULTS FROM THE MULTIVARIABLE MODEL FOR PREDICTING INJURY RATES

Parameter		Estimate	Standard Error	*p* Value	Rate Ratio (95% CI)
Ceiling-mounted total-lift hoist available	No	0.13	0.15	0.37	1.14 (0.85, 1.53)
	Yes[a]				
Bath lift/easy-access bath tubs available	No	–0.05	0.07	0.47	0.95 (0.83, 1.09)
	Yes[a]				
Powered sit-to-stand devices available	No	–0.08	0.08	0.32	0.92 (0.79, 1.08)
	Yes[a]				
Electric beds available	No	0.23	0.12	0.07	1.26 (0.99, 1.59)
	Yes[a]				
Ratio of admissions to number of licensed beds		0.05	0.03	0.08	1.05 (0.99, 1.11)
Mean number of hours worked per month per employee		–0.0025	0.0014	0.08	0.998 (0.995, 1.000)
Total number of residents using wheelchairs for 2007		–0.0069	0.0022	0.0022	0.99 (0.989, 0.997)
Total number of bedfast residents for 2007		–0.02	0.02	0.22	0.98 (0.94, 1.02)

Note. CI = confidence interval.

[a] *Reference levels for the categorical variables.*

ratio of number of residents using wheelchairs to number of licensed beds increases from 25% to 50%, holding all other predictor variables constant. The smallest facilities (less than 51 licensed beds) have a predicted injury rate 0.41 (95% confidence interval [CI]: 0.28, 0.59) times lower than the rate in the largest facilities (more than 125 licensed beds). It is important to note that this differs from the positive association suggested by the one-variable-at-a-time analysis in **Table 2.** This factor increases (RR = 0.61 [CI: 0.47, 0.78] and RR = 0.66 [CI: 0.54, 0.80]) in the middle two size categories (51 to 100 and 101 to 125 beds), respectively.

The absence of a zero-lift policy results in an RR = 1.42 (CI: 1.00, 2.02), suggesting that the rate of injury in a nursing home that does not have a zero-lift policy is 42% higher than the injury rate in a nursing home that has a zero-lift policy. While this point estimate suggests a protective effect of having a zero-lift policy, the CI suggests the effect of not having a zero-lift policy effect can range from having no protective effect to having twice the injury rate. Arguably, a clear prior hypothesis of a protective effect is present and a one-tailed CI is appropriate, which would indicate a significant effect.

DISCUSSION

In this study, we characterized the safety equipment available in Ohio nursing homes and linked the equipment, along with other facility characteristics, to nursing home worker injury rates. We reported 23 of the safety equipment profiles (composed of combinations of 9 types of safety equipment) that described more than 80% of nursing homes. No clear relationship was found between the number of types of equipment available and worker injury rates. Multivariable models of injury rates suggested lower reported injury rates were associated with smaller facilities, nursing homes with a zero-lift policy, and facilities with a lower mean number of residents using wheelchairs. None of the particular equipment was significantly related to injury rates. As with all multivariable models, the impact of each predictor variable is evaluated in the context of all other predictor variables in the model. Thus, future analyses might examine alternative metrics of safety equipment profiles as an alternative to separate additive effects on the (log) rate of worker injuries.

Larger nursing homes reported significantly higher worker injury rates in the multivariable model. This may reflect a decrease in staffing ratios (number of residents per number of direct care workers) in larger facilities. A review of direct care practice might lead to insights and possible explanations for the differences in injury rates between larger and smaller facilities. For example, workers in larger facilities may find that the equipment is farther away when needed and may not take the time to bring it to where

it is currently needed. An alternative explanation is that these facilities may have a more established process for the reliable completion of OSHA logs for worker injuries than smaller facilities. Thus, larger facilities and those in multifacility chains may be more accurate than smaller facilities in reporting injuries. Nursing homes with a higher proportion of residents using wheelchairs experience higher worker injury rates. This may reflect more exposure to musculoskeletal stress and strain associated with resident transfer. (The number of residents with wheelchairs is an accurate surrogate measure for exposure to musculoskeletal stress and strain for it directly reflects residents' inability to bear weight.) Staffing ratios and availability of resident transfer equipment could be indexed to resident transfer needs, as indicated by mean proportion of wheelchair users or another index. Finally, facilities without a zero-lift policy had an estimated 42% higher reported injury rate than those with a policy. The nonsignificance of the separate equipment types may be due to the difficulty of detecting an effect of such equipment given the presence of a zero-lift policy. It is difficult to imagine a facility with a zero-lift policy that does not have some kind of lifting or transfer equipment available.

Castle et al.'s (2009) analysis is most relevant for comparison to our work. Castle et al. (2009) identified higher injury rates in not-for-profit versus for-profit nursing homes and in facilities that were part of chains. Our estimates of the effects of these factors were not statistically significant, although the point estimates of the effects were in the same direction. Facility size was significantly related to injury rates in our study, although not in Castle et al.'s (2009). Our work differed on other dimensions, as well including explicitly modeled safety equipment; not including control variables corresponding to geographical and economic context (e.g., urban location, per-capita income, number of nursing home beds in county); measuring resident care need using a surrogate measure related to transfer needs (residents using wheelchairs versus ADLs); and a staffing measure based on number of employees (versus ratio of staff to residents). Finally, we focused on rate modeling of injuries using Poisson regression versus logistic regression to model a dichotomous outcome defined as higher-than-average injury rates.

This study has several limitations. First, this was a cross-sectional study, and thus, we cannot assert a causal relationship between safety equipment and policies and rates of worker injury. Second, we did not have injuries recorded exclusively for direct care nursing staff. Because nursing home reports were based on the OSHA form that collects data on all workers, the workers of interest included everyone on a nursing home's payroll—full time, part time, contract, or agency staff—regardless of the employee's duties or job title. Therefore, direct care nursing workers were counted along with other staff (e.g., administrative, custodial). Approximately two thirds of nursing home workers are involved in direct care of residents, and these workers are more likely to have work-related injuries. Thus, we believe that rates constructed here are likely underestimates of the true injury rate experienced by direct care workers.

While this study has not been able to definitively explain the linkage between worker injuries and nursing home safety equipment, this research documents the range of injury rates across Ohio nursing homes, along with the range of safety equipment currently in use. It is important to note that the underlying issue here is not only the presence of lifting equipment and assistive devices, but whether these devices are used. Future studies might examine the nursing homes with the highest and lowest rates of worker injury in an effort to better understand how to reduce injury rates. Given the high cost of nursing home care in Ohio, efforts that can improve quality and decrease costs are critical for state policy makers and the industry overall. In addition, efforts that reduce injuries may also assist Ohio's nursing homes in retaining staff who are so critically needed to meet the care needs of older Ohioans.

CONCLUSION AND IMPLICATIONS FOR RESEARCH AND PRACTICE

The relationship between worker injury rates is more complicated than

KEYPOINTS

Stanev, S., Bailer, A.J., Straker, J.K., Mehdizadeh, S., Park, R.M., & Li, H. (2012). **Worker Injuries and Safety Equipment in Ohio Nursing Homes.** *Journal of Gerontological Nursing, 38*(6), 47-56.

1. Injuries are most prevalent among workers in larger facilities and facilities with more residents who use wheelchairs.
2. The presence of no single piece of equipment or combination of equipment is associated with nursing homes exhibiting fewer worker injuries. The impact of access and frequency of use of such equipment is an important topic for future research.
3. Among the many factors associated with injury rates in nursing homes, self-reported availability of lifting and other protective devices does not clearly predict fewer injuries. Enforcement of no-lift policies, which implies the use of such equipment, is associated with lower injury rates.

can be resolved by a simple cross-sectional look at safety equipment availability. For example, a facility with an excess of worker injuries might respond by investing in additional safety equipment. In this case, the availability of safety equipment may signal a facility with higher-than-average rates of injury. In addition, facilities that have residents with greater care needs may require more resident transfers, and thus, workers at such facilities may be at higher risk. Another important indicator that is missing from this study is the extent to which equipment is actually used. Some facilities may have a stricter safety culture in which available equipment is always used, but in other facilities, where staff members may use equipment only when convenient or absolutely necessary. Future studies should incorporate this information to the fullest extent possible.

This work has numerous clinical implications for gerontological nurses. Special concern exists for injuries to nurses working in facilities with higher numbers of wheelchair-using residents and for nurses working in larger facilities. Resident transfer activities are more frequent when caring for residents who use wheelchairs, and transfers are one of the activities associated with a higher risk of injury. The greater risk of injury at larger facilities may suggest that transfer/lifting equipment needs to be more conveniently located to facilitate use. While this study provides a description of the availability of transfer/lifting equipment, information on the frequency of use was not available. Nurses might benefit from examining the convenience of equipment locations and monitoring the use of such equipment at their workplace. Finally, the absence of a zero-lift policy at a facility was associated with higher worker injury rates. Gerontological nurses may want to examine the policies that currently apply in their workplace and advocate for appropriate changes.

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The authors have disclosed no potential conflicts of interest, financial or otherwise. Data were collected under a contract with the Ohio Department of Aging. Drs. J. Collins (NIOSH), R. Applebaum (Miami University), and L. Stayner (University of Illinois-Chicago) all provided comments on an earlier draft of this manuscript. Anonymous reviewer and Editor comments on early versions of this manuscript resulted in a much improved presentation. The authors are very appreciative of this guidance.

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Received: March 27, 2011
Accepted: January 27, 2012
Posted: May 18, 2012
doi:10.3928/00989134-20120508-01