Perceptions of Work and Family Assistance and the Prevalence of Lower Back Problems in a South African Manganese Factory

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Abstract: An analytical cross-sectional epidemiological study was carried out among 109 manganese plant workers to examine the prevalence and association between lower back problems (LBP) and family and workplace related psychosocial risk factors. Outcome (LBP) was defined using a guided questionnaire and a functional rating index. Exposure to family and workplace related psychosocial risk was determined using the Occupational Risk Factor (ORFQ) and APGAR questionnaires for work and family support. Using inclusive and stringent definitions for perceived LBP, point prevalence was 37.6% and 29.4%, respectively. Only 8 cases of LBP were, however recorded officially over a 7-yr period (1996–2003). Multivariate analyses indicated a high, but non-significant odds ratio (OR) for negative perceptions of workplace support OR 3.29 (CI 0.95–11.30). A positive, non-significant, association for negative perceptions of family support (2.56; CI 0.69–9.52) and a protective, but non-significant, association for control over the order and pace of working tasks (OR 0.40; CI 0.12–1.35) was found. These findings together with the under-reporting, leads one to conclude that work hardening and a cultural ethos of non-complaining among manual labourers, moderates the association between LBP and the aetiological factors studied.

Key words: Epidemiology, Back pain, Manganese workers, Psychosocial, Work control, APGAR, South Africa

Introduction

Many adults will suffer from back pain at some stage of their lives, making lower back problems (LBP) one of the foremost health-care epidemics of our time. Numerous studies attest to the high frequency of back complaints in society1–4. Research around the world has identified LBP as a relevant problem. In the United Kingdom lost productivity and resulting economic costs, due to LBP, were estimated to be in the region of £12 billion in 1998. Indirect costs, due to lost productivity and informal care costs, by far comprise the largest proportion of these costs5, 6. In Japan the number of occupational LBP among workers, who have missed four days of work or more, has been gradually
decreasing but still totaled more than 4,600 cases in 20007). These cases of occupational LBP accounted for approximately 60% of all occupational diseases from 1990 to 2000, and have been recognized as a significant occupational health problem in Japan8). In South Africa it is calculated that 30,000 persons suffer daily from back and neck problems and that 10% of them will become chronic cases9). Compensation costs for LBP in South Africa resulted in the equivalent of approximately 20 million US dollars in 200010).

Individual, psychosocial and lifestyle factors together with work-place exposures have been implicated in the onset of LBP symptoms8, 11). Both work- and nonwork-related psychosocial factors have been associated with back disorders12–16). From the early 1990’s, work-related psychosocial factors have increasingly been considered as risk factors for LBP4, 17–20). It has been suggested that various organizational and social factors of the work place may be related to increased stress and subsequent adverse health outcomes. Work satisfaction and the measure of family support are psychosocial risk factors for LBP often mentioned in literature21–24). Hoogendoorn and co-workers13) concluded that strong evidence exists associating poor social support in the workplace and low job satisfaction with back pain. There is, however, still confusion regarding the contribution of psychosocial factors to lower back pain. Unlike the more familiar range of physical factors, such as force, repetition, posture, vibration and many others, the concept of psychosocial factors includes a vast array of conditions.

Further study is required to expound the association between certain psychosocial factors and the outcome of LBP in different industrial populations. The unexplored African industrial setting, particularly in the labor-intensive sector, lends itself to authentic research in this regard. In the present study, the objective was to determine whether family and workplace-related psychosocial factors and work organization are associated with the prevalence of LBP in a South African Manganese industry.

**Materials and Methods**

**Subjects and design**

The design entailed an analytical cross-sectional study on a group of 109 manganese plant workers, all of whom were males. The process of manganese production, via electrolysis, requires that plates be removed from acid cells and placed on monorails (cell stripping) and then be moved to an area where the manganese residue is removed or “knocked off” with rubber hammers (knock-off bins). Eighty-two (75%) of the subjects studied worked in cell houses, primarily performing hard manual labour during cell stripping and knock-off bin (KOB) work. The remaining 27 (25%) workers worked in the metal handling houses, performing various tasks such as forklift driving, light packing and process control work. A positive feature of this study was the involvement of 109 (mean age 35.52 ± 9.29; mean years of work exposure 7.78 ± 6.99) of the 113 total workforce, thus eliciting a high rate of participation (96%) and ensuring an in-depth analytical study.

**Measurements and instruments**

**Case definition**

The Functional Rating Index (FRI) comprising 10 items developed and validated by Feise and Menke27) to assess the extent to which LBP have affected daily activities, was applied to determine case definition. A FRI of ≥ 30% perceived disability was used in the analyses as a stringent definition and the mere presence of back pain at the time, was used as an inclusive definition to record cases of LBP. We further compared the prevalence figures determined by case definition with company statistics for comparison.

**Work and family support**

Information on potential psychosocial risk factors for LBP was assessed using the APGAR’s (Adaptation, Partnership, Growth, Affection, and Resolve) questionnaires17, 26, 27). A modified Work APGAR (WAPGAR), which evolved from the family APGAR, and was refined by Bigos and co-workers17) for the benchmark Boeing study, was used to examine the perceptions of support at the workplace. A measure of the family support system was obtained by the use of the Family APGAR (FAPGAR), which comprises a brief, five-item, family function questionnaire.

The standard scoring for the FAPGAR interprets high scores (7–10) as indicating high functionality and low scores (0–3) indicating severe dysfunctionality. However, for statistical modeling purposes, we amended the scoring inversely such that a score of 0–3 and 7–10 indicated high functionality and severe dysfunctionality, respectively. A score of ≥ 4 (moderate to severe dysfunctionality) was thus utilized as the criteria to classify exposure (confirm the risk factor). The modified WAPGAR was scored in the same manner, and used a score of 7 and higher as the classification of low social support and job satisfaction in the workplace.

**Work organization**

Information on work organization was attained from part of the new Occupational Risk Factor Questionnaire (ORFQ), developed by Halpern and co-workers28). Using categorical
(yes/no) scales, a yes answer was associated with risk in questions 2, 4 and 5 of the ORFQ. Questions 1 and 3 differed, however, and a no answer was associated with risk. For statistical purposes all questions were processed in the same manner, with positive odds being associated with risk in questions 2, 4 and 5; and odds lesser than 1.0 being associated with risk in questions 1 and 3.

Procedures
Collecting data without influencing daily routine and production is a challenging task, obliging one to make use of non-disrupting instruments with the risk of data being incomplete and inaccurate. To ensure reliability of the data and representation, the questionnaires were administrated during guided interview sessions, with anonymity being assured. The study was furthermore conducted in accordance with the declaration of Helsinki. The local Ethics committee approved the informed consent of all parties and the experimental design and procedures. The FRI is known for its reliability, validity, and responsiveness27). This was confirmed in the South African industrial population, with high internal consistency (Cronbach alpha values) being recorded (CA 0.95). Good internal consistency was recorded for the ORFQ, modified Work and Family APGAR’s with Cronbach alpha values of 0.83; 0.79 and 0.75, respectively. Similarly high test-retest reliability (Frequency of differences <20%) for the FRI, ORFQ and two APGAR’s was recorded.

Statistical analyses
For the assessment of risk factors, crude odd ratios (OR) were derived directly from $2 \times 2$ tabulations, while adjusted ORs followed from multivariate analyses, adjusting for age, smoking habits, job description, and years of work exposure as possible confounders. In the statistical analyses, testing was done at the 0.05 level of significance. The ORs described the relative effect, while the confidence intervals described the precision of the estimate. Where appropriate, and where the data was of a ratio nature, standard descriptive statistics (means and standard deviations) were employed. Significant differences between sets of ratio data were evaluated using an independent t-test, with the 95% level of confidence ($p \leq 0.05$) applied29). The statistical data analysis was performed using Stata Release 8, Stata Press, STATA CORPORATION, College Station, Texas. Copyright 1985–2003.

Results

Prevalence
Using an inclusive definition (presence / absence of LBP), the lifetime and annual prevalence of LBP was 71.6% and 69.8%, respectively with month and point prevalence being 55.0% and 37.6%, respectively. Using the FRI to measure perceived dysfunction and pain, 29.4% of the workers measured a 30% or higher disability (stringent outcome definition).

Comparison of LBP prevalence between workers in the cell houses (n=82; hard manual labour) and workers of the metal handling houses (n=27; various tasks) indicated higher inclusively (39.02% compared to 30.77%) and stringently defined prevalence of LBP (36.37% compared to 11.54%) for the cell house workers.

Company statistics on incidence of LBP (injury on duty reporting), over a 7-yr period from April 1996 to April 2003, indicated only 8-recorded cases of LBP. These findings thus indicate a high prevalence of unreported LBP when comparing self-reported, perceived LBP in the cross-sectional study to reported company injury statistics.

APGAR scores
In comparing the disability groups the mean APGAR scores were slightly higher ($p>0.05$) in the FRI $\geq 30\%$ group, indicating a lower but statistically insignificant perceived rating of family and workplace support systems as compared to the FRI $<30\%$ group (Fig. 1).

In univariate analyses (Table 1), using the inclusive definition of LBP and the more stringent classification of perceived dysfunction and pain as outcome, crude ORs were 3.64 (CI 0.69–19.29) and 2.31 (CI 0.69–7.63) respectively, for negative perceptions of support at the workplace. In multivariate analyses adjusted for possible confounders, using the inclusive definition of LBP, a high, but non-significant OR of 3.29 (CI 0.95–11.30) was reported for negative perceptions of support at the workplace, and a positive, but non-significant OR of 2.56 (CI 0.68–9.67), using the more stringent classification of LBP (Table 1).

Univariate analyses, using the inclusive and stringent classification of LBP as outcome, produced crude ORs of 1.65 (CI 0.38–7.32) and 2.19 (CI 0.61–7.89) respectively, for negative perceptions of the family support system. Multivariate analyses, adjusted possible confounders for the same variables, indicated ORs of 2.56 (CI 0.68–9.52) and 2.35 (CI 0.58–9.48), respectively (Table 1).

Work Organization
In univariate analyses the following respective crude ORs were found for work organizational factors when contrasting the inclusive versus stringent classification of LBP, viz: control over the order and pace of work - 0.50 (CI 0.12–
2.16) vs. 0.71 (CI 0.22–2.34); dependence on others - 0.60 (CI 0.14–2.67) vs. 1.29 (CI 0.38–4.39); and time pressure and deadlines - 1.31 (CI 0.24–7.06) vs. 1.27 (CI 0.24–6.70) (Table 1).

In multivariate adjusted analyses the following respective ORs were found for work organizational factors when contrasting the inclusive versus stringent classification of LBP, viz: control over the order and pace of work - 0.40 (CI 0.12–1.35) vs. 0.39 (CI 0.10–1.56); dependence on others - 0.94 (CI 0.25–3.49) vs. 0.48 (CI 0.09–2.39); and time pressure and deadlines - 0.83 (CI 0.16–4.19) vs. 0.78 (CI 0.11–5.44) (Table 1).

**Discussion**

**Prevalence**

Comparing prevalence and incidence rates of LBP with literature may be difficult and unwise due to disparate definitions of LBP. The lifetime prevalence (71.6%) of these workers is, however, comparable with the 80% often quoted in literature. While 37.6% of the workers indicated to have some form of LBP at the time of data capturing, a fairly high proportion (29.4%) of the workers seem to have more serious LBP, which limits their daily activities. These findings are in accordance with point prevalence rates between 12% and 35% mentioned in literature. The 29.4% of workers who perceive to have LBP, which limits their daily activities substantially is, however, a point of concern for this specific industry. Another interesting observation is that such more severe LBP is more prevalent in the cell house workers than in the metal-handling workers. The nature of the tasks for these workers is that of hard manual labor.

Comparing these perceived LBP prevalence figures with company statistics on incidence of LBP, however creates a contradictory picture. In a 7-yr period from April 1996 to April 2003, only 8 cases of LBP were recorded. The findings of this study therefore indicated a high prevalence of unreported LBP if compared to reported company injury statistics. This observation is nonetheless consistent with most literature on the under-reporting of work injuries, which indicates that most musculoskeletal symptoms produced or aggravated by work go unreported.

**Workplace support**

Results indicated positive associations between LBP and perceptions of a lack of workplace support (WAPGAR) for these workers with ORs between 2.31 and 3.64, with a high, but non-significant association between the inclusive classification of LBP and low perceived workplace support, after adjusted for possible confounders.

These findings are consistent with those reported by two reviews noted in literature. Burdorf and Sorock found ORs ranging from 1.39 to 2.40 for job satisfaction. Hoogendoorn and colleagues found the magnitude of the risk estimates (RR / OR) ranged from 1.70 to 3.00 for job satisfaction and from 1.30 to 1.90 for social support in the workplace. These ranges of risk estimates are very similar to some of the risk estimates found in this study. Our findings, however, were non-significant. This could be explained, by having a closer look at sub-question analyses within the

![Fig. 1. Comparison of disability groups with respect to APGAR scores.](image-url)
WAPGAR, which indicated job enjoyment and satisfaction to be the only significant adjusted OR (1.78; CI 1.01–3.16).

Five of the seven WAPGAR items deal with co-worker relationships, for which no significant associations were found. Some were actually negative, indicating positive co-worker support. This could be due to the fact that they are generally cohesive, because of the hardships they share together. Long working hours, hard manual work, and difficult working surroundings all play a role in building a feeling of cohesion between workers. This together with teamwork often needed in performing different tasks in the plant, such as cell stripping, all leads to positive feelings towards fellow workers. The significant association between job dissatisfaction and LBP is supported by Bigos and co-workers who found a positive association between job dissatisfaction and workers filing compensation claims for back injury. In their study, subjects who stated that they “hardly ever” enjoyed their job tasks were 2.5 times more likely to report a back injury than those who “almost always” enjoyed their job tasks.

Family support
Although limited data are available on family perceptions and support, some studies have investigated low social support and poor social relationships outside the working situation as possible contributing factors in development of LBP. In their review on psychosocial risk factors for LBP, Davis and Heaney found only positive associations between poor social relationships and LBP in 20% of their studies reviewed. In our study positive non-significant associations between family support (FAPGAR) and LBP were found with crude and adjusted odds ranging between 1.65–2.56. In this plant, shift work, and long working hours may have a negative effect on family relationships, which in turn may lead to increased stress and LBP.

Work organization
Although not significant, most univariate findings for work organization factors indicated that workers, who perceived to be working under stressful situations, specifically referring to time pressure and deadlines, was more prone to LBP (ORs 1.27–1.31). This however was not confirmed with multivariate analyses. The opposite was true for workers who perceived to be working under more controlled conditions, where they had control over the order and pace of their tasks as indicated by protective ORs of between 0.39 and 0.71. These findings are supported by Hoekstra and co-workers who, in a study among teleservice operators controlled for a number of individual and work-related factors, found perceived job control at work to be inversely associated with back disorders (OR 0.6). Likewise, earlier work by Sauter found that low job control was related to neck, back, and shoulder discomfort. In a more recent study by Byrns and co-workers perceived job control was also inversely associated with lower back pain symptoms (OR 0.8), although not significantly (p>0.05).

A distinct observation of this study is that there appears to be major underreporting of LBP when contrasting company statistics with the high prevalence of self-reported LBP. The reason for workers not presenting to the clinic with their condition could be ascribed to a cultural ethos among manual labourers, of not complaining about work organisational and support systems, and related concerns for job security in a
scenario where unemployment is rife. Alternatively the robust worker phenomenon could be in play where, although they experience LBP, their task demands leads to work hardening and the ability to cope with the condition. It can be concluded that the above arguments also forms the basis of the general finding of a non-significant association between perceived LBP and the psychosocial and work organisational aetiological factors studied.

Given the wide range of factors appearing to influence industrial LBP, epidemiological research in this area remains a daunting but absolutely necessary task. A particular question that remains to be answered is: Whether a similar mix of risk factors influences LBP in different parts in the world? It is unlikely that the data of a manganese factory in South Africa is comparable with a motor manufacturing company in the UK. Therefore the importance of regional and industrial specific studies, conducted in a prospective manner where possible, cannot be overemphasized and are eminently in the quest for seeking preventative measures to decrease LBP in industry.

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