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Disabling Back Injuries Among Nursing Personnel: Research Needs and Justification

Roger C. Jensen

The need for more research on the problem of work-related back injuries among nursing personnel is documented by two comparisons based on the ratio of back injury workers' compensation claims to eligible employees. The first analysis of occupations across industries indicated that nursing aides, licensed practical nurses, and registered nurses all had high back injury ratios compared to other occupations. The second analysis of occupations within four parts of the health care industry indicated that aides in nursing and personal care facilities had the greatest problem with disabling back disorders. The article concludes with a list of research needs and suggested research methodologies.

Health care industry employees are certainly not immune from work-related injury and illness (Howells & Knight, 1981). Nursing personnel in particular experience relatively high prevalence of back pain (Cust, Pearson, & Mair, 1972; Harber, Billet, Gutowski, SooHoo, Lew, & Roman, 1985; Magora & Taustein, 1969; Owen & Damron, 1984), and frequent inability to work due to back pain (Klein, Jensen, & Sanderson, 1984). While such studies indicate that the back injury problem of nursing personnel is important, few nurse researchers have reported studies prevention programs. This may be due to the limited availability of research funding, or a failure to recognize the many unanswered questions. Whatever the reasons, this injury problem needs research, and nurses with research skills should be able to contribute more than other researchers due to greater familiarity with nursing tasks and procedures, appreciation for constraints on the way tasks are performed, understanding of patient needs, and access to appropriate study populations.

The potential benefits of getting nurse researchers to focus on this problem prompted the initiation of this investigation as part of a larger project of the National Institute for Occupational Safety and Health (NIOSH). The specific goals of the investigation were developed after reviewing literature on the subject and identifying three basic prerequisites for generating more research. These were to develop the background material needed to support funding requests, identify appropriate study populations, and select research projects that address critical issues.

Funding requests generally require showing that the problem is important. The matter of how back injuries compare in importance to other occupational injuries and illnesses has been addressed by (NIOSH), the U.S. Public Health Service agency with primary responsibility for research concerning the prevention of work-related injuries and ill-

Roger C. Jensen, MSE, JD, is a Senior Engineer Officer, Commissioned Corps of the U.S. Public Health Service, National Institute for Occupational Safety and Health, Division of Safety Research, Morgantown WV.

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Address for reprint requests: Roger Jensen, NIOSH-DSR, 944 Chestnut Ridge Road, Morgantown WV 26505-2888.

nesses. NIOSH established a priority list consisting of the 10 leading occupational injury and illness problem areas (Millar & Myers, 1983). Disabling back pain is included among the second problem area—musculoskeletal disorders resulting from occupational exposure to stressors such as manual load handling, vibration, repeated pressure, and repetitive motion. Within this problem area, back injuries account for almost half of the workers' compensation cases (NIOSH, 1985). Thus, NIOSH clearly recognizes occupational back injury as an important problem.

Another government agency totally independent of NIOSH recently reported that low back pain is surpassed only by upper respiratory tract ailments in terms of total contribution to lost work-time and that low back pain is the most costly occupational ailment in terms of treatment costs plus workers' compensation expenditures (Office of Technology Assessment, 1985). The annual cost to United States employers for workers' compensation for back injuries has been estimated at 2.7 billion or 4.6 billion dollars, depending on which estimation method is used (Snook & Jensen, 1984). Additionally, workers' compensation record systems indicate that back injury cases coded as sprains or strains contribute about one-fifth of all workers' compensation cases (Klein et al., 1984). Such figures, however, only show that back injury is an important occupational ailment. To compete for research funding it is necessary to document why the back injury problems experienced by nursing personnel should have a high priority relative to back injuries experienced by other occupational groups.

Many of the studies comparing occupations in terms of low back pain have been sumarized recently (see Andersson, Pope, & Frymoyer, 1984; Yu, Roht Wise, Kilian, & Weir, 1984). Only a few such studies compare nursing occupations with other occupational groups in terms of back pain prevalence, incidence, or disability. Some reports included only health care industry employees. One retrospective study of a large general hospital in Israel found that occupational category was the single most important determinant of injury rate (Pines & Cleghorn de Rohrmoser, 1985). Two other comparisons of nursing personnel to other hospital employees collectively indicated that nursing personnel sustained more lifting injuries (Hoover, 1973), and more lost-workday injuries (Hefferin & Hill, 1976). A study of reported cases of back pain during a one-year period in a major university hospital found no differences in incidence between registered nurses, licensed practical nurses, and nursing aides (Wilkinson, 1983). At another university hospital in the U.S., a questionnaire survey of 513 RNs and licensed vocational nurses, plus 37 unit service coordinators, found that 52% of the nurses and 20% of the unit service coordinators reported experiencing low back pain during the past 12 months (Harber et al., 1985). A survey of nursing personnel in Finland found that nursing aides had higher percentages than nurses of lifetime prevalence and days of unfitness for daily tasks due to low back pain, but no difference in chronic disability (Videman, Nurminen, Tola, Kuorinka, Vanharanta, & Troup, 1984). A survey of nursing personnel in four districts of the British National Health System (BNHS) failed to find differences in point prevalence of low back pain between nursing personnel groups defined by the BNHS occupational classification system (Stubbs, Buckle, Hudson, Rivers, & Worringham, 1983). Injuries reported by employees in three Australian general hospitals were analyzed by Ferguson (1970). Only those cases recorded as strain injuries were analyzed. The patient-handling occupations had the largest incidence, and the most adversely affected group was female nursing aide trainees.

A few comparisons with workers outside the health care industry have been reported. Magora and Taustein (1969) reported the results of a multi-occupational survey in Israel that ranked nurses second in terms of back pain prevalence, after heavy industry workers. Nurses ranked higher than farmers, light industry workers, bus drivers, post office clerks, bank clerks, and policemen. A survey in Great Britain of nursing personnel and teachers found: (a) lifetime prevalence of low back pain was slightly, but nonsignificantly, higher in female nurses (34.6%) than the female teachers (30.0%), as well as in male nurses (45.9%) compared to male teachers (38.6%); (b) lifetime prevalence of low back pain attributed to their work was significantly higher in the female nurses (19.9%) than the female teachers (12.8%), and higher, but nonsignificantly due to the

small samples, in the male nurses (32.4%) than the male teachers (12.2%) (Cust et al., 1972). Danish occupational injury reports indicated that of all cases classified as overstraining the back, over 42% were coded as involving hospital work, home nursing, or patient treatment (Biering-Sørensen, 1985). Also, studies of selected populations in Denmark found that forklift operators, nursing aides, and hospital porters reported the highest point prevalence and period prevalence of low back trouble; somewhat lower prevalence percentages were found among nurses and housewives (Biering-Sørensen, 1985).

In the United States two relevant retrospective analyses of workers' compensation claim reports have been reported. Root and Sebastian (1981) ranked occupations within the Services Industrial Division as defined in the Standard Industrial Classification (SIC) Manual (Office of Management and Budget, 1972) in order of risk of work-related injury, including but not limited to back injuries. They found that nursing aides ranked fourth, behind truck drivers, freight and material handlers, and laborers. The other investigation compared occupations in terms of their ratio of workers' compensation claims for back sprains or strains to employed persons in the occupation (Klein et al., 1984). Their list of the 10 occupations with the largest incidence ratios [(below)] showed that nursing aides and licensed practical nurses ranked fifth and ninth respectively.

OCCUPATIONAL CATEGORY	RANK
Miscellaneous laborers	1
Garbage collectors	2
Warehousemen	3
Miscellaneous mechanics	4
Nursing aides, orderlies, & attendants	5
Nonspecific laborers	6
Material handlers	7
Lumberman	8
Licensed practical nurses	9
Construction laborers	10

These studies were limited in several respects. The various studies used different measures of the extent of the low back problem including point prevalence of pain, period prevalence of pain based on several different periods, incidence of reported episodes, and incidence of workers' compensation claims. Additionally, survey data from different countries are not easily compared due to different occupational classification systems. Another limitation of these investigations of back pain and disability is that the comparison of occupations without regard to industry of employment prevents the identification of more specific groups that might have exceptionally elevated risk of disabling back problems. Such information would be useful for focusing research resources toward investigations addressing the hazards faced by these populations.

This investigation makes three contributions toward the eventual reduction of back injuries among nursing personnel. The first is new data for comparing the back injury experiences of nursing personnel with other occupational groups in the United States. The second is a comparison of the disabling back injury experiences of nursing personnel working in five parts of the health care industry in order to identify occupation-by-industry groups that appear to be most adversely affected. Finally, a compilation of suggested research topics is provided in the Discussion section.

METHODS

Sample

Both injury and employment information were needed for comparisons. The injury data were obtained from the Bureau of Labor Statistics' Supplementary Data System (SDS). This is a federal-state cooperative injury information system based on pre-coded records submitted by participating states concerning their respective workers' compensation records during the past year (Bureau of Labor Statistics, 1982). The SDS coding variables used for this analysis were: year of occurrence, year case closed by agency, part of body injured, nature of injury or illness, type of event or exposure most directly causing the injury or illness, industry of employment, and claimant's occupation. Cases that occurred during 1980 were selected to provide the closest possible matching of case data to employment data obtained by the 1980 census. Further, in an attempt to include only cases determined to be compensable, only the seven states that submitted closed-case records for 1980 and 1981 were considered: Colorado, Delaware, Idaho,

Montana, New York, North Carolina, and Wisconsin. Delaware and Montana were not included because each reported comparatively few cases. The remaining five states provided a reasonable representation of geographic areas except both Idaho and Colorado are in the Rocky Mountain region. Since there was no apparent advantage to including both these states, a coin flip determined that Idaho would be included and Colorado excluded from the analysis.

Requirements for inclusion in the record systems of the four states differ somewhat. All four include cases of work-related death or permanent disability. For temporary disability the requirements for inclusion were: Idaho and Wisconsin, 4 or more days of disability; New York, 8 or more days of disability; North Carolina, 8 or more days of disability, or a shorter period of disability with medical costs greater than $200. Temporary disability in the context of workers' compensation refers to the employee actually missing work; not included are temporary reassignments to light duty jobs. Thus, back disorder cases found in workers' compensation data are a subset of the population of workers who experience low back pain. The subset should only include those workers with back pain that arose out of their work and resulted in their being permanently or temporarily disabled as defined by the applicable workers' compensation statute.

The SDS system for coding occupation included three employment categories involving patient handling tasks: registered nurses (RNs); licensed practical nurses (LPNs); and nursing aides, orderlies, and attendants (Aides). Employees in these classifications are collectively referred to as nursing personnel.

Employment information was derived from the U.S. Census of the Population for 1980. State-specific publications list the number of employed people (not including members of the armed forces) in each state for specified occupational categories (Bureau of the Census, 1984). Computer tapes containing a 5% sample of individuals provided additional information about employment (Bureau of the Census, 1983). Frequency output from these tapes were multiplied by 20 to obtain estimates of the respective population frequencies.

The industry classification systems for the injury and employment data differ. The injury data were classified using the SIC codes (Office of Management and Budget, 1972), whereas the employment data were coded with the Industrial Classification System (ICS) used for the census (Bureau of the Census, 1982). To obtain proper quotients for some of the industries it was necessary to include cases from multiple SIC's. This matching is shown on Table 1.

Measure

The criterion variable used for comparing groups of employees is an incidence ratio (IR). It is the number of cases arising from a population in a year divided by the average number of people in the population. For these analyses the numerator of the IR was the number of workers' compensation cases for the group in each state for which the SDS coding indicated: (a) the injury occurred in 1980, (b) the case was closed by the State workers' compensation agency during 1980 or 1981, (c) the part of body injured was the back, (d) the nature of the injury was a sprain or strain, and (e) the type of event which directly led to the injury was reported to be overexertion associated with lifting, pulling, pushing, carrying, or sudden motion. The denominator of the IR was the number of employed persons in the group covered by the workers' compensation plan of the particular state.

Procedures

The first analysis was a comparison of RNs, LPNs, and Aides, with 21 other occupational groups selected to provide interesting contrasts between occupations involving patient handling, other hospital jobs, and several familiar non-hospital jobs including two from the top ten list in Klein et al. (1984). IRs were determined for each occupation in each state using SDS data in the numerator, and corresponding denominator data obtained as follows. For each occupation, the numbers of civilian employed persons in each of the four States were obtained from the census publications (Bureau of the Census, 1984). Subtracted from these figures were the number of employees not covered by the state workers' compensation plan, i.e., federal government civilian workers, self-employed individuals, and unpaid family workers. The numbers for these non-covered

Table 1. Industry Categories Used for the Incidence Ratio of Back Injuries (Numerator) to Employees (Denominator) (Employment)

Injuries (SIC)	Employees (ICS)[b]	Industry Title (ICS)[b]
801 + 803	812	Offices of Physicians[c]
805	832	Nursing and Personal Care Facilities[d]
806	831	Hospitals[e]
807 + 808 + 809	840	Health Services, not elsewhere classified[f]

[a] Standard Industrial Classification Manual (Office of Management and Budget, 1972).
[b] Industrial Classification System (Bureau of the Census, 1982).
[c] Includes offices of either medical or osteopathic physicians.
[d] Includes such facilities as alcoholic sanitariums, convalescent homes, nursing homes, and retardation centers.
[e] Includes asylums, community hospitals, university hospitals, specialized hospitals like kidney dialysis centers, mental hospitals, osteopathic hospitals, and medical clinics.
[f] Includes abortion clinics, non-manufacturing medical support laboratories, medical research laboratories, birth control clinics, city health services not in the other health services categories, out-patient clinics for drug and alcohol problems, and physical therapy clinics.

employees were obtained from the Public-Use Microdata Files (Bureau of the Census, 1983). The results of this subtraction were used as occupation-specific estimates of the number of people who were eligible for state worker's compensation in 1980 if they incurred a work-related injury that met the various requirements for compensation.

The second analysis was a comparison of the IRs of employment groups defined by the intersects of three occupational categories (Aides, RNs, and LPNs), and four health care industries (offices of physicians, nursing and personal care facilities, hospitals and health services not elsewhere classified). For each state the IRs of these occupation-by-industry groups were determined using SDS data in the numerator and census data in the denominator (Bureau of the Census, 1983).

In both analyses the IR values were used for rank-ordering the groups within each state. Some of the groups had IR = 0 due to their having zero cases. These groups were assigned ranks according to the order of their respective population so that larger population groups were assigned a higher rank value. The rationale was that a larger population with zero cases is more likely to actually have a lower incidence ratio than a smaller population with zero cases. For multi-state analyses, the within-state ranks were averaged using a weighting formula to account for differences in the respective state populations. This rank-ordering procedure was used for both analyses.

RESULTS

The results of the rank-order analysis of occupations are shown in Table 2. The occupations are listed in order of their respective IRs; rank 1 corresponding to the largest IR. The Friedman Rank Sum test confirmed that the occupational groups differ in their IRs at the 0.001 significance level (Hollander & Wolfe, 1973). The state-specific ranks of the nursing personnel were remarkably consistent across the four states; Aides ranged from 1 to 3, LPNs ranged from 3 to 5, and RNs ranged from 6 to 9.

Occupations-by-Industry Groups

Twelve groups are defined by three occupational categories and four industry categories. The group-specific IRs were used to rank order the 12 groups in each state. The groups are listed in Table 3 in order of their multi-state weighted average rank. The list shows that Aides in nursing and personal care facilities had the greatest IR for disabling back disorders. LPNs in hospitals

Table 2. Occupational Rankings Based on Incidence Rates (RI) of Back Sprains and Strains Reported by Four Workers' Compensation Agencies

Occupational Category[a]	State				Average Rank[b]
	ID	NC	NY	WI	
NURSING AIDES, ORDERLIES, & ATTENDANTS	2	3	1	1	1.4
Construction laborers	6	2	2	2	2.2
Garbage collectors	1	1	4	3	3.3
LICENSED PRACTICAL NURSES	3	5	3	4	3.6
Truck drivers	4	4	5	5	4.7
REGISTERED NURSES	7	9	6	7	6.6
Health aides (except nursing aides)	5	6	7	8	7.0
Machinists	8	8	9	6	8.0
Radiologic technicians	15	7	8	9	8.3
Therapist	12	11	12	10	11.5
Cooks (not including household cooks)	11	12	11	13	11.7
Cashiers	10	14	14	11	13.4
Health record technicians	19	20	10	18	13.9
Clinical lab. technicians	16	19	13	15	14.7
Dietitians	22	13	22	19	16.4
Stenographers	21	21	16	21	16.9
File clerks	9	24	15	24	17.1
Industrial engineers	13	17	20	12	17.5
Typists	18	15	18	17	17.6
Librarians	14	16	19	23	19.0
Dental assistants	24	23	17	22	19.1
Pharmacists	23	10	24	14	19.5
Telephone operator	17	18	21	16	19.9
Dental hygienists	20	22	23	20	22.2

[a] Defined by the Standard Occupational Classifications (Office of Federal Statistical Policy and Standards, 1980).
[b] Weighted for the population of workers.

ranked second. Also shown is the range of each-group's rank within the four states.

DISCUSSION

The purpose of this investigation was to provide background material to support funding requests, identify groups of nursing personnel with elevated risk of disabling back trouble, and suggest research projects that address critical needs for reducing the incidence of disabling back injuries among nursing personnel. The comparison of the back injury workers' compensation claim experiences of nursing personnel with 21 other occupations indicated that the disabling back injury problem among Aides, LPNs, and RNs is more serious than that of most other occupational groups. The comparison of 12 occupations by industry groups showed which appear to have the greatest problem. Finally, the literature review indicated the need for the following research.

Studies are especially needed to establish the relationships between various tasks performed by nursing personnel and risk of back pain, impairment, and/or disability. Various studies of industries other than health care have shown that heavy load handling is an important risk factor for low back troubles (Chaffin, 1979; Herrin, Anderson, & Jaraiedi, in press). For studies of patient handling an appropriate methodology was applied by Lortie (1985) in a study that found patient transferring and lifting to be the highest risk tasks performed by male orderlies in a geriatrics hospital in Quebec. Owen and Damron (1984) found seven variables useful for distinguishing between cases and controls. One of these was the number of years the nurse spent working on nursing units where frequent lifting was required. Several studies based on information provided by nursing personnel indicate that patient lifting is a task often associated with the onset of back pain episodes (Jensen, 1985). These studies suggest, but do not firmly establish, that patient lifting and transfer tasks are the main factor in explaining the relatively high incidence ratios among nursing personnel. Other tasks also create large forces in the lower back and are, therefore, suspected risk factors worthy of investigation.

Longitudinal epidemiologic studies based on routine injury records have always been plagued by uncertainty about possible differences in reporting between comparison groups. For example, if the criterion variable (e.g., IR) based on employee-reported injury records or compensation claims indicates that women and men have different experience with low back trouble, is the difference explained by physiological, task, or report-

Table 3. Occupations by Industry Groups Rank Ordered for Most Back Strain Compensation Cases Per Number of Employees

Occupational[a] Category	Industry[b]	Range[c]	Average Rank[d]
Aides	Nursing & Personal Care Facilities	1–2	1.3
LPN	Hospitals	2–4	2.3
Aides	Hospitals	1–4	2.9
LPN	Nursing & Personal Care Facilities	3–5	3.9
Aides	Health Services, n.e.c.[d]	5–11	5.6
RN	Nursing & Personal Care Facilities	5–7	6.2
RN	Hospitals	6–7	6.7
LPN	Health Services, n.e.c.[d]	8–12	8.1
LPN	Offices of Physicians	3–11	8.6
RN	Offices of Physicians	8–9	10.1
RN	Health Services, n.e.c.[d]	8–13	10.2
Aides	Offices of Physicians	10–14	11.3

[a] Defined by the Standard Occupational Classifications (Office of Federal Statistical Policy and Standards, 1980).
[b] Defined by Industrial Classification System (Bureau of the Census, 1982).
[c] Lowest and highest rank of the group in four states (ID, NC, NY, WI).
[d] Weighted for the population of workers in four states(ID, NC, NY, WI).
[e] "n.e.c." is not elsewhere classified.

ing differences? Similar concerns haunt investigations like the one reported here that attempt to determine which occupational groups have the greatest problem with back trouble. Additional data such as those obtained by Dehlin and Berg (1977) concerning psychological and sociological factors are needed to determine whether the different values of IR are due to differences in: (a) back pain experiences, (b) physical demands of the jobs, (c) motivation to work while experiencing a moderate level of back pain, or (d) other factors. Prospective cohort studies using methods similar to those used by Biering-Sørensen (1982) are needed to adequately explain the large differences in IR values of different employment groups.

The research literature provides little information about the efficacy of health promotion and training-oriented low back pain prevention programs (Dehlin, Hedenrud, & Horal, 1976; McGovern, 1985; Raistrick, 1981; Scholey, 1983; Stubbs, Buckle, Hudson, & Rivers, 1983). Much of the reason for the dearth of reported studies on the topic may be due to the difficulty of finding a valid and sensitive criterion measure (Alavosius & Sulzer-Azaroff, 1985; McKechnie, 1985; St-Vincent, Lortie, & Tellier, 1985). There is even considerable disagreement about what principles should be taught for simple lifts as well as for the many patient-handling tasks (see review by Owen, 1985). Studies are needed to assess the possible benefits of programs that teach: (a) the importance of personal fitness and/or back care fitness, (b) techniques for lifting and transferring patients, and (c) the importance of and proper techniques for using devices to assist in patient handling. Programs which combine two or more of these instructional elements also need to be evaluated. In addition, the long-term effects of training, and the associated questions concerning refresher training need investigation.

Most previous studies in the U.S. have been conducted in a single university hospital (Harber, et al., 1985; Owen & Damron, 1984). Future studies should include patient handlers in other health care facilities for three reasons. One is to learn about causes and interventions applicable to workers in these other facilities. The second is for comparative purposes such as determining whether a factor identified as a risk factor in a university hospital setting (e.g., smoking found by Owen & Damron, 1984) is also a risk factor in another health care setting. The third is that nursing personnel in the long-term care facilities appear to have more disabling back troubles than those in general hospitals.

Research is needed on the relationship between back injury risk and staffing levels on wards that require stressful patient handling. This, however, appears to be especially difficult because of the many interacting variables. In particular, the various alternative ways of assigning tasks to RNs, LPNs, and Aides together with the diverse ward specialties makes for a tremendously large number of conditions. Perhaps the most feasible approach would be to study a naturalistic experiment such as the situation in which a facility has decided to change staffing level or task allocation in a certain department or ward. An opportunistic investigator could assess the impact by obtaining before and after measures using a criterion variable such as proportion of patient lifts and transfers that should be performed by two people working together, but are actually performed by only one person.

In addition to epidemiological studies, biomechanical studies are needed to compare the stresses in the lower back of nursing personnel performing specific patient-handling tasks using alternative procedures. Another line of related research recommended by Videman et al. (1984) is to find better ways for hospital personnel to avoid performing the more biomechanically stressful tasks. Bell, Dalgity, Fennell, and Aitken (1979) investigated the use of patient-handling devices in one hospital and found infrequent use. The reasons appeared to be a combination of difficult to use devices, insufficient space, patient dislike, and storage too far from patients. Four lines of related, but distinct, research and development efforts are suggested: (a) Improve procedures for assessing lifting and transfer tasks for individual patients, and for selecting the optimal patient-handling devices for those tasks which may be performed with devices. (b) Assess the effects of implementing such procedures on the health of nursing personnel and patients; (c) Determine the relationship between the proportion of patient lifts and transfers in which devices are used and factors likely to affect usage such as the proximity of the devices to the patient during periods of non-use and the extent of participation by the patient handlers in decisions about device selection and (d) Develop and conduct a program for obtaining feedback from nursing personnel who use these devices, concerning both desirable and undesirable characteristics, in order to stimulate the development of better devices.

Three concluding suggestions are offered. First, many nurse researchers are well qualified to conduct the studies suggested here, but the involvement of competent researchers from other disciplines could enhance the quality of such studies. Second, the compensation data indicate that more attention should be directed toward long-term nursing care facilities with particular focus on nursing aides and orderlies. Finally, the suggested research methodologies point to a shift from questionnaire surveys of nursing personnel to more on-site analyses of the patient-handling tasks and associated health outcomes. It is hoped that investigations of these topics by nurse researchers will lead to practical techniques for minimizing the risk of nursing personnel incurring work-related low back injuries.

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