FEATURE ARTICLE
Information Update

# Back Pain Prevalence in Nursing Personnel

## Measurement Issues

by Nancy N. Menzel, PhD, RN, COHN-S

Workplace injuries, primarily musculoskeletal disorders, are a persistent problem for nursing personnel as evidenced by the large number of lost work time cases among registered nurses (RNs) and nursing aides (NAs) reported by the Bureau of Labor Statistics (BLS) (U.S. Department of Labor [US DOL], BLS, 2001). However, musculoskeletal injury reports obtained from data collected for purposes other than population surveillance may not be the best indicator of the extent of this problem. Symptoms surveys not only more accurately describe the epidemiology of this problem, but also hold promise as outcome tools in ergonomic intervention studies.

One of the primary factors hindering surveillance and assessment of effective interventions for back pain among this population is the lack of standardized methodology and reporting by researchers in the field. This article analyzes questionnaires and symptoms surveys used to measure self reported back pain incidence and prevalence among nursing personnel. The analysis begins with a literature review of international studies using these data collection tools and culminates in a recommendation for instrument standardization to facilitate ergonomic population studies.

### BACKGROUND

The U.S. DOL BLS (2002) calculated an annual incidence rate of 13 injuries per 100 full time nursing home employees in 2001, while Goldman (2000) reported a back injury incidence rate of 9.8 per 100 full time hospital employees. These incidence rates are calculated from a national sample of employers' Occupational Safety and Health Administration (OSHA) Injury and Illness Logs. As high as these rates seem, the 1 year back pain prevalence rate, which a recent study shows at 47 per 100 U.S. RNs (Trinkoff, 2002), consistently dwarfs injury incidence rates.

Incidence is defined as "the number of new events or cases of disease that develop in a population of individuals at risk during a specified time interval," while prevalence is "the proportion of individuals in a population who have the disease at a specific instant" (Hennekens, 1987). Although it may seem a contradiction in terms, many studies reviewed here calculated "lifetime prevalence" of low back pain to mean the percent of respondents who reported ever having this disorder, not just individuals experiencing pain at the time of the survey. Injury incidence rates are an incomplete measure of the extent of work related musculoskeletal disorders (WMSDs) in an employee population for a number of reasons. These reasons include recording restrictions on what constitutes an injury case, the reluctance of affected employees to file an injury claim because of fear of employment repercussions, and health care worker conditioning to ignore back pain (Cato, 1989; Collins, 1990; deCastro, 2003).

Most work related back injuries develop gradually. "The scientific studies reviewed support the conclusion that repetitive mechanical strain exceeding tolerance limits, imposed in a variety of ways, results in chronic skeletal muscle injury," according to the U.S. Department of Health and Human Services (USDHHS), National Insti-

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tute for Occupational Safety and Health (NIOSH) (1997b). Because pain and discomfort are initial symptoms of musculoskeletal impairment and disability (USDHHS, 1997b), intervention researchers have earlier indications of outcome effectiveness if they survey periodically for back pain prevalence rather than waiting a year to accumulate a sufficient number of cases to assess back injury incidence rates.

Despite the advantages of prevalence data, many ergonomic intervention studies among health care personnel rely on passive surveillance data for their outcome measures. These are injury incidence data collected for another purpose (Rosecrance, 2002). Examples of these data sources include workers' compensation claims data (e.g., medical and wage replacement costs) and OSHA Log injury and illness incidence rates (Brophy, 2001; Evanoff, 1999; Lynch, 2000; Ronald, 2002).

One reason for the popularity of using injury incidence data is these outcomes are of most interest to employers and regulators because they allow comparison, benchmarking, and quantification of direct dollar cost. In contrast, little is known about the costs caused by lost productivity that result from employing nursing staff members suffering a disabling amount of discomfort. However, even those intervention studies that have relied on prevalence data as opposed to incidence data are subject to a number of methodological weaknesses that stymie comparisons of populations over time and make meta-analyses impossible (Deyo, 1998; Schierhout, 1996).

For the collection of WMSD prevalence data, researchers generally rely on musculoskeletal symptoms surveys or questionnaires. Although NIOSH states that "[c]ompared with OSHA logs, symptoms surveys provide a more sensitive way to determine who has symptoms and who does not" (USDHHS, 1997a), these tools are not without quality problems. Chief among these is the widespread variability of the instruments used in research on WMSD symptoms among nursing personnel.

Many researchers in the studies reviewed here reported designing their own questionnaires, but provided little other information about them. This lack of standardization seriously weakens researchers' ability to compare different populations or the same population at different times. For example, it is not possible to determine trends in back pain prevalence following the adoption of the United Kingdom (UK) Manual Handling Regulations (Health and Safety Executive, 1992) because the six prevalence studies of nursing personnel in the UK published in the 10 subsequent years all used different researcher designed questionnaires (Hollingdale, 1997; Klaber Moffett, 1993; Leighton, 1995; Newman, 1993; Smedley, 1995; 2003).

## REVIEW OF BACK PAIN PREVALENCE STUDIES AMONG NURSING PERSONNEL

### *Method*

The literature search for this review was conducted using PubMed, which, according to the U.S. National Library of Medicine (2003), provides access to more than 12 million MEDLINE citations going back to the mid 1960s from 4,600 biomedical journals. Search terms used for defining study subjects included:

- Nurse.
- Nursing.
- Hospital employees.
- Aides.
- Hospital workers.
- Hospital staff.
- Health care workers.
- Home care personnel.
- Home care workers.

The following terms were added to the search with the appropriate Boolean operators (i.e., and, or, not): "occupational," "work related," "musculoskeletal," "back pain," "low back pain," "back injury," "incidence," "prevalence," "symptom(s) survey," "questionnaire," and "Nordic Musculoskeletal Questionnaire."

The search was limited to articles published in English between 1970 and late 2003. References of each study were hand searched for additional studies not captured in the electronic search. Forty six studies, including the author's doctoral research (Menzel, 2001), were chosen for further review. The selected studies reported using questionnaires or standardized interviews to obtain back pain prevalence in nursing personnel, including RNs, licensed practical nurses, NAs, orderlies, institutional aides, and home health aides, but excluding aides whose duties were primarily housekeeping and not patient care.

Also excluded were studies that included nurses among other occupational groups in the sample but did not stratify the results by occupation. Studies that determined prevalence through physical examinations alone, such as Larese (1994), were not included. Studies with a subject inclusion criterion of current back pain were excluded as well. To avoid redundancy, only one article was included when multiple research reports were published using the same initial data. Studies were reviewed to assess study type, primary data collection tool and its psychometric properties, sample demographics, case definition, recall period, and prevalence findings. A summary of the studies included in the review appears in Table 1. The Table contains the author's assessments of methodological limitations, only some of which are discussed in this article.

### *Overview of Studies*

Investigators from the UK took the early lead in identifying the extent of low back pain in nurses, with three cross sectional studies in the 1970s and 1980s (Cust, 1972; Stubbs, 1983; Videman, 1984). Although it is not possible to infer cause and effect from cross sectional studies, all found an association between back pain prevalence rates and patient lifting or manual handling, with Videman reporting a heavier physical workload and higher back pain prevalence for NAs than for licensed nurses. Shortly thereafter, U.S. researchers began to report findings of increased back pain prevalence in nursing personnel associated with manual handling (Cato, 1989; Harber, 1985; Mandel, 1987; Skovron, 1987). In a

Table 1

## Prevalence of Back Pain in Nursing Personnel: Studies Using Symptom Surveys and Questionnaires

| Reference | Country of Study Population | N and Population Description* | Study Type | Tool Used | Methodology Limitations | Recall Period | Prevalence |
|---|---|---|---|---|---|---|---|
| Ahlberg-Hulten, Theorell, & Sigala, 1995 | Scandinavia | 90 female RNs and NAs | C | RD | CD, RV | ≤ 1 month | 41% |
| Alexopoulos, Burdorf, & Kalokerinou, 2003 | Greece | 377 nursing staff | C | NMQ | N, RP | 1 year | 75% |
| Ando et al., 2000 | Japan | 314 RNs | C | RD | CD, RV | ≤ 1 month 1 year | 54.5%, 54.7% |
| Arad & Ryan, 1986 | Australia | 831 female nurses | C | RD | RV | 1 month, Lifetime | 42%, 87% |
| Botha & Bridger, 1998 | South Africa | 96 nurses | C | RD | CD, N, RP | Lifetime | 63% |
| Bru, Mykletun, & Svebak, 1994 | Scandinavia | 547 female service personnel, auxiliary nurses, RNs, and MDs | C | NMQ | | ≤ 1 month, 1 year | Not reported; factor analysis |
| Burton et al., 1997 | Belgium and the Netherlands | 1,216 nurses | C | RD | CD, N, RV | ≤ 1 month, Lifetime | 36.9%, 53.3% |
| Cato, Olson, & Studer, 1989 | United States | 53 staff nurses | C | RD | N, RP | 6 months, Lifetime | 54%, 72% |
| Chiou, Wong, & Lee, 1993 | China | 3,159 RNs and NAs | C | RD | CD, RP | Lifetime | 77.9% |
| Coggan, Norton, Roberts, & Hope, 1994 | New Zealand | 4,636 RNs, comprehensive, midwives, enrolled, NAs | C | RD | CD, RP, RV | 1 year | 36.9% |
| Cust, Pearson, & Mair, 1972 | United Kingdom | 911 nurses | C | RD | N, RV, RP | Lifetime | 34.6% women, 45.9% men |
| Engels, van der Gulden, Senden, & van't Hof, 1996 | The Netherlands | 846 nurses in 4 nursing homes | C | DM | N, RP | Lifetime | 34% |
| Eriksen, 2003 | Scandinavia | 6,485 NAs | C | NMQ | | 14 days | 54.9% |
| Estryn-Behar, et al., 1990 | France | 1,505 female nursing personnel | C | RD | N, RP, RV | 1 year | 47% |
| Fanello, Jousset, Roquelaure, Chotard-Frampas, & Delbos, 2002 | France | 272 NAs and nurses | RCT | NHP 38 | CD, RP, RV | NR | At baseline: 56% IG, 75% CG |
| French et al., 1997 | China | 47 RNs | C | RD | RP | Lifetime | 80.9% |
| Fujimura, Yasuda, & Ohara, 1995 | Japan | 443 NAs in special nursing homes for elderly individuals | C | J | RV | ≤ 1 month, Lifetime | 64.1%, 88.5% |
| Gerdle, Brulin, Elert, & Brittmarie, 1994 | Scandinavia | 97 home care personnel | C | RD | CD, N, RV | ≤ 1 month | 22% |

*Continued*

Table 1 (continued)

## Prevalence of Back Pain in Nursing Personnel: Studies Using Symptom Surveys and Questionnaires

| Reference | Country of Study Population | N and Population Description* | Study Type | Tool Used | Methodology Limitations | Recall Period | Prevalence |
|---|---|---|---|---|---|---|---|
| Guo et al., 1995 | United States | Nurse subset of 30,000 workers interviewed | C | NHI | RP | Lifetime | 18.8% NAs, 16.3% LPNs, 10.4% RNs |
| Harber et al., 1985 | United States | 550 RNs and LPNs | C | RD | RV | ⩾ 1 month, 6 months | 37%, 52% |
| Hofmann, Stossel, Michaelis, Nubling, & Siegel, 2002 | Germany | 2,207 nurses at hospitals and geriatric homes | C | NMQ | N | ⩽ 1 month, Lifetime | 61.2%, 87% |
| Hollingdale, 1997 | United Kingdom | 168 nursing staff | C | RD | CD, N | ⩽ 1 month, 1 year | 36.9%, 59.5% |
| Horneij, Hemborg, Jensen, & Ekdahl, 2001 | Scandinavia | 534 female NAs and assistant nurses in home care | RCT | NMQ | | 6 months | At baseline: 62% IG #1, 60% IG #2, 59% CG |
| Johansson, 1995 | Scandinavia | 305 home care workers | C | NMQ | CD, N, RP | 1 year | 64% |
| Josephson, Lagerstrom, Hagberg, & Hjelm, 1997 | Scandinavia | 285 female nursing personnel | CP | NMQ | N, RP | 1 year | 64% |
| Klaber Moffett, Hughes, & Griffiths, 1993 | United Kingdom | 199 student nurses | P | RD | RP, RV | 1.5 years | 37% |
| Knibbe & Friehle, 1996 | The Netherlands | 390 female nurses in home care | C | NMQ | N, RP | 1 year, Lifetime | 66.8%, 87% |
| Kumar, 1990 | Canada | 161 NAs in group homes | C | CB | CD | ⩽ 1 month | 62% |
| Lagerstrom, Wenemark, Hagberg, & Hjelm, 1995 | Scandinavia | 688 RNs and auxiliary nurses | C | NMQ | | ⩽ 1 month | 52% |
| Leighton & Reilly, 1995 | United Kingdom | 1,134 nurses "of all grades" | P | RD | CD, RP | ⩽ 1 month, 1 year, Lifetime | 24.2%, 58.8%, 61.4% |
| Mandel & Lohman, 1987 | United States | 413 female RNs | C | RD | RP, RV | 1 year | 15% for 1st time in past year |
| Maul, Laubli, Klipstein, & Krueger, 2003 | Switzerland | 269 nurses | P | NMQ | N, RP | 1 year | At baseline: mild pain, 35%; moderate to severe pain, 33% |
| Menzel, 2001 | United States | 113 RNs, LPNs, NAs | C | CMD | | ⩽ 1 month | RN, 62%; LPN, 70%; NA, 52% |

*Continued*

Table 1 (continued)

## Prevalence of Back Pain in Nursing Personnel: Studies Using Symptom Surveys and Questionnaires

| Reference | Country of Study Population | N and Population Description* | Study Type | Tool Used | Methodology Limitations | Recall Period | Prevalence |
|---|---|---|---|---|---|---|---|
| Newman & Callaghan, 1993 | United Kingdom | 173 RNs, midwives | C | RD | CD, RP, RV | 2 years | 76% |
| Niedhammer, Lert, & Marne, 1994 | France | 469 female nurses | P | RD | N, RP | 1 year | 58% |
| Skovron et al., 1987 | United States | 787 RNs and NAs | C | RD | RP, RV | 6 months, Lifetime | 19.6%, 43% |
| Smedley, Egger, Cooper, & Coggon, 1995 | United Kingdom | 1,659 nurses | C | RD | N, RP | ≤ 1 month, Lifetime | 45% women, 39% men; 60% women 56% men |
| Smedley et al., 2003 | United Kingdom | 1,239 female nurses | QE | RD | CD, N | ≤ 1 month | Baseline: 27% IG, CG Follow-up: 30% IG, 27% CG |
| Smith, Ohmura, Yamagata, & Minai, 2003 | Japan | 305 female nurses | C | RD | CD, RP | 1 year | 59% |
| Stubbs, Buckle, Hudson, Rivers, & Worringham, 1983 | United Kingdom | 3,912 nurses representing the main nursing specialties | C | RD & CB | RP | 1 year | 43.1% all cases; 15.9% because of patient handling |
| Trinkoff, Lipscomb, Geiger-Brown, & Brady, 2002 | United States | 1,163 RNs | C | NMQ | RP | 1 year | 47% |
| Vasiliadou, Karvountzis, Soumilas, Roumeliotis, & Theodosopoulou, 1995 | Greece | 407 female nurses | C | RD | CD, N, RP, RV | ≤ 1 month, 6 months | 63%, 67% |
| Videman et al., 1989 | Scandinavia | 199 female student nurses followed prospectively | QE | RD | CD, RP, RV | NR | At baseline: 64% IG, 47% CG |
| Videman, et al., 1984 | Scandinavia | 562 RNs, 318 NAs | C | RD | RP | Lifetime | 79% RNs, 85% NAs |
| Yassi et al., 2001 | Canada | 346 nurses and unit assistants | RCT | O | N | ≤ 1 month | 33% |
| Yip, 2001 | China | 377 nurses | C | RD | RV | 1 year | 40.6% |

*All hospital-based unless noted*

*Key to Abbreviations: C = cross sectional; CB = Corlett Bishop Questionnaire; CD = case definition not reported; CG = control group; CMD = Cornell Musculoskeletal Discomfort Tool; CP = both cross sectional and prospective cohort; DM = Dutch Musculoskeletal Discomfort Questionnaire; IG = intervention group; J = Japan Association of Industrial Health form; N = No description of type of nursing personnel included (e.g., registered nurse, nursing aide); NA = nursing aide; NHI = National Health Interview Survey; NHP 38 = Nottingham Health Profile; NMQ = Nordic Musculoskeletal Questionnaire (modified by researcher); O=Oswestry Low Back Pain Disability Questionnaire; P = prospective cohort; QE = quasi-experimental intervention study—no randomization; RCT = randomized clinical trial; D = researcher designed; RN = registered nurse or qualified nurse; RP = recall period greater than 1 month; RV = none of the following reported: reliability, validity, or pilot testing.*

study of more than 500 nurses in a Los Angeles hospital, the researchers concluded "there is a high frequency of significant occupational low back pain in hospital nursing staff. Data reflecting lost work time injuries markedly underestimate its importance" (Harber, 1985). Yet, almost 20 years later, most WMSD researchers continue to focus on injury incidence rates, in effect measuring just "the tip of the iceberg."

During the 1980s, researchers began to document high prevalence back pain rates in nurses working in Australia and the Scandinavian countries (Arad, 1986; Videman, 1984). In 1989, Videman reported the results of an intervention study using Finnish student nurses, some of whom received additional training in patient handling skills, with back prevalence as an outcome variable. The group with better patient handling skills a year after graduation was found to have a lower prevalence of back pain than the controls.

During the 1990s, Scandinavian researchers published six nurse back pain prevalence studies (Ahlberg-Hulten, 1995; Bru, 1994; Gerdle, 1994; Johansson, 1995; Josephson, 1997; Lagerstrom, 1995). These studies confirmed the problem of high back pain prevalence in direct care staff whose jobs involve moving and handling patients in hospitals. Investigators in the UK published five studies (Hollingdale, 1997; Klaber Moffett, 1993; Leighton, 1995; Newman, 1993; Smedley, 1995). Researchers in the U.S. published one, based on an analysis of 1988 data (Guo, 1995). All were cross sectional or epidemiological cohort studies. By the end of the 20th century, researchers from 14 countries, including Japan, China, and South Africa, had published studies, with 1 year back pain prevalence rates ranging from a low of 47% (Estryn-Behar, 1990) to a high of 66.8% (Knibbe, 1996). Compared with 1 year prevalence rates reported for more sedentary occupational groups, such as 34% for office workers (Burdorf, 1993), these results pointed to a world wide health and safety problem among nursing personnel, a problem associated with heavy manual lifting.

It was not until the 21st century that randomized clinical trials using prevalence data began to be reported in the literature, with one from Canada (Yassi, 2001), one from France (Fanello, 2002), and one from Scandinavia (Horneij, 2001). Experimental studies enhance the scientific rigor of the findings because the investigator manipulates the independent variable and allocates subjects randomly to either intervention or control groups. Researchers at a Manitoba Health Sciences Center hospital found that nurses in a program that involved the introduction of safe patient handling and movement equipment showed significant improvement in back pain prevalence compared to those using standard techniques alone (e.g., body mechanics) (Yassi, 2001).

Swedish researchers found that neither physical training nor workplace stress management programs significantly reduced low back pain in home care personnel compared to controls (Horneij, 2001). Fanello (2002) found that French hospital workers who completed ergonomics training in safe patient handling techniques had a significant reduction of lower back pain over controls.

## QUESTIONNAIRE/SURVEY QUALITY

### *Reliability and Validity*

Selection of an instrument appropriate to measure back pain prevalence requires careful consideration of its psychometric qualities in light of the outcome data of interest. Psychometric assessment is "an evaluation of the quality of an instrument, based primarily on evidence of its reliability and validity" (Polit, 2003).

A questionnaire's reliability is "the consistency with which it measures the target attribute" (Polit, 2003), in this case, back pain.

According to Rosecrance (2002):

> Questionnaire reliability is critical if the instrument is used to assess intervention effectiveness. If the items on the questionnaire do not yield a similar [W]MSD prevalence from week to week, they cannot be used to assess changes in [W]MSD symptom prevalence from year to year.

One way to assess an instrument's reliability, also known as stability, is to give the test on two separate occasions and compare the scores, producing a reliability coefficient. The higher the coefficient, the more reliable or stable the test. Another type of reliability is internal consistency (i.e., the extent to which the instrument measures back pain and nothing else). Answers are compared with each other for consistency. The statistic produced is called coefficient alpha or Cronbach's alpha. The higher the coefficient, the higher is the internal consistency (Polit, 2003).

The three major types of validity include criterion related, content, and construct.

*Criterion validity.* Criterion validity is a measure of a tool's sensitivity and specificity. McDowell (1996) defines the use of these terms in screening. The "sensitivity" of a test refers to the proportion of individuals with a particular disease who are correctly classified as diseased by the test, while "specificity" refers to the proportion of individuals without the disease who are so classified by the test.

If symptoms surveys are to be used in a workplace to identify which jobs are causing ergonomic problems, it is important to have a tool with high sensitivity (with the trade off of having some false positives). However, in ergonomics intervention outcomes research, a tool with high specificity is more important—one that correctly discriminates between individuals with and without back pain. Unlike self report questionnaires used to screen for conditions that have a specific criterion, such as fasting blood glucose for diabetes, criterion validity is difficult to determine in WMSD questionnaires because WMSDs lack a "gold standard" that correlates with the condition (Lemasters, 1996).

*Content validity.* Perhaps more important than criterion validity when selecting a symptoms survey to use as an outcome measure is its content validity, which is the extent to which the tool contains a sufficient sample of items to measure the construct (e.g., WMSD). Content validity is determined primarily by expert judgment. Dimensions of low back WMSDs include questions

about pain location, quality, severity, duration, associated disability, and etiology.

*Construct validity.* Construct validity is the extent to which a tool measures the variable of interest, in this case, work related back pain. One way of verifying construct validity is the known groups technique. With this technique, the instrument is tested on groups with and without the attribute, followed by comparison of the results. The difference should be in the expected direction (Polit, 2003).

One standardized musculoskeletal symptom survey used for screening working populations prior to reported injury (as opposed to instruments that assess level of disability after an injury is reported) is the Nordic Musculoskeletal Questionnaire (NMQ) (Kuorinka, 1987). This widely used instrument has published reliability and validity information. Reliability for the low back version was reported as 0% to 4% non-identical answers following testing of 25 Scandinavian nursing staff members twice after a short interval. Validity was established by comparing employee responses with findings from clinical histories taken by a physical therapist and finding a high degree of correlation (Kuorinka, 1987). Maul (2003) assessed the specificity of the NMQ by conducting a clinical examination and functional tests on a subset of respondents and found the tool correctly classified respondents as either cases or non-cases in most instances. Reliability was assessed by computing the correlation between duplicate questions asking about 12 month prevalence and found coefficients to be $\geq .79$. Investigators in the UK evaluated an English language version of the NMQ and found the number of non-identical answers for weekly prevalence varying from 6% to 19% (Dickinson, 1992).

There are several versions of the NMQ, including one for assessing the whole body and another focusing on the lumbar region. Eleven studies included in this review used a modified version of the NMQ for data collection. (None described the modifications.) While the preponderance of those studies came from Scandinavian countries, back pain researchers in Germany, Greece, the Netherlands, Switzerland, and the United States have employed this tool as well. Studies using the NMQ that reported 1 year back pain prevalence rates show a lower figure in the United States than in other countries:

- 47% in the United States (Trinkoff, 2002).
- 75% in Greece (Alexopoulos, 2003).
- 64% in Sweden (Johansson, 1995; Josephson, 1997).
- 66.8% in the Netherlands (Knibbe, 1996).
- 68% in Switzerland (Maul, 2003).

However, these figures are not directly comparable because the U.S. sample included only RNs, while the Swedish and Dutch studies included unlicensed assistive personnel, as well—an occupational group known to have a higher prevalence of back pain.

Other non-researcher developed tools used in the reviewed back pain prevalence studies include one report using an instrument that incorporated parts of the Corlett and Bishop (CB) tool (1976), one using the Dutch Musculoskeletal Questionnaires (DMQ) (Hildebrandt, 2001), and two using the Cornell Musculoskeletal Discomfort (CMD) Tool (Cornell University, 2003). These tools have shortcomings in terms of availability, reliability, validity, and case definitions, among other qualities. For a summary, see Table 2.

Twenty seven studies reported using researcher designed questionnaires, with only 10 of those reporting any information on at least one of the following: validity, reliability, or pilot testing. Without knowing how back pain was defined and measured, it is difficult to interpret or compare the findings of studies that did not report psychometric information.

### Responsiveness

For use in longitudinal intervention studies, a tool must have not only reliability and validity, but also responsiveness, or the ability to "detect clinically important changes over time, even if those changes are small" (Guyatt, 1989). This dimension has not been addressed for existing WMSD symptoms surveys. Questions such as "Have you ever been hospitalized because of low back trouble," part of the NMQ, reduce responsiveness because a Yes answer will never change, even if the individual benefits from the intervention. Assessing whether the respondent has ever had back pain (lifetime prevalence) is another question of no value for measuring symptom reduction over time. Despite this, one study used the NMQ to measure outcome in a randomized clinical trial (Horneij, 2001).

### Definition of Back Pain and Case

Great differences exist in the way back pain is defined in questionnaires and what constitutes sufficient severity, frequency, duration, or disability for the respondent to be counted as a case for prevalence purposes. Some questionnaires, such as the NMQ, have anatomic diagrams with the regions in question clearly marked, while other studies simply report they inquired about the presence of "back pain" or "low back pain," leaving it to the respondent to infer corresponding body regions. The range of back pain and case definitions is illustrated by comparing one study (Smedley, 1995), which combined case definition and anatomic landmarks to limit positive responses to "pain lasting longer than a day in an area (indicated in a diagram) between the twelfth ribs and the gluteal folds," to another study (Hollingdale, 1997), which simply described the variable as the "back pain experience." To be counted as a case in one Canadian study (Yassi, 2001), a participant could have experienced pain for anywhere from 1 day to 3 months. However, most studies did not report whether duration was measured.

French (1997) limited positive responses to "all conditions of pain, ache, stiffness or fatigue localized to the back related to nursing practice," which was an effort to limit the cases to work related pain. However, most other studies in this review failed to describe whether they had asked the respondents if the pain was work related, raising the possibility of confounding by non-work causes of back pain or nonspecific pain syndromes (e.g., fibromyalgia).

Table 2

## Measurement Qualities of Selected Instruments Used in Prevalence Studies Reviewed

| Instrument | Developer | Administration* | Conceptual Definition of Musculoskeletal Symptoms | Dimensions Measured | No. of Questions | Rating Scales | Time to Complete | Reliability Testing | Validity Testing | Recall Period |
|---|---|---|---|---|---|---|---|---|---|---|
| Corlett-Bishop | Corlett & Bishop, 1976 | S | Industrial (work posture) comfort in 12 body regions | Discomfort; body parts affected | NR | 7 point Likert scales | NR | NR | NR | Current |
| Cornell Musculoskeletal Discomfort Questionnaire | Hedge, Morimoto, & McCrombie, 1999 | S | Pain in 20 body regions | Frequency of ache, pain, discomfort; amount of discomfort and work disability | 60 | Ordinal | 5 minutes | 1 week test–retest of controls showed no significant differences (69% versus 67% prevalence) | None | Last work week |
| Dutch Musculoskeletal Questionnaire (In Dutch; no English version located.) | TNO (Netherlands Institute for Applied Scientific Research) (Hildebrandt, Bongers, van Dijk, Kemper, & Dul, 2001) | S | Pain nature and severity | Ache, pain, discomfort; body parts affected | approx. 225 | Nominal | 30 minutes | NR | NA | NR |
| 1988 National Health Interview Survey—Occupational Health Supplement | National Center for Health Statistics with NIOSH and DOL | I | Back pain every day for a week, more brought on by repeated activities or resulting from an accident or injury at work | Pain | NR | Yes or No | NR | NR | NR | 1 year |
| Nordic Low Back | Kuorinka et al., 1987 | S | Frequency and severity of pain and disability (work and leisure time); has anatomic diagram | Ache, pain, discomfort in low back | 16 | Nominal, ordinal, and interval | 5 minutes | Test–retest 4.4% disagreeing answers | Up to 13% disagreement between questionnaire and physiotherapist's assessment | Lifetime, 1 year, and 7 days |
| Nottingham Health Profile 38 | Hunt, McEwen, & McKenna, 1985 | S | Health-related quality of life | Energy, emotional reaction, social isolation, pain, physical disability, & sleep | 37 | Yes or No | 5 to 7 minutes | Cronbach's alpha > .70 (Essink-Bot, Krabbe, Bonsel, & Aaronson, 1997) | Many international studies confirm construct validity, but tool has ceiling effects (inability to discriminate gradations at the "best health" end of the scale) (Beaton, Bombardier, & Hogg-Johnson, 1996) | Current |
| OSHA Symptoms Survey (U.S. DOL, 1990) | B. Silverstein | S | Pain or discomfort; has anatomic diagram indicating body regions | Pain quality (e.g., aching), inception, length, currency, medical treatment, work disability | approx. 21 | Nominal, Likert scales | NR | NR | NR | 1 year, 7 days |
| Oswestry Low Back Pain Disability Questionnaire 2.0 (Roland & Fairbank, 2000) | J. O'Brien, North American Spine Society | S or I | Low back pain; not designed as a screening tool to identify cases versus non-cases | Pain affecting personal care, lifting, walking, sitting, standing, sleeping, sex life, social life, traveling | 10 | Ordinal | < 5 minutes | Test–retest correlation of .99 | Correlates with other known tools measuring disability and pain | Past week |

*Administration: I = interview, S = self. Note: NR = not reported, NA = not available.*

The National Institute for Occupational Safety and Health recommends setting a minimum severity threshold of "discomfort lasting at least 1 week or of at least moderate intensity" (Baron, 1996) to increase specificity. The National Research Council and the Institute of Medicine (2001) have called for developing agreed upon criteria for defining WMSD cases, as well as standardized survey instruments to measure them. These criteria and tools could then be used in epidemiologic and intervention studies.

#### *Practicality*

A final issue in evaluating a questionnaire is its availability to users and its acceptability to respondents. The NMQ has not been published separately in a format suitable for administration (Kuorinka, personal communication, September 7, 2002). Researchers must recreate it by extracting the questions from a 1987 issue of *Applied Ergonomics*, a journal not widely available in the United States, and then redraw the anatomic figure. The author could not locate a published English language version of the DMQ.

When screening large numbers of workers who may have limited time to respond, the tool used should be relatively brief and have "face validity" (i.e., the questions should appear to be related to the construct being measured). Multiple pages may hinder potential respondents' interest in completing questionnaires and are of concern to employers who calculate the loss of productivity involved in research participation. One page questionnaires with an anatomic figure, such as the NMQ or CMD, reduce response time as well as barriers and errors caused by poor reading comprehension skills. However, this efficiency did not translate into higher response rates for cross sectional studies using the NMQ compared to ones using longer researcher designed instruments. One concern when using brief tools is that "surveillance instruments usually trade simplicity and speed for precision" (USDHHS, NIOSH, 2001).

## ADDITIONAL STUDY ISSUES

#### *Definition of Nurse*

In the preponderance of studies of back pain in nursing personnel, the word "nurse" is not further defined as to whether the respondents were unlicensed assistive personnel, such as NAs, or licensed staff, such as RNs (or the equivalent category in countries other than the United States). These distinctions are crucial in comparing prevalence rates among groups. Job specific comparisons across studies are impossible when studies describe their respondents as simply "nurses" (Engels, 1996; Hofmann, 2002; Knibbe, 1996; Maul, 2003; Niedhammer, 1994; Smedley, 1995, 2003; Stubbs, 1983), or when they do not report prevalence by job classification even though known (Ahlberg-Hulten, 1995; Coggan, 1994; Estryn-Behar, 1990; Skovron, 1987). The few studies that did report prevalence by job title found a higher prevalence in NAs than RNs (Guo, 1995; Videman, 1984).

#### *Recall Bias*

Pain recall accuracy is affected by time. The longer the time between the experience of pain and the request to remember it, the less accurate are the results (Gendreau, 2003). Back pain is not well recalled over time (Burton, 1996). Thus, asking nursing personnel to remember episodes of back pain during the past year is likely to be inaccurate because of memory lapse. Yet many of the studies reviewed here report using a 1 year (or longer) recall period exclusively (Botha, 1998; Cato, 1989; Chiou, 1993; Coggan, 1994; Cust, 1972; Engels, 1996; Estryn-Behar, 1990; French, 1997; Guo, 1995; Johansson, 1995; Josephson, 1997; Klaber Moffett, 1993; Knibbe, 1996; Mandel, 1987; Maul, 2003; Newman, 1993; Niedhammer, 1994; Skovron, 1987; Smedley, 1995; Stubbs, 1983; Trinkoff, 2002; Videman, 1984, 1989). This lengthy recall period most likely results in an underestimation of both prevalence and incidence. A long recall period also limits responsiveness for intervention studies seeking to assess short term results. A 1 month or shorter recall period is likely to produce more accurate and consistent results and more closely fits the definition of prevalence.

#### *Population Demographics*

To allow meta-analysis and trend analysis, when gathering prevalence statistics for nursing personnel, investigators should further specify the job category (e.g., RN, NA) and job position (e.g., direct care RN, head nurse, supervisor) of respondents when reporting not only sample description but also prevalence rates. This allows comparison of groups with similar job exposures.

#### *Research Needs*

Although OSHA recommends employee surveys to identify problem jobs in its ergonomics guidelines for nursing homes (U.S. DOL, 2003), it does not provide a tool to do this. In 2001, the NIOSH National Occupational Research Agenda (NORA) Musculoskeletal Disorders Team identified a research gap in surveillance, which it defines as "the ongoing systematic collection, analysis, interpretation, and dissemination of [W]MSD health and hazard information to identify trends, develop prevention strategies, and evaluate the effectiveness of those strategies" (USDHHS, NIOSH, 2001). More specifically, the report called for additional research on "how surveillance information can be collected, using...active surveillance data (annual symptoms surveys of all employees in manual handling jobs)" (USDHHS, NIOSH, 2001). However, the report does not recommend a specific tool.

The National Institute for Occupational Safety and Health has used a variety of WMSD assessment instruments in conducting health hazard evaluations (USDHHS, NIOSH, 1990, 1993). In its 1997 publication, "Elements of Ergonomics Programs," NIOSH (1997a) printed the symptoms survey presented by Hales and Bertsche in 1992, which is virtually identical to the one published by OSHA in 1990 (U.S. DOL). This tool is of unknown reliability and validity. A valid and reliable, standardized, NIOSH developed tool would have great utility not only for researchers, but also for employers wishing to monitor the musculoskeletal health of their work force.

Questionnaire development follows a structured process considering such things as question sequencing, language, and layout, followed by pilot testing, revisions, and reliability and validity testing (Dickinson, 1992). As the federal agency charged with conducting occupational safety and health research, NIOSH is the most appropriate body in the United States to conduct this project, especially in consideration of the extensive expert and statistical resources needed. Currently, NIOSH is not conducting any intramural research on symptoms surveys (J. Boiano, personal communication, July 28, 2003).

## RECOMMENDATIONS AND CONCLUSIONS

As this literature review has shown, there has been an abundance of cross sectional and epidemiological studies documenting the high prevalence and persistence of low back pain in nursing personnel. Far fewer clinical trials of interventions have used prevalence as an outcome measurement. Although back pain has a multifactorial origin that includes physical, psychosocial, individual, and work organizational factors (USDHHS NIOSH, 1997b; World Health Organization, 1985), most interventions to date have focused on addressing a single etiological factor, usually physical load. However, some researchers are currently recommending preventive interventions targeting multiple etiological factors (Burton, 1997; Nelson, 2003; Smedley, 2003). To enhance the search for effective back pain prevention approaches, it is vital to use outcomes measures that are classified as active surveillance and are highly specific, responsive, rapid, reliable, and valid. Injury incidence statistics fall short of these standards, whereas WMSD prevalence rates hold promise for this purpose if measurement tools are standardized and refined.

To gauge the musculoskeletal health of any work force, occupational health nurses must have adequate instruments. The National Institute for Occupational Safety and Health needs to develop and test such tools through either intra- or extra-mural research. Questionnaires obtaining pain and disability data, although subjective, have been shown as the most appropriate variables for measuring clinical outcomes in low back pain research (Deyo, 1998) and should be used more often in ergonomic intervention studies.

IN SUMMARY

### Back Pain Prevalence in Nursing Personnel

Measurement Issues

*Menzel, N.N.*

*AAOHN Journal, 2004; 52(2), 54-65.*

1. The problem of work related musculoskeletal disorders of the low back in nursing personnel has been well documented in the literature by cross sectional studies showing high prevalence rates in licensed nurses and nursing aides. However, it is difficult to compare findings among these studies because of the use of nonstandardized symptom surveys, variations in case definitions, and other methodological inconsistencies.

2. Measuring the change in current back pain prevalence yields more timely information about the effectiveness of an ergonomic intervention than assessing injury incidence rates, because of the high percent of nursing staff members who work in pain but delay filing workers' compensation claims.

3. As employers attempt to reduce manual handling injuries, occupational health nurses may be called upon to survey workers for musculoskeletal symptom prevalence and document the effectiveness of ergonomic interventions. Before using or developing any musculoskeletal disorder symptom survey for workplace surveillance or research, occupational health nurses should determine whether the survey has adequate reliability, validity, responsiveness, and practicality.

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