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Psychosocial Factors Related to Lower Back Problems in a South African Manganese Industry

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The purpose of this study was to determine the association between the prevalence of lower back problems, fear-avoidance beliefs, and pain-coping strategies in using an analytical cross-sectional epidemiological study among a group of 109 workers in a South African manganese industry. Outcome (LBP) was defined using a guided questionnaire and functional rating indexes. Exposure to psychosocial risk was determined using the Fear-Avoidance Beliefs (FABQ) and Coping Strategies (CSQ) questionnaires. 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-year period reflecting a tendency of underreporting. Multivariate logistic regression analyses indicated significant adjusted relative risk ratios (RR) for work-related fear-avoidance beliefs (RR 2.35; 95% CI 1.39–3.95) as a singular psychosocial risk while no specific coping strategy could be isolated. In conclusion, work hardening and a contented ethos of the manual laborers under study moderates the association between the prevalence and etiology of LBP.

KEY WORDS: epidemiology; risk factors; psychosocial; industrial; South Africa.

INTRODUCTION

Pain is one of the most powerful drives in humans and is closely allied to fear (1). Pain has been viewed as complex, multidimensional developmental processes where various psychosocial factors are important (2,3). Back pain, one of the most common pain manifestations, affects millions of people worldwide, and mankind has suffered from back problems for at least as long as documented records exist. Lower back problems (LBP) constitutes one of the most difficult and costly medical problems in industrial countries,

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with an incidence of about 5% per year reported in a recent article by Quittan (4). It is further commonly accepted that 50–80% of the population suffers from idiopathic lower back pain at least once in their lifetime (5).

There is increasing evidence that psychosocial factors related to the job and work environment are associated with the development of work-related lower back pain (6–10). Individual psychological factors, such as personal traits and cognitive and behavioral variables, are also categorized as psychosocial factors in addition to the psychosocial factors observed at work and in private life. Back pain is not only a physical problem, but may also depend on the person's attitudes and beliefs, psychological distress, and illness behavior (11). Researchers have also found the direct relationship between pain and disability, to be low (12–14) while the impact of cognitive processes, like beliefs and expectations have been found to be important (15,16). Fear-avoidance beliefs and fear of movement and reinjury in particular have been shown to be strong predictors of physical performance and pain disability. (17).

During the last decade the role of pain-related fear, and its associated avoidance behavior in the development of chronic musculoskeletal pain, has received increased attention (3,18). Avoidance behaviors are further mediated by attitudes and beliefs about work and activity (19). Literature suggests that fear-avoidance beliefs about physical activity and work might form specific cognitions intervening between low back pain and disability (1,20,21). Fear-avoidance beliefs about work are strongly related with disability of daily living and work lost in the past year, even more so than pain variables, time pattern, and pain severity (20). Pain-related fear is further associated with impaired physical performance (22,23) together with increased self-reported disability (23).

Recently, specific beliefs about management of health and pain have also received widespread attention (24–27). Individuals who experience pain develop many ways to tolerate, minimize, or reduce their pain. These efforts made by pain patients to deal with their pain have been called coping strategies. Coping strategies have been classified in a number of ways, dating back from the late seventies (28). These strategies have traditionally been classified into cognitive and behavioral coping strategies (29). There is growing recognition that coping strategies may be an important factor determining how patients adjust to chronic pain (5,20,30,31).

A positive relationship between fear-avoidance beliefs, cognitive behavioral coping strategies for pain, and chronic pain has been reported in the literature (3,5,18,32,33). In order to search for some of the answers surrounding fear-avoidance beliefs, pain-coping strategies, and work-related lower back problems, studies are needed, among others, to investigate if these beliefs and strategies manifest in different industrial populations. The mostly unexplored South African situation lends itself to possible authentic research in this regard, especially in the labor population. The objective of this specific study was to determine the association between the prevalence of lower back problems, fear-avoidance beliefs, and pain-coping strategies in a South African manganese industry.

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 labor during cell stripping and knock-off bin (KOB) work. The remaining 27 (25%) subjects 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 $\pm$ 9.29; mean years of work exposure 7.78 $\pm$ 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 Menke (34) to assess the extent to which LBP affects daily activities, was applied to determine case definition. A FRI of $\geq$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. Together with the FRI, a complaint index (35) validated by Zinzen (36) comprising graphic display of three thermometers (TTCI) illustrating different degrees of pain, from zero to unbearable pain, was used to add to the validity of the outcome measurement. Accordingly workers were asked to indicate their pain experience in the worst and best situations, as well as how the pain was experienced at the time of the questionnaire. Responses thus indicating severe pain to unbearable pain were used to classify outcome.

Psychosocial Risks

Fear-Avoidance Beliefs

Fear-avoidance beliefs (FAB) were assessed using the Fear-Avoidance Beliefs Questionnaire (FABQ) developed by Waddell *et al.* (1). The FABQ measures the extent to which an individual believes that physical or work-related activities will lead to increased bodily damage, and focuses on the patient's beliefs about how work and physical activity affects their low back pain (20,37). The measure has 16 items and two subscales comprising beliefs about possible harm resulting from physical activity (items 1–5) and beliefs about possible harm from work-specific activities (items 6–16).

Pain-Coping Strategies

Cognitive and behavioral coping strategies for pain were assessed with the Coping Strategies Questionnaire (CSQ) developed by Rosenstiel and Keefe (29) and validated by Main and Waddell (30). The CSQ comprises 50 items assessing six cognitive coping strategies namely: 1) Diverting attention (DA); 2) Reinterpreting pain sensations (RPS); 3) Coping self-statements (CSS); 4) Ignoring pain sensations (IPS); 5) Praying/hoping (PH);

and 6) Catastrophizing (CAT); together with two behavioral coping strategies namely: 1) Increasing activity level (IAL); and 2) Increasing pain behavior (IPB).

Procedures

The measurement of psychosocial risk exposure is an important, but difficult task in industrial research. To ensure reliability of the data and representation, the questionnaires were administrated during guided interview sessions, with anonymity being assured. The relevant ethics committee approved the design and procedures, and the study was furthermore conducted with the informed consent of all parties and in accordance with the declaration of Helsinki. The FRI is known for its reliability, validity, and responsiveness (34). 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 two FABQ subscales (Physical Activity and Work) with Cronbach alpha values of 0.68 and 0.85, respectively. Good internal consistency was found, for the different subscales of CSQ, with the exception of the IPB subscale. Cronbach alpha values for the different subscales of the CSQ were RPS 0.74; DA 0.76; IPS 0.65; CSS 0.72; IAL 0.73; CAT 0.73; IPB 0.57; and PH 0.79, respectively. Similarly high test-retest reliability (frequency of differences $<20\%$) for the FRI, the three thermometers complaint index (TTCI), the FABQ and the CSQ was recorded.

Statistical Analyses

Adjusted relative risks (RR) followed from logistic regression analyses. To control for potential confounding factors, all the observed risk factors were included in the logistic regression analyses. In the statistical analyses, testing was done at the 0.05 level of significance. The risk ratios described the magnitude of 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. Again, the 95% level of confidence ($p \leq 0.05$) was applied as the minimum to interpret significant differences among sets of data. The statistical data analysis was performed using Stata Release 8, Stata Press, STATA Corporation, College Station, TX. Copyright 1985–2003.

RESULTS

Prevalence of LBP

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 (38). 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

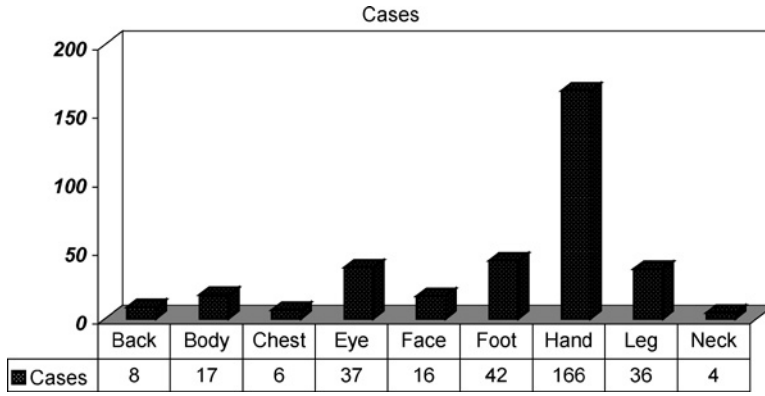


Fig. 1. Injury on duty reports of musculoskeletal disorders (April 1996 to April 2003).

labor) and workers of the metal handling houses ($n = 27$; various tasks) indicated a higher inclusively (39.02% vs. 30.77%) and stringently defined prevalence of LBP (36.37% vs. 11.54%) for the cell house workers.

Company statistics on the incidence of LBP (injury on duty reports), over a 7-year period from April 1996 to April 2003, indicated only eight recorded cases of LBP (Fig. 1). 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 (38).

Fear-Avoidance Beliefs

Mean fear-avoidance beliefs about work and physical activity scores were significantly higher ($p \leq 0.05$) in the 30% or higher disability group (Fig. 2).

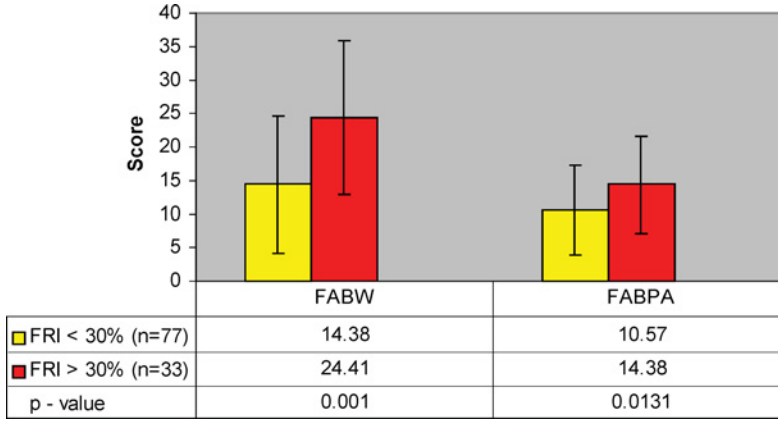


Fig. 2. Fear-avoidance beliefs scores by disability category. FABW: Fear-avoidance beliefs about work; FABPA: Fear-avoidance beliefs about physical activity.

Table I. Logistic Regression Analyses (Fear-Avoidance Beliefs)

Variables	Multivariate analyses (adjusted RRs)			
	RR inclusive definition	CI 95%	RR stringent (FRI)[a] definition	CI 95%
Fear-avoidance beliefs for work	6.07	1.89–19.55*	2.35	1.39–3.95*
Fear-avoidance beliefs for physical activity	0.94	0.32–2.74	0.59	0.21–1.68

[a]Functional Rating Index.
*$p \leq 0.05$.

Multivariate logistic regression analyses using the inclusive definition of LBP and the more stringent classification of LBP showed relative risk ratios (RRs) of 6.07 (CI 1.89–19.55) and 2.35 (CI 1.39–3.95), respectively, for every 10-point increase in the score for fear-avoidance beliefs about work (Table I). These results therefore indicated highly significant ($p \leq 0.05$) associations between LBP and fear-avoidance beliefs about work. No significant associations were however found between LBP and fear-avoidance beliefs for physical activity in the manganese workers, with even a surprisingly negative RR of 0.59 (CI 0.21–1.68) reported.

Univariate analyses (crude RRs), using the "worst of times" subscale of the three thermometers complaint index as outcome, indicated significant crude RRs of 2.31 (CI 1.19–1.69) for every 10-point increase in the score for fear-avoidance beliefs about work, and 1.84 (CI 1.33–2.55) for every 5-point increase in the score for fear-avoidance beliefs about physical activity.

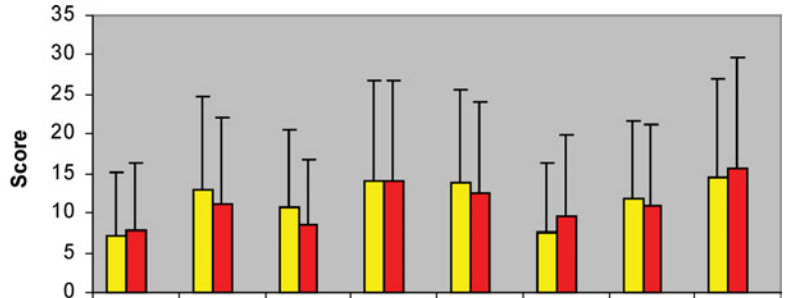
Pain-Coping Strategies

There were no significant differences between the mean scores of the two disability groups (FRI) in the six cognitive and two behavioral coping strategies of the CSQ (Fig. 3). No real differences were thus apparent in the nature of the coping strategies irrespective of the level of disability due to LBP. In multivariate analyses, no significant associations ($p > 0.05$) were found in the coping strategies of the manganese workers and LBP (Table II).

DISCUSSION

Prevalence

Comparing prevalence and incidence rates of LBP with literature may be counterproductive due to disparite definitions of LBP. The lifetime prevalence (71.6%) of these workers is, however, comparable with the 80% often quoted in literature (39). 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%) seem to have more serious LBP, which limits their daily activities. These findings are in accordance with point prevalence rates of between 12 and 35% mentioned in literature (4,5,39,40–43). The 29.4% of workers who perceive to have LBP that substantially limits their daily activities are, however, a point of concern for this specific industry. Another interesting observation is that such more severe LBP is more prevalent in



	RPS	DA	IPS	CSS	IAL	CAT	IPB	PH
FRI<30% (n=77)	7.09	12.9	10.61	14	13.81	7.69	11.79	14.44
FRI>30% (n=32)	7.78	11.09	8.47	14	12.47	9.53	11	15.63
p - value	0.6958	0.4494	0.2503	1	0.59	0.3732	0.7121	0.6792

Fig. 3. Pain coping strategies scores by disability category. RPS: Reinterpreting pain sensations; DA: Diverting attention; IPS: Ignoring pain sensations; CSS: Coping self-statements; IAL: Increasing activity level; CAT: Catastrophizing; IPB: Increasing pain behavior; PH: Praying/hoping.

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 injury on duty statistics for incidences of LBP, however, creates a contradictory picture. In a 7-year period from April 1996 to April 2003, only eight 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 underreporting of work injuries, which indicates that most musculoskeletal symptoms produced or aggravated by work go unreported (44,45). The reason for workers not presenting to the clinic with their condition could be ascribed to a cultural ethos among manual laborers, of not complaining, 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 lead to work hardening and the ability to cope with the condition.

Table II. Logistic Regression Analyses (Pain-Coping Strategies)

	Multivariate Analyses Adjusted RRs	
Variables	RR stringent (FRI)[a] definition	CI 95%
Diverting attention (DA)	0.53	0.16–1.77
Reinterpreting pain sensations (RPS)	0.62	0.17–2.33
Coping self-statements (CSS)	0.94	0.32–2.74
Ignoring pain sensations (IPS)	0.96	0.36–2.54
Praying/hoping (PH)	1.41	0.39–5.13
Catastrophizing (CAT)	1.36	0.60–3.08
Increasing activity level (IAL)	2.31	0.65–8.27
Increasing pain behavior (IPB)	0.55	0.13–2.25

[a]Functional Rating Index.

Fear-Avoidance Beliefs

The significant associations between LBP and fear-avoidance beliefs about work supports the work of Vowles and Gross (37) and Ciccone and Just (46) which advocates the hypothesis that fears specific to work-related activities have an effect on self-reported disability, and that these fears are related to perceived disability for work. This is further supported by the work of Fritz *et al.* (47), who found that higher fear-avoidance beliefs for work activities were related to higher scores on a modified version of the Oswestry Disability Questionnaire, similar to the FRI used in this study.

These findings on fear-avoidance beliefs about work should not be taken lightly by the industries involved when looking at the work by Waddell *et al.* (1) who found that fear-avoidance beliefs about work are strongly related with disability of daily living and work lost in the past year, more so than biomedical variables such as anatomical pattern of pain, time pattern, and severity of pain. Waddell and coworkers also reported that fear-avoidance beliefs about work explained a substantial amount of the variance in disability and work loss, even after controlling for pain intensity and location (1). Our results furthermore support the work of Crombez *et al.* (20) who found the FABQ-Work subscale to be the only variable among the pain-related fear scales that was significantly related to pain intensity. Zinzen (36) showed furthermore that FABQ-Work was the strongest discriminating variable in relation to LBP in a nursing population.

Comparing the actual mean scores of the 30% or higher disability groups for the fear-avoidance subscales for work (24.41 ± 11.44) and physical activity (14.38 ± 7.19) with previously published studies shows similar observations. Waddell and coworkers (1) reported mean FABQ-Work subscale scores of 21.9 ± 14.3 in patients with back pain alone and 25.2 ± 12.1 in low back patients with referred pain. Crombez and coworkers (20) reported mean scores of 25.8 ± 11.3 for the work subscale and 15.9 ± 4.8 for the physical activity subscale in their initial study of referred chronic lower back problem patients. Their second study on referred chronic lower back problem patients indicated lower mean scores of 17.5 ± 12.08 for the work subscale and 13.86 ± 4.87 for the physical activity subscale. Fritz and coworkers (47) however reported slightly higher fear-avoidance scores (27.9 ± 8.6 for the work subscale; 18.9 ± 5.8 for the physical activity subscale) in their sample of acute back pain patients than most studies using the FABQ. Their higher values were properly due to the acuity of their subjects' lower back pain, the work-related nature of the injuries, or a combination of both factors.

Pain-Coping Strategies

Although there were no significant differences in the coping strategy scores for the two disability groups, higher values were reported in the reinterpreting pain sensations, catastrophizing, and praying and hoping coping strategies for the FRI disability group of 30% and higher. On the other hand lower values were reported in the diverting attention, ignoring pain sensations, increasing activity level, and increasing pain behavior coping strategies for the same LBP disability group. Similarly, though nonsignificant associations ($p > 0.05$) were however found in logistic regression analyses between coping strategies of the manganese workers and LBP. Nonetheless, a RR of 2.31 was reported for increased activity level, which was the only RR of more than 2. These findings contradict some international

findings which found coping strategies such as catastrophizing to be significantly related to LBP (16,20,26,27,48–50).

CONCLUSION

There is a clear need for prospective studies to follow in the South African Industrial population so that the temporal relationship between exposure and outcome can be further investigated. 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. Furthermore highly significant associations between industrial lower back problems and fear avoidance for work-related activities were observed in this South African industry. However no significant associations between cognitive and behavioral coping strategies for pain and LBP could be identified. It can be concluded that the robust worker argument referred to earlier also form the basis of the general finding of a nonsignificant association between perceived LBP and the majority of psychosocial aetiological factors studied. These findings attest to the need for application of the most appropriate interventions to manage the individual patient's signs and symptoms, in addition to consideration of the potential influence of cognitive factors such as fear-avoidance beliefs.

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