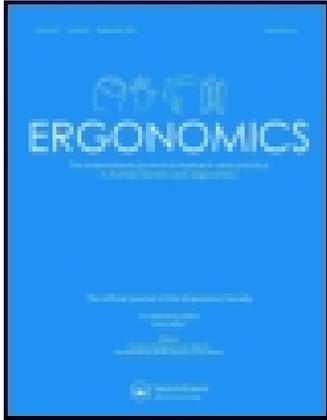


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Back pain in the nursing profession I. Epidemiology and pilot methodology

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Back pain in the nursing profession

I. Epidemiology and pilot methodology

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A survey of 3912 nurses suggests that 750,000 working days are lost annually from back pain and that 1 in 6 (159 per 1000 at risk) attributes the onset of pain to a patient-handling incident. Attempts to identify risk areas within nursing using point prevalence data have failed to confirm previous results using historical data (Stubbs *et al.* 1980). Evidence is presented that suggests the conditions being assessed in each case are different. The need for further epidemiological data is emphasized together with ergonomic assessment of the tasks performed throughout the nursing profession. Such an assessment will form the foundation for safer systems of work within the National Health Service and, it is hoped, a reduction in the magnitude of the back pain problem.

1. Introduction

There have been a number of epidemiological studies of back pain in the nursing profession: some have been concerned only with nursing, whilst others have compared nurses with other occupational groups. Hoover (1973), Ferguson (1970) and Raistrick (1980), compared the incidence in nurses with other hospital employees, while Magora (1969), Cust *et al.* (1972) and G. David (1980, personal communication) used occupational groups outside the health professions for comparison. The findings of these studies show that nurses have relatively high incidence of back pain, neurological signs and officially reported strain injuries. Direct comparison between these studies separately is impossible as each examined a different population and had its own methodology for assessing the extent and effects of the problem.

Evidence from other sources includes a report by the Government Health and Safety Executive (1978) of working conditions in the medical services. Their analysis of accidents and accident reporting systems suggested that the largest proportion of accidents was the result of falls, lifting/carrying and sharp instruments and apparatus. They also indicated that, in general, the format of the accident report form was very varied and the information elicited often defied proper statistical analysis. Indeed, most systems relied on the injured person reporting the accident and there was evidence that they did not always do so. Lee (1979) has similarly commented on accident reporting systems and examined the associated legal aspects.

With regard to lifting, the Executive noted that it was difficult to apply standards imposed by existing legislation, in that some of the lifting done by nurses is in an emergency situation, where the basic rules of training, which include the desirability of summoning help, may not always be appropriate. They further suggested that some of the problems of lifting may be obviated by the provision of suitable equipment or by implementing safer systems of work. Similarly, a report by the

Royal College of Nursing (1979) entitled *Avoiding Low Back Injury Among Nurses* stated that low back pain 'has been and still is regarded as an occupational hazard of nursing'. Their recommendations placed a heavy emphasis on improving the training of nurses in lifting techniques and usage of hoists, evaluation and development of lifting techniques, and ergonomic analysis of potentially hazardous situations and equipment.

There is, however, no information available concerning the manoeuvres or procedures implicated in back injuries nor has there been any reliable estimate of the total amount of sickness absence due to back pain in the nursing profession. This paper, the first in a series, reports the results of an epidemiological investigation (Part A) and the pilot methodology (Part B), currently being evaluated, for assessing nursing tasks from an ergonomic standpoint.

Part A. Epidemiology

2. Introduction

It is often the case that political and economic pressures demand an epidemiological investigation to be undertaken in order to assess the magnitude of the problem and the areas of potential risk before a workplace assessment can be made from an ergonomic standpoint. Care should be taken to avoid the possible bias of such assessments which may result from a prior knowledge of high risk areas.

Other problems relating to the use of epidemiology within an ergonomic setting have been noted by Rey (1979). He has reported that occupational choice is by definition some kind of self-selection process involving different patterns of life, which, in turn, may influence health. The selection process may involve such variables as age, sex and health status, and when these factors are considered along with temporal effects and changes in job it will be appreciated that the interpretation of the results of such epidemiological studies is unlikely to be specific.

The results presented below should be seen in the light of these problems, and following this their implications with respect to the nursing profession will be discussed.

2.1. Definition of terms

A common difficulty in studies of back pain is its highly variable and symptomatic nature. Firm diagnosis is rarely possible, either at GP level or on referral to a consultant. Dillane *et al.* (1966) report that there was no evident (pathological) cause for 83.7% of 345 cases of acute back pain in general practice over a 4-year period. Similarly for 80.4% of the 404 back pain cases referred to a consultant rheumatologist no definite diagnoses could be made (Kersley, as reported by Manstead 1980). These difficulties should not preclude attempts to estimate the extent of the back pain syndrome, and this study uses the term 'back pain' without any further definition except to ask for the site or sites of pain. To this extent, the definition is that of the subject.

3. Methods

3.1. Questionnaire design and distribution

Since existing hospital staff accident and incident records are kept with varying degrees of thoroughness and detail, and could not reliably be used for the study, a questionnaire was devised to carry out a confidential, retrospective survey of back

pain incidents in a large sample of nurses. The questionnaire was pre-coded and designed for self-administration. A pilot study was conducted at a local general hospital, with each respondent being interviewed following completion of the questionnaire. Some modifications were made as a result of the respondents' comments. Figure 1 illustrates the variables studied.

The four Health Districts were chosen to cover the main nursing specialities approximately in proportion to their national distribution. Table 1 shows the numbers and proportions of beds allocated to the principal specialities in the sample, and in Great Britain as a whole. The proportions are generally similar, although mental handicap beds were under-represented in the sample and mental illness beds were over-represented. Health visitors, school and clinic nurses were not included.

Table 1. Proportions of beds in major specialities in sample and in Great Britain.

Speciality	Number of beds in sample	%	Number of beds in GB* (1977)	%
Mental handicap	330	6.1	62 000	13.5
Maternity	297	5.5	24 000	5.2
Geriatrics	814	15.1	71 000	15.4
Mental illness	2 039	37.7	117 000	25.5
Surgical	1 275	23.6	96 000	20.9
Medical	554	10.2	65 000	14.2
Others	99	1.8	25 000	5.4

* SOURCE: O.H.E. *Compendium of Health Statistics*, 3rd ed., 1979. Table 3.2.

Questionnaires were allocated to all nurses in the four Health Districts, and were collected 2–3 weeks later. Postal distribution was used for district nursing staff and nurses on annual or sick leave. Other staff received the questionnaires from their Sister, Charge Nurse or Nursing Officer. After collection, the responses were analysed using the SPSS programme version M8.1 on the University of Surrey Prime 750 computer.

4. Results

4.1. Response rate

Of the questionnaires distributed, 3912 were returned, giving an overall response rate of 76%, with no significant variation between the four Health Districts and the various nursing grades and specialities. The results presented are based on these 3912 responses.

4.2. Incidence and prevalence of back pain

Table 2 shows the annual incidence and prevalence rates of all back pain and of back pain, the onset of which was attributed to specific patient-handling incidents. It can be seen that 43.1% of the nurses suffered back pain in 1 year (table 2(a)), and 159

Table 2. Prevalence and incidence of back pain in nurses.

(a) Annual prevalence (all cases) of back pain (all cases)	431 per 1000 at risk
(b) Annual incidence (new cases) of back pain (all cases)	77 per 1000 at risk
(c) Annual prevalence (all cases) of back pain the onset of which was attributed to patient-handling incidents	159 per 1000 at risk
(d) Annual incidence (new cases) of back pain the onset of which was attributed to patient-handling incidents	29 per 1000 at risk

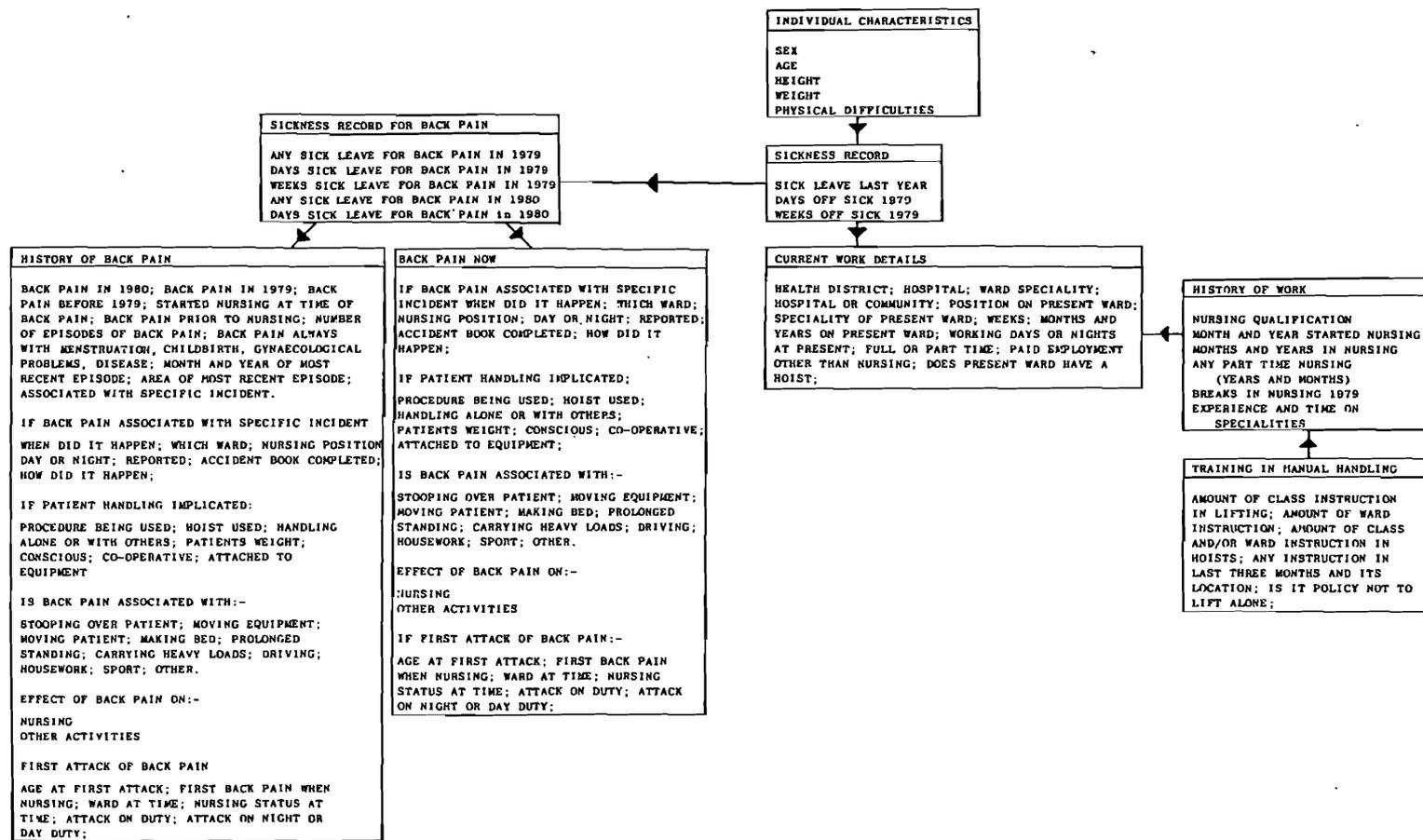


Figure 1. Questionnaire variables.

per 1000 suffered back pain, the onset of which was attributed to a specific patient-handling incident (table 2(b)). 77 nurses per 1000 suffered back pain for the first time in the year preceding completion of the questionnaire (table 2(c)), and 29 of these attributed the onset of this first episode to a specific patient-handling incident (table 2(d)).

4.3 Site of back pain

Each respondent who had suffered back pain was asked to shade in the site or sites of their most recent episode of pain on a diagram. The distribution of back pain by site is shown in figure 2. The largest single category was 'low back pain', with 53.7% of the responses. The second largest category was 'multiple sites', with 27.5% of the responses, the majority of which included 'low back pain'. Pain in the low back was reported inclusively or exclusively by 77.9% of cases.

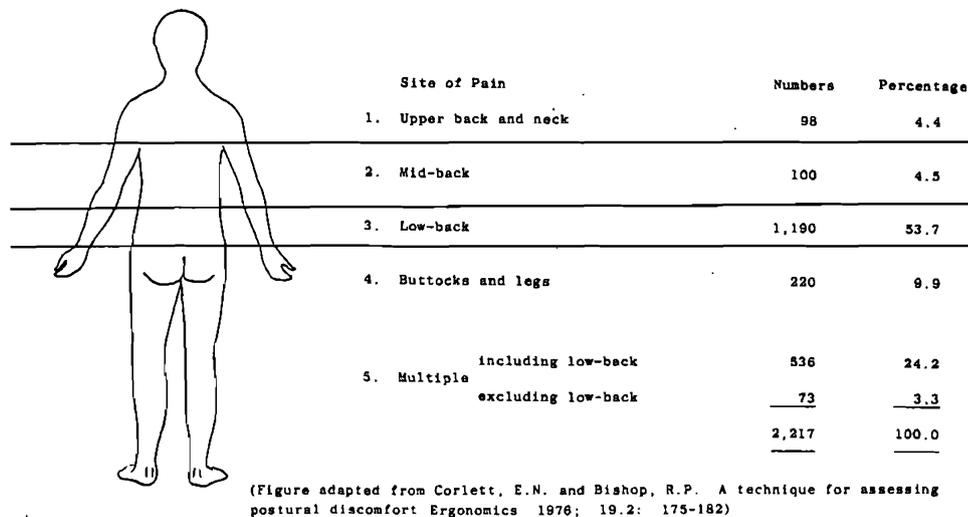


Figure 2. Site of most recent episode of back pain.

4.4. Number of back pain episodes

The number of episodes of back pain suffered by respondents is shown in figure 3. The coding of the questionnaire did not allow subdivision of the final category (seven or more separate episodes) although this was the largest, with 43% of all those nurses who had had back pain reporting at least seven episodes.

4.5. Sickness absence and back pain

Of the 3660 respondents who were in nursing in 1979, 340 (9.5%) had one or more days' sick leave for back pain during that year. In the same period 6500 working days were lost from this cause, out of 40 203 working days lost because of all forms of sick leave, thus back pain accounted for 16.2% of all sick leave in the sample. If the results are extrapolated to the 430 000 nurses in the N.H.S. it can be estimated that 40 000 nurses have sick leave for back pain each year, with an annual total of 764 000 working days lost from this cause.

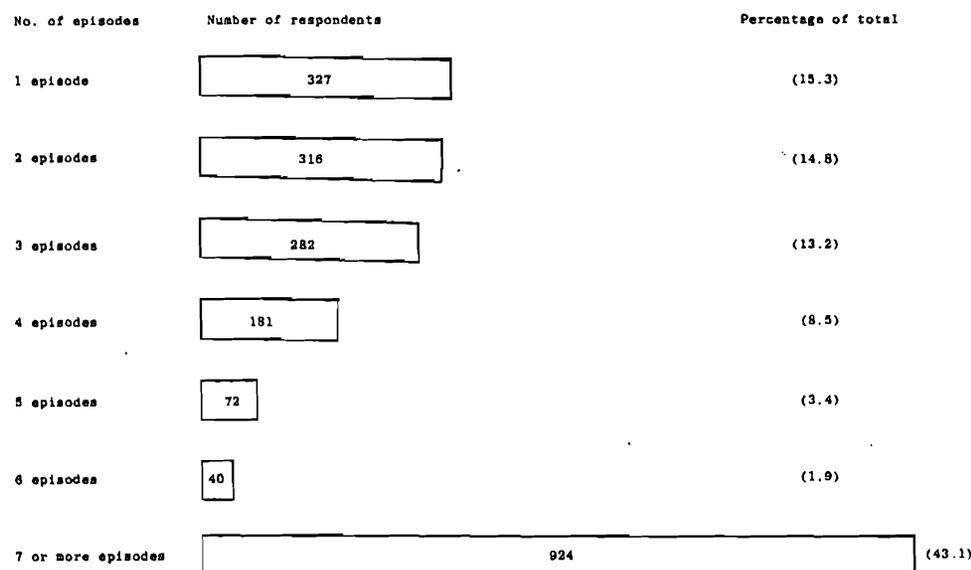


Figure 3. Number of separate episodes of back pain reported.

4.6. Age effects

The effects of age in the study sample are described in table 3.

Analysis of age with respect to absence or presence of pain at the time of completion of the questionnaire ('Back Pain Now') indicated that for the group as a whole the mean age of nurses with 'Back Pain Now' was slightly but significantly greater ($p < 0.001$) than those without (see table 3). Results for full- and part-time nurses are also to be found in table 3.

Table 3. Age effects.

	Mean age (years)	S.D.	<i>n</i>	Missing data
Total study sample	35.8	11.8	3856	56
Full time (only)	33.1	12.1	2321	48
Part time (only)	39.9	10.1	1517	27
Male	36.2	11.7	397	8
Female	35.8	11.9	3459	66
With 'back pain now'	37.3	11.7	663	11
Without 'back pain now'	35.4	11.8	3166	63
Full time				
With 'back pain now'	34.8	12.3	364	15
Without 'back pain now'	32.8	12.1	1942	
Part time				
With 'back pain now'	40.2	10.3	296	11
Without 'back pain now'	39.7	10.1	1210	

5. Discussion

Findings presented previously (Stubbs *et al.* 1980), identified high- and low-risk areas with respect to ward speciality and nursing status. The analysis focused on patient-handling incidents and the data were derived from nurses attributing the onset of back pain to a patient-handling incident in 1979. The analysis has subsequently been repeated using data of a point prevalence nature (i.e. 'Back Pain Now'). These data should be of better quality than the previous prevalence data, in that the time span for recall of information relating to the onset of back pain is considerably shorter. This analysis has failed to identify areas of nursing (with respect to ward speciality or nursing status) which are at a greater or lesser risk.

This difference may be attributed to a number of factors

- (a) The number of cases reporting 'Back Pain Now' is considerably smaller than the number of cases reporting 'Back Pain in 1979' and detection of significant differences will therefore be more difficult.
- (b) A significant age effect was found when presence or absence of 'Back Pain Now' was considered ($p < 0.001$). However, no age difference was observed for 'Back Pain in 1979'.
- (c) The point prevalence (i.e. 'Back Pain Now') was 170 per 1000 at risk. This value, similar to those reported by other workers (Dehlin *et al.* 1976, Magora 1969), is considered to be inconsistent with respect to the annual prevalence of 431 per 1000 at risk if the same condition is being assessed.
- (d) Analysis of the two types of reported back pain ('Now' and '1979') shows that 'Back Pain Now' is more often associated ($p < 0.001$) than is 'Back Pain in 1979' with the following factors: Stooping over patients; lifting/moving patients and equipment; making beds; prolonged standing; carrying heavy loads; driving; housework and sport.

Similarly, nurses with 'Back Pain Now' are more likely to report multiple locations of pain ($p < 0.001$), more episodes of back pain ($p < 0.001$) and a greater frequency of first attacks whilst nursing ($p < 0.0005$) than do nurses reporting 'Back Pain in 1979' only. However, there are no observed differences between the two groups with respect to back pain associated with menstruation, childbirth, gynaecological problems or disease. Nor are there differences with respect to attributing a specific incident to the onset of the most recent episode. The back pain reported in each group therefore appears to be different with respect to some variables. Unfortunately, it is not possible to estimate what proportion of the observed difference is attributed to recall of events and what proportion is attributed to real differences in the nature of the perceived pain.

The effects described in the results section indicate that the analysis of the nursing profession with respect to back pain differs from many other occupations. Any such analysis within nursing must take into account age effects with respect to sex, full- and part-time nursing, nursing status and ward speciality. Although there are tasks common to any nursing situation, the authors are of the opinion that each combination of nursing status and speciality must be considered as a separate occupation.

The analysis is further confounded by the problems of the career 'flow-path' of each nurse. Mercer (1980) has emphasized the scattered knowledge of the flows within, between and out of the nursing stock and pool. Earlier research (Mercer

1979) showed that, overall, nurses offered a short-stay profile, with 37% having been in their current posts for less than 1 year, with a median length of 20 months. When such a profile is considered along with possible external employment undertaken by part-time nurses, it will be appreciated that the assessment of possible cumulative factors with respect to back pain is beyond the scope of the data so far collected.

The need for control data from other predominantly female occupations is recognized and is to be dealt with in the next phase of the research. (Time and resources did not allow such data collection in the pilot study.)

Similarly, the results reported to date have been based on data collected only in the South-East (S.E.) region of the country. The study has now expanded to cover the national distribution with regard to the employment and unemployment figures, geographical considerations (including population of each region) and the national spread of nursing specialities.

Part B. Pilot Methodology

6. Introduction

In dealing with a problem such as back pain, where the aetiology is ill-understood, the researcher is faced with a multitude of variables whose inter-relationship may be highly complex. The problems are often further confounded by the reliance on subjective estimates with little or no opportunity for validation. The use of systems ergonomics can aid the researcher in the development of a clearer concept of the relationship between such factors, but the quality of the data may still be poor.

In this study, the approach to this particular problem is the development of a battery of measures, both objective and subjective, within an ergonomics framework. Additionally, it is hoped that correlation between the measures may result in a 'package' of techniques which will be adaptable to many other occupational settings.

7. Methods

The first two techniques outlined are primarily to follow-up aspects of the epidemiological study.

7.1. *Back pain incident interviews*

Nurses in the S.E. area are to be interviewed as soon as is reasonably possible after an incident of back pain. The interview will be structured and, in this way, it is hoped to elicit data related to the triggering of an episode of back pain. Whilst the element of temporal recall is kept to the minimum, it is recognized that biasing resulting from willingness to be interviewed or to report an incident will be considerable.

7.2. *Leavers' questionnaire*

A questionnaire has been designed for national distribution in order to estimate how many nurses leave the profession because of back pain or with back pain as a contributory factor.

7.3. *Measurement of physiological, anthropometric and biomechanical factors*

Trunk stresses during periods of work will be measured indirectly from intra-abdominal pressure recordings. The development of the four-channel Oxford

Medilog recording system (Series 4:24) and a suitable receiver interface (E.S. Ambulatory Receiver) has enabled continuous monitoring and recording of intra-abdominal pressure (IAP) as detected by the radio pressure pill (Davis *et al.* 1977). This enables readings to be taken over a working day or shift without interference from the researcher or from bulky equipment. This system will be used to record IAP data from a large sample of nurses. This sample will be representative of nursing status and speciality. The remaining Medilog channels will be used to record (a) trunk movements (flexion/extension) by means of an inclinometer and (b) the heart rate of the subject.

The metabolic output of a sample of nurses will be measured with the Oxylog apparatus. This will be compared with existing data (Fordham *et al.* 1978). Anthropometric assessment will include the development of work envelopes as a function of the restrictions imposed by the nurses' uniform and its variation.

7.4. *Observational techniques*

Two types of observational techniques will be used. The first involves direct field observation and assesses the type, frequency and duration of postures. In addition, quantification of loads moved and the use and availability of lifting aids will be recorded. Finally, a general ergonomic assessment will be made of the work situation.

The second observational technique involves video recording of nursing activities. This enables the validity and reliability of some of the field observations and inter-observer reliability to be evaluated. This technique will also allow a more detailed analysis of postures adopted and of their duration, especially where rapid movements are involved.

7.5. *Subjective data*

Nurses will be asked to evaluate their work-load and, in addition, they will be asked to complete discomfort charts (Corlett and Bishop 1976). These measures will be correlated with objective data as described in the Introduction.

8. Discussion

The methods outlined above will, it is hoped, allow an ergonomic appraisal of many work situations within the nursing profession. The authors believe that, as a result of the lack of knowledge surrounding the aetiology of back pain, a combination of epidemiology and ergonomics is the best approach currently available.

With regard to prevention, existing training schemes are being investigated. Several aspects of lifting techniques, including patient-handling, have been evaluated using physiological criteria (Osborne 1978, Stubbs and Osborne 1979, Scholey 1980). One aim of this study is to develop new national training schemes based on further evaluation. The mismatches between the classroom training and ward observations have been recognized. Analysis of these will include studying the degree of communication between the nurses and patients when manoeuvres are undertaken, as well as evaluation of the observed procedure.

9. Conclusions

The magnitude of the back pain problem within the nursing profession has been considered both here and previously (Stubbs *et al.* 1980). In relation to possible risk

areas within nursing, differences emerge between current back pain and earlier results using historical data (i.e. 'Back Pain in 1979'). A number of factors (e.g. age effects, prevalence rates and associated events) are discussed which indicate that the conditions being assessed in each case may be different. The need for further epidemiological data is emphasized and will include comparisons from other predominantly female occupations. This together with an estimate of how many nurses leave the profession because of back pain, or with back pain as a contributory factor, will complete this aspect of the study.

The multifactorial nature of the problem (e.g. full- and part-time, status and ward speciality, and age and sex effects) together with the limits of epidemiological techniques (Rey 1979) necessitates a broad ergonomic assessment of the profession. The battery of techniques described will, it is hoped, elucidate the relationship between these factors and will form the foundation for establishing safer systems of work. It is suggested that such an approach may reduce the magnitude of the back pain problem and dispel the belief that it is an inevitable 'occupational hazard of nursing' (Royal College of Nursing 1979).

Acknowledgments

The authors thank the four Health Districts and all the nurses who participated in the survey. Dr. D. Evans of the Department of Surgery, University Hospital, Nottingham, for his development of the Radio Pill/Medilog interface, and the DHSS for funding the study.

Une étude portant sur 3912 infirmières montre que trois quarts de millions de journées de travail sont perdues annuellement à cause de douleurs lombaires et que une sur six infirmières (159 par mille sous risque) attribue la cause de la douleur au maniement d'un malade. Des tentatives pour identifier les zones de risque au moyen de données de prévalence n'ont pas confirmé les résultats antérieurs utilisant des données chronologiques (Stubbs *et coll.* 1980). On montre que les conditions étudiées diffèrent d'un cas à l'autre. On met l'accent sur la nécessité d'obtenir des données épidémiologiques supplémentaires et sur la nécessité d'une analyse ergonomique des tâches qui incombent aux infirmières, dans leur profession. Une telle étude permettra de promouvoir la prévention des affections dans le cadre de l'Organisme National de Santé et une réduction de la fréquence des douleurs lombaires.

Die Untersuchung einer Stichprobe von 3912 Krankenschwestern ergab einen jährlichen Ausfall von 0,75 Millionen Arbeitstagen aufgrund von Rückenbeschwerden. Bei jeder sechsten Krankenschwester (159 pro 1000) trat der Schmerz während des Hebens von Patienten auf. Frühere Untersuchungen, die bestimmte Risikozonen im Krankenpflegebereich identifiziert hatten, konnten nicht bestätigt werden (Stubbs *et al.* 1980). Aufgrund der vorliegenden Daten ist anzunehmen, daß die Bedingungen für einen jeden Einzelfall unterschiedlich sind. Zur Klärung sind weitere epidemiologische Studien erforderlich, die mit einer ergonomischen Beschreibung der Tätigkeiten im Krankenpflegeberuf einhergehen müssen. Dies könnte die Grundlage für eine bessere Arbeitssicherheit im öffentlichen Gesundheitswesen darstellen und könnte die Häufigkeit von Rückenschmerzen vermindern.

看護婦3,912名について調査した結果、毎年労働日のうち750,000日は背中の痛みにみまわれており、その6件に1件(159/1000)は痛みの起こる原因が患者を扱うことにある。看護作業の中でこのような危険性のある分野をポイント・プレバランス・データを用いて同定した結果は、以前にヒストリカル・データを用いて調べた結果(Stubbs *et al.* 1980)と食い違いを見せた。これは評価される条件が異なるためと思われる。看護職全体を通じての仕事の人間工学的評価と共に、疫学データの必要性も強調される。このような評価はNHSにおけるもっと安全な作業システムの基礎を作り、背中の痛みの問題を減少させるものと期待できる。

References

- CORLETT, E. N., and BISHOP, R. P., 1976, A technique for assessing postural discomfort. *Ergonomics*, **19**, 2, 175-182.
- CUST, G., PEARSON, J. C. G., and MAIR, A., 1972, The prevalence of low back pain in nurses. *International Nursing Review*, **19**, 2, 169-179.
- DAVIS, P. R., STUBBS, D. A., and RIDD, J. E., 1977, Radio pills: their use in monitoring back stress. *Journal of Medical Engineering and Technology*, **1**, 4, 209-212.
- DEHLIN, O., HEDENRUD, B., and HORAL, J., 1976, Back symptoms in nursing aides in a geriatric hospital. *Scandinavian Journal of Rehabilitation Medicine*, **8**, 47-53.
- DILLANE, J. B., FRY, J., and KALTON, G., 1966, Acute back syndrome—a study from general practice. *British Medical Journal*, **2**, 82-84.
- FERGUSON, D., 1970, Strain injuries in hospital employees. *Medical Journal of Australia*, **1**, 376-379.
- FORDHAM, M., APPENTENG, K., and GOLDSMITH, R., 1978, The cost of work in medical nursing. *Ergonomics*, **21**, 5, 331-342.
- HEALTH AND SAFETY EXECUTIVE, 1978, *Working Conditions in the Medical Service* (Pilot Study). London.
- HOOVER, S. A., 1973, Job-related back injuries in a hospital. *American Journal of Nursing*, **73**, 2078-2079.
- LEE, R. G., 1979, Health and safety in hospitals. *Medical Science and Law*, **19**, 2, 89-103.
- MAGORA, A., 1969, An investigation of the problem of sick leave in the patient suffering from low back pain. *Industrial Medicine*, **38**, 11, 80-90.
- MANSTEAD, S. K., 1980, *Back Pain* (London: BACK PAIN ASSOCIATION).
- MERCER, G., 1979, *The Employment of Nurses* (London: CROOM HELM).
- MERCER, G., 1980, Nurse employment and mobility of trained staff. *Nursing Times*, 27 November, 2120-2122.
- O.H.E., 1979, *Compendium of Health Statistics*, 3rd ed. Table 2.8 (London: OFFICE OF HEALTH ECONOMICS).
- OSBORNE, C. M., 1978, Low back pain in nurses. B.Sc. dissertation, University of Surrey (unpublished).
- RAISTRICK, A., 1980, The back pain problem in nurses—Can it be prevented? In *Prevention of Back Pain in Nursing* (Proceedings of the Conference organized by the Nursing Practice Research Unit, Northwick Park Hospital and Clinical Research Centre, Back Pain Association and Department of Health and Social Security, 26 September 1980). Pp. 31-40.
- REY, P., 1979, Ergonomic criteria necessary to epidemiological studies in industrial medicine and public health. *Ergonomics*, **22**, 6, 661-671.
- ROYAL COLLEGE OF NURSING, 1979, *Avoiding Low Back Injury Among Nurses* (London: ROYAL COLLEGE OF NURSING).
- SCHOLEY, M., 1980, The effect on the truncal stress of nurses performing lifting tasks with geriatric patients. M.Sc. thesis, University of Surrey.
- STUBBS, D. A., and OSBORNE, C. M., 1979, How to save your back. *Nursing*, **3**, 116-124.
- STUBBS, D. A., HUDSON, M. P., RIVERS, P. M., and WORRINGHAM, C. J., 1980, Patient-handling and truncal stress in nursing. In *Prevention of Back Pain in Nursing*. (Proceedings of the Conference organized by the Nursing Practice Research Unit, Northwick Park Hospital and Clinical Research Centre, Back Pain Association and the Department of Health and Social Security, 26 September 1980), pp. 14-27.