REDUCING BACK INJURIES AMONG NURSES: RESULTS OF A LABORATORY STUDY

LOW-BACK PAIN: THE ROLE OF RESEARCH AND THE SAFETY PROFESSIONAL

WORKER DEATHS IN CONFINED SPACES—A DETAILED ANALYSIS
Postural Load of Nurses During Bathing and Showering of Patients: Results of a Laboratory Study

By Nico E. Knibbe and Hanneke J.J. Knibbe

When compared to other occupational groups, nursing personnel have a relatively high prevalence rate of back pain and high incidence rates of workers' compensation (WC) claims for back injuries (Knibbe and Friese 186; Jensen 386). According to scientific studies, the primary contributors to this trend are 1) lifting of patients and 2) static, postural stress (Estyn-Beer 744). During the last decade, injury prevention programs have focused on the former. For example, based on National Institute for Occupational Safety and Health limits for unusual handling, non-lifting policies were widely introduced. Currently, ergonomics is the focus in patient handling—in other words, patient lifting is now more frequently mechanized (Fragala 22).

Research continues to prove that an ergonomic approach can be beneficial (Knibbe and Knibbe). For example, a controlled longitudinal experiment in home care showed that back pain prevalence among nursing personnel dropped after patient transfers were mechanized via hoists (Knibbe and Friese). This study also revealed that the problem of postural stress (static load) has not yet been adequately assessed—nurses were still bending over while performing routine tasks. This finding is supported by research performed in an institutional care setting, which revealed that during 24 percent of total work time, a nurse's back is in a bent, twisted, or bent and twisted position (Engels et al. 339).

With respect to static load, bathing and showering patients is one of the most stressful tasks a nurse must perform. To reduce back pain prevalence (more so than can be accomplished solely via a non-lifting policy), more attention should be paid to static stress on the musculoskeletal system.

Currently, however, no reliable data are available concerning the load on a nurse's musculoskeletal system during patient bathing or bathing activities. Furthermore, little is known about the extent to which hygiene equipment, the patient or the nurse (attitude, behavior, height) is the source of this load. Therefore, consider this article a first step toward developing such data.

RESEARCH METHODOLOGY

A pilot study in nursing practice revealed that, due to the great number and diversity of confounding factors which influence postural load, these research questions could not be answered via a field study. Therefore, a laboratory study was required. It compared four nurses, who washed, showered or bathed three patients while using seven different pieces of hygiene equipment (Table 1).

Data concerning load on each nurse's musculoskeletal system during these activities were gathered using the Ovako Working Posture Analyzing System (OWAS), which is a widely accepted and reliable observational method for postural analysis (Kahru, et al. 1977). This method is based on multi-moment sampling at a fixed interval. In this study, an observation consisting of a back score, arm score, leg score and external weight score was made every 15 seconds. Then, the four scores were combined. Via this process, 262 working postures were identified and grouped into four "action categories" (AC) to indicate the load's degree of harmfulness on the musculoskeletal system. Table 2 describes the ACs.

Three physiotherapists posed as "patients," acting out a range of cooperation. Each of the four nurses possessed a different level of experience, and all were different heights—the shortest being 156 cm, the tallest 184 cm. This variation was chosen due to the possible confounding influence. For example, tall nurses may have problems working on material at a fixed height. "Patients" and nurses were rotated in random order throughout the study.

All other factors were kept constant as much as possible. A washing protocol was established as well. The whole body had to be washed, including the hair, but no dressing/undressing was performed.

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STUDY RESULTS

A total of 1,624 OWAS scores were gathered. Table 3 presents AC classification for the seven pieces of equipment. Note that the higher percentage of observations in AC1, the less harmful the activity is to the musculoskeletal system. As Table 3 shows, working with the hi-lo shower chair, bath and shower trolley produces less physical stress than does working with other equipment. Also note that 37.7 percent of observations concerning the fixed shower chair is categorized in AC3 (meaning action should be taken as soon as possible).

Based on the OWAS scores, a "top seven of harmfulness" list was devised (Figure 1). The sequence points to three groupings, which differ significantly (χ2=0.1). In order of least harmful, the first group consists of the hi-lo shower chair, bath and shower trolley. The second group contains the fixed bath, hi-lo bed and fixed shower trolley. The fixed shower chair was found to be most harmful to the musculoskeletal system.

DISCUSSION

OWAS Method

The OWAS method has proven to be useful in dynamic work situations (Burden). In 1994, however, De Looze and Toussaint stated that this type of direct observation of activities (such as nursing) is not a valid method for assessing postural load; they believed the practice of nursing to be an example of dynamic work (De Looze and Toussaint 21). The study discussed here reduced "nursing" to "washing," however, and was performed in a laboratory situation. As a result, the activity can be considered less dynamic.

Doreen's and Duf's research substantiates this belief. They proved that a valid postural assessment can be made in a laboratory setting. Thus, under ideal circumstances (i.e., this study), an observation method such as OWAS can, indeed, produce valid results. To further increase reliability, the number of items to be scored by each observer was reduced (De Looze and Toussaint). Two observers were used, each assessing one-half of the items needed for one OWAS score. Now, a critical comment on the way scores were categorized in the four ACs. Several experts analyzed and ranked the 252 postures according to four degrees of harmfulness (AC1 (Von Störjert 31-)). Although a few studies have found a relationship between poor working postures and musculoskeletal disorders, the scientific operationalization of "harmfulness" remains open to interpretation (Genyad 77). In our opinion, it may be helpful to replace the word "harmfulness" with "stressfulness."

Hygiene Equipment

Based on this study's results, working with hi-lo adjustable equipment is the preferred choice with respect to postural load placed on the musculoskeletal system. The fact that the fixed bath was scored "least harmful" among the non-adjustable equipment may be due to the fact that it was used in conjunction with the hi-lo bath trolley. It is interesting to note that the fixed shower chair, which is commonly used in hospitals and nursing homes, places the highest load on the nurse's musculoskeletal system. With respect to the prevention of back pain, these findings can have serious implications for nursing practice.

Individual Differences

A fundamental question for nursing practice is: What exactly is the source of postural load on the musculoskeletal system? Beyond equipment, the degree of a patient's self-activity may be a factor, as may be the nurse's attitude with respect to back care. To answer this question, three factors that may determine postural load were analyzed: 1) equipment used, 2) nurse and 3) patient. Based on a Kruskal-Wallis test, it appears that the harmful load has a relationship with the nurse (height, posture preference, working speed) and type of equipment (Table 1), but no clear relationship with the amount of patient cooperation.

For example, some nurses bend over more frequently and for longer durations than others. Let's examine some potential reason(s) for this behavior. Height is one factor. Initially, one might think being short would have advantages (i.e., fixed hygiene equipment is often at a suitable height for shorter people). However, this study revealed that being short also requires one to stretch the upper body more when working at the same horizontal distance. For example, when a patient is lying in a bed or on a trolley, a short nurse must stretch the trunk and arms, which places postural stress on the musculoskeletal system. For tall nurses, the angle between their trunk and arms remains smaller.

Based on this study, width of material is crucial for short nurses, while height is crucial for tall nurses. This does not mean, however, that narrow material is not beneficial for tall nurses as well, nor that hi-lo equipment would not be beneficial for short nurses. To ensure that a nurse can maintain an upright position as much as possible, both narrow and hi-lo adjustable equipment should be considered.

Personal posture preference is another reason why the "nurse" variable strongly influences total load. In this study, one nurse remained in a stooped position even though she was only scooping the washing glove, while another nurse stood up back as much as possible. For nursing practice, this implies that training and awareness of postural stress can be a necessary component of injury prevention programs.

The third reason for these individual differences may involve how each nurse balances patient comfort with personal comfort. For example, when using the fixed bath, one nurse removed soap while the patient was lying on the trolley, above water level. This choice was based on back load—one must bend over when removing soap while the patient is in the bath. The other nurses removed soap while the patient was lying in the bath. She considered this process to be more comfortable for the patient. The other nurses removed soap while the patient was lying on the trolley, above water level. This choice was based on back load—one must bend over when removing soap while the patient is in the bath.

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Washing the patient on a conventional powered hi-lo bed.</td>
</tr>
<tr>
<td>2</td>
<td>Shivering the patient on a hi-lo shower chair.</td>
</tr>
<tr>
<td>3</td>
<td>Shivering the patient on a conventional shower chair at a fixed height.</td>
</tr>
<tr>
<td>4</td>
<td>Bathing the patient in a hi-lo bath.</td>
</tr>
<tr>
<td>5</td>
<td>Shivering the patient in a fixed bath.</td>
</tr>
<tr>
<td>6</td>
<td>Shivering the patient on a hi-lo shower trolley.</td>
</tr>
<tr>
<td>7</td>
<td>Shivering the patient on a conventional shower trolley at a fixed height.</td>
</tr>
</tbody>
</table>

TABLE 2. OWAS action categories.

<table>
<thead>
<tr>
<th>EQUIPMENT</th>
<th>AC1</th>
<th>AC2</th>
<th>AC3</th>
<th>AC4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hi-lo bed</td>
<td>58.4</td>
<td>45.7</td>
<td>17.5</td>
<td>3.3</td>
</tr>
<tr>
<td>Hi-lo shower chair</td>
<td>38.8</td>
<td>15.0</td>
<td>18.4</td>
<td>1.4</td>
</tr>
<tr>
<td>Fixed shower chair</td>
<td>31.4</td>
<td>20.0</td>
<td>37.7</td>
<td>4.0</td>
</tr>
<tr>
<td>Hi-lo bath</td>
<td>58.3</td>
<td>23.7</td>
<td>17.4</td>
<td>0.5</td>
</tr>
<tr>
<td>Fixed bath</td>
<td>41.3</td>
<td>37.1</td>
<td>20.4</td>
<td>0.8</td>
</tr>
<tr>
<td>Hi-lo shower trolley</td>
<td>33.0</td>
<td>27.0</td>
<td>18.8</td>
<td>0.3</td>
</tr>
<tr>
<td>Fixed shower trolley</td>
<td>39.9</td>
<td>42.4</td>
<td>19.0</td>
<td>0.0</td>
</tr>
</tbody>
</table>

TABLE 3. Classification of ACs (by percentage) for the seven types of equipment used in this study.
**Conclusions**

With respect to postural load, the hi-lo shower chair, bath and shower trolley place significantly less stress on the musculoskeletal system, especially when compared to the fixed bath, fixed shower trolley, fixed shower chair and hi-lo bed. Since time required to bathe a patient is largely determined by the nurse, any discussion of time consumption and equipment should focus more on load on the nurse’s musculoskeletal system and quality of care.

**References**