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ORIGINAL REPORT

FACTORS ASSOCIATED WITH WORK ABILITY IN PATIENTS WITH CHRONIC WHIPLASH-ASSOCIATED DISORDER GRADE II–III: A CROSS-SECTIONAL ANALYSIS

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Objective: **To investigate the factors related to self-perceived work ability in patients with chronic whiplash-associated disorder grades II–III.**
Design: **Cross-sectional analysis.**
Patients: **A total of 166 working age patients with chronic whiplash-associated disorder.**
Methods: **A comprehensive survey collected data on work ability (using the Work Ability Index); demographic, psychosocial, personal, work- and condition-related factors. Forward, stepwise regression modelling was used to assess the factors related to work ability.**
Results: **The proportion of patients in each work ability category were as follows: poor (12.7%); moderate (39.8%); good (38.5%); excellent (9%). Seven factors explained 65% (adjusted $R^2=0.65$, $p<0.01$) of the variance in work ability. In descending order of strength of association, these factors are: greater neck disability due to pain; reduced self-rated health status and health-related quality of life; increased frequency of concentration problems; poor workplace satisfaction; lower self-efficacy for performing daily tasks; and greater work-related stress.**
Conclusion: **Condition-specific and psychosocial factors are associated with self-perceived work ability of individuals with chronic whiplash-associated disorder.**

Key words: work ability; neck pain and disability; whiplash-associated disorders.

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INTRODUCTION

Chronic musculoskeletal disorders are recognized as an increasing health and occupational problem (1). Whiplash-associated disorder (WAD) is one such chronic disorder, with symptoms resulting from injury to the neck, following a sudden acceleration-deceleration force (2). An accepted classification system based on physical symptoms grades the injury as WAD 0–IV, where a higher grade indicates greater severity of injury (3). Common symptoms include neck, shoulder and arm pain and headaches. Patients may also experience numbness, dizziness, tinnitus, nausea, visual/auditory impairments, localized spasm and tenderness, as well as cognitive and psychological disturbances (2, 4). There is substantial evidence demonstrating that, for many patients, these symptoms may become chronic, with rates varying between 15% and 50% (3). Individuals at greater risk of persistent symptoms are those with WAD grades II–III (5).

There is ample research investigating the factors associated with recovery and return to function in patients with chronic WAD. While there is no accepted definition of functional recovery, an individual's ability to return to work or resume usual work activities may potentially be affected by chronic WAD (6). Despite the high rates of chronicity, work outcomes for the WAD population do not seem to be significantly affected, with evidence that 68–79% of patients with WAD return to work (7, 8). Factors found to negatively impact recovery for work include the severity of physical symptoms (9) and psychological distress (10). Factors associated with higher return to work rates include higher education, higher income and fewer or no depressive symptoms (3, 5). Female gender has been found to be associated with poorer return to work outcomes (9); yet other studies suggest that gender is not a predictor of work disability (11). Heavy manual work may affect the ability to return to work (9), although there is evidence suggesting that concentration deficits, regardless of the degree of manual labour, are significantly associated with poor return to work outcomes (7). Taken together, the literature indicates that a mix of physical, psychosocial, work-related and socioeconomic factors are important for positive work outcomes in patients with chronic WAD (12).

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Return to work is an important rehabilitation milestone. However, it does not mark the end of the process of recovery, nor does it reflect an individual's ability to work. The rate and prognostic factors for return to work have been investigated, yet there is limited insight into the work ability of patients with chronic WAD who have returned to work. Thus, there is a need to investigate the impact of chronic WAD and associated factors on the ability to work. The objective of this study was to identify factors associated with work ability in patients with chronic WAD grades II–III. A comprehensive assessment of potential psychosocial, socioeconomic, condition- and work-related factors were included to better understand their relationship with work ability. The results may provide direction for rehabilitation and organizational strategies to target the needs of individuals returning to work after a WAD.

METHODS

Study design

A cross-sectional study design was used. An analysis of background data was performed to determine the factors most associated with self-perceived work ability in patients with chronic WAD. The registration number for this study is ClinicalTrials.gov Identifier: NCT01528579.

Participants

The study participants were recruited from a population of patients involved in a randomized controlled trial investigating the effect of different exercise interventions on patients with chronic WAD (13). Patients who had previously sought care for neck pain/trauma from primary care, emergency and orthopaedic clinics in Sweden were invited by post to participate. Those who responded with positive self-reported eligibility were further assessed via a telephone interview ($n=419$) conducted by experienced physiotherapists. This was followed by interviews and a physical examination ($n=216$). The reasons for loss of patients between telephone interview and physical examination were variable and are set out in Ludvigsson et al. (14). The patients who were working or had returned to work since sustaining their injury formed the population sample in this analysis ($n=166$).

Subjects were eligible if they were diagnosed with a WAD grade II–III (grade II, $n=95$; grade III, $n=71$), were between 6 months to 3 years after injury, aged 18–63 years, reported pain greater than 20 mm on a 100-mm visual analogue scale (VAS) and scored greater than 20% on the Neck Disability Index (NDI) (0–100%). Patients with WAD grade I were not included as it is likely that they are less disabled for work. The WAD grade was determined by a physical examination by the researchers (who are experienced physiotherapists). Individuals were excluded if they had a known serious physical pathology (tumour/malignancy), persistent symptoms from other neck trauma, cervical spine surgery, neck pain causing more than one month absence from work during the previous year, signs of traumatic brain injury, presence of significant pain in another area of the body determined by a physiotherapist through anamnestic questions and a clinical examination, diseases or injury preventing participation in the study, a diagnosed severe psychiatric disorder, known drug abuse or insufficient knowledge of the Swedish language.

Ethical approval was granted by the Ethics Committee at the Faculty of Health Sciences at Linköping University in Sweden. Informed consent was obtained from each participant at the time of data collection.

Measures

A number of self-report questionnaires were used to gather information regarding demographic, personal, psychosocial, work-specific and condition-related factors (13).

Dependent variable

The Work Ability Index (WAI) to record self-perceived work ability was the primary outcome measure and is a valid and reliable predictor of work disability (15). It consists of 7 items: current work ability compared with lifetime best; work ability in relation to demands of the job; number of current diseases diagnosed; estimated physical work impairment due to diseases; sick leave during the past year; own prognosis of work ability 2 years from now and mental resources (16). Each item has 1 or more associated questions, taking into account the individual's work demands (physical and mental), health status and resources. A cumulative score of poor (7–27), moderate (28–36), good (37–43) or excellent (44–49) work ability is recorded.

Independent variables

Demographic factors. Demographic data included age (years), gender, level of education and living status, was collected. In addition, smoking status, duration since the accident (months) and WAD grade (II or III) were also recorded.

Personal factors. Health-related quality of life was quantified using the EuroQol Five Dimension Scale (EQ-5D, 243 possible health states converted to a single index value –0.594 to 1, where 1 is perfect health) and EuroQol VAS (0–100 representing worst to best imaginable health state respectively) (17). Self-reported financial situation was recorded on an ordinal scale (1: very good; 5: very bad) due to its potential effect on expectation of recovery and return to work (18).

Psychosocial measures. The 11-item Tampa Scale of Kinesiophobia (score range 11–44) evaluated fear of movement with higher scores indicating greater fear of movement (19). The Pain Catastrophising Scale (score range 0–52) provides an indication of individuals who ruminate, magnify or feel helpless about controlling their pain (20). A higher score reflects greater negative pain-related thoughts, greater emotional distress, and greater pain intensity. The Hospital Anxiety and Depression Scales were used to detect depression and anxiety and their role in the manifestation of somatic symptoms. There are 7 items, which produce a cumulative score of 0–21 for the anxiety and depression subscales with a higher score indicative of greater anxiety and depression (21). Self-efficacy to achieve daily life tasks despite pain was assessed with the 20-item Self-Efficacy Scale (score range 0–200) (22). A higher score indicates enhanced ability to achieve daily life tasks.

Work-specific factors. The work-specific variables were related to change in work hours/tasks, physical demands of work and workplace flexibility. Work satisfaction, occupation change and work task changes due to neck problems were assessed as binary outcome (yes/no). The physical demands of work were assessed using the Borg Scale (scale 6–20) (18) with a higher score indicating greater demands. Frequency of working with arms above shoulder height was quantified on an ordinal scale (1: never/almost never; 5: every day). Data reflecting workplace flexibility was measured trichotomously and included the possibility of: choosing work tasks, obtaining assistance from colleagues, having longer work breaks, performing less work hours, working from home, receiving further work training and working without being disturbed (never/sometimes/always). Increased work stress may hinder health and well-being (23) and was measured with the Effort-Reward Imbalance Scale. It is comprised of 3 dimensions scored on a 4-point Likert scale, including effort (6 items), reward (11 items) and over-commitment (6 items) with the total score used in the analysis (0–100 scale) (24).

Condition-related factors. Previous neck problems and current numbness/tingling in the arms were recorded dichotomously (yes/no). The frequency (1: never; 5: always) of problems with the jaw, swallowing, concentration, sleeping, vision, hearing, nausea, dizziness and trouble lifting the arms were each measured on an ordinal scale. The scales also measured the frequency of neck and arm pain as well as headaches and neck stiffness. Visual Analogue Scales (0–100 mm, 100: severe problems) recorded the severity of neck pain, arm pain and headaches as

Table I. *Frequency distribution of study population characteristics*

Factors	*n* (%)
Age	
<25 years	19 (11.4)
25–34 years	30 (18.1)
35–44 years	52 (31.3)
45–54 years	45 (27.1)
55–64 years	20 (12.0)
Gender	
Male	58 (34.9)
Female	108 (65.1)
Level of education	
Elementary school	11 (6.6)
High School	89 (53.6)
University	57 (34.3)
Other	9 (5.4)
Country of birth	
Sweden	141 (84.9)
Other Nordic	13 (7.8)
Europe	4 (2.4)
Other	7 (4.2)
Current Smoker	
Yes	26 (15.8)
No	139 (84.2)
Living status	
Live alone	37 (22.4)
Live with others	118 (71.5)
Alternative	10 (6.1)
Previous neck pain	
Yes	25 (15.2)
No	140 (84.8)
Treatment received after injury	
No: had no symptoms	18 (11.0)
No: had symptoms	26 (16.0)
Yes: within the first week	41 (25.2)
Yes: 2–3 weeks after incident	44 (27.0)
Yes: >3 weeks after the incident	34 (20.9)
Financial situation	
Very good	24 (14.8)
Good	66 (40.7)
Moderate	52 (32.1)
Bad	13 (8.0)
Very bad	7 (4.3)
Occupation change since injury	
Yes	26 (15.7)
No	138 (84.1)
Occupation	
Managers	17 (7.9)
Occupations requiring advanced level of higher education	33 (15.3)
Occupations requiring higher education qualifications or equivalent	30 (13.9)
Administration and customer service clerks	20 (9.3)
Service, care and shop sales workers	44 (20.4)
Building and manufacturing workers	12 (5.6)
Mechanical manufacturing and transport workers etc.	27 (12.5)
Elementary occupations	8 (3.7)
Work Ability Index Score	
Poor (7–27)	21 (12.7)
Moderate (28–36)	66 (39.8)
Good (37–43)	64 (38.5)
Excellent (44–49)	15 (9.0)

well as the extent of dizziness and balance problems. The 10-item NDI (25) (score range 0–100%) reflects disability due to neck pain with 6 possible response options (0: no disability; 5: complete disability). The Pain Disability Index (26) (score 0–70), using 10-point Likert scales, evaluates the degree to which normal life tasks are disrupted by pain levels, with a higher score indicative of greater disability due to pain.

Statistical analysis

Demographic characteristics were examined with descriptive statistics. The aim of the statistical analysis was to determine the factors associated with work ability (using the non-categorized cumulative score), using multiple linear regression modelling. First, a Spearman rank bivariate analysis was used to determine the independent variables statistically significantly correlated with the WAI. The frequency of neck stiffness and numbness/tingling in the arms were inter-correlated with physical demands of work (Borg scale) ($\rho < 0.8$) and were excluded from further analysis. Those variables with $p < 0.05$ were then used in a standard multiple linear regression analysis. The variance inflation factor (≥ 10) (27) was used to assess for multi-collinearity, no variables were further excluded. Forward, stepwise multiple regression modelling established the variables most associated with the WAI. Any variable that reduced the power of the model was excluded, an exit $p < 0.05$ was used.

RESULTS

A frequency distribution table (Table I) represents the study population demographics. The mean time since injury was 19.2 months (standard deviation (SD) 9.2). The mean WAI score was 35.5 (SD 7.0). The mean, standard deviation, median and interquartile range (25th–75th percentile) for the self-report questionnaires are displayed in Table II. Low back pain was reported by 64.1% of participants; however, the correlation between low back pain and work ability was non-significant ($p = 0.10$) with a low r-value of 0.13. The correlation between low-back pain and EQ-5D had an r-value of 0.01 with $p = 0.97$. The correlation between low-back pain and concentration was significant ($p = 0.03$), but with low r-value of 0.15.

The bivariate analysis established 20 independent variables that were significantly correlated with the WAI. These variables are shown in Table III, accompanied by their Spearman rank correlation values. The final prediction model included 7 factors and was statistically significant, F (7, 158) = 44.285 ($p < 0.001$).

Table II. *Mean, standard deviation, median and interquartile range (IQR; 25th and 75th percentile) of self-report questionnaires*

Self-report questionnaire	Mean (SD)	Median (IQR)
Work Ability Index	35.53 (6.95)	36 (32–40)
Neck Disability Index	33.34 (13.26)	32 (24–44)
Euroqol Five Dimension Scale	0.62 (0.25)	0.72 (0.62–0.80)
Euroqol Visual Analogue Scale	63.18 (18.28)	66 (50–75)
Self-Efficacy Scale	150.33 (36.49)	157 (127–180)
Tampa Scale of Kinesiophobia	21.84 (6.01)	21 (17–26)
Pain Catastrophising Scale	17.97 (11.31)	15 (9–25)
Effort-Reward Imbalance Scale	0.86 (0.28)	0.80 (0.65–1.01)
HAD anxiety	6.72 (4.34)	6 (3–9.50)
HAD depression	4.83 (4.08)	3 (1–7.50)
Pain Disability Index	20.08 (13.82)	18 (9–28.50)

SD: standard deviation; IQR: interquartile range.

Table III. *Independent variables significantly correlated with the Work Ability Index in Spearman Rank bivariate correlation analysis*

Independent variable	Spearman rank (ρ)
Neck disability index	–0.67
Euroqol Five Dimension Scale	0.62
Euroqol Visual Analogue Scale	0.62
Self-Efficacy Scale	0.60
Pain Disability Index	–0.58
Frequency of concentration problems	–0.57
Hospital Depression Scale	–0.53
Frequency of trouble lifting arms	–0.45
Tampa Scale of Kinesiophobia	–0.43
Financial situation	–0.42
Severity of headaches	–0.41
Pain Catastrophising Scale	–0.37
Frequency of arm pain	–0.36
Hospital Anxiety Scale	–0.36
Frequency of neck pain	–0.34
Effort-Reward Imbalance Scale	–0.34
Frequency of sleeping problems	–0.33
Frequency of dizziness	–0.33
Physical demands of work (Borg Scale)	–0.26
Work satisfaction	0.21

Significance (2-tailed): $p<0.01$.

This model accounted for approximately 65% of the variance of self-rated work ability (adjusted $R^2=0.65$). In descending order of strength of association, work ability was associated with the score on the NDI, followed by EQ-5D and Euroquol VAS, frequency of concentration problems, workplace satisfaction, score on the Self-Efficacy Scale and the Effort-Reward Imbalance Scale. The cumulative adjusted R^2 values, standardized and raw regression coefficients are shown in Table IV.

DISCUSSION

This study revealed a set of factors significantly associated with work ability in patients with chronic WAD grades II–III. Seven variables explained 65% of the variance of self-rated work ability. The factors related to reduced work ability as evaluated by the WAI include greater neck disability due to pain (indicated by NDI), reduced self-rated health status (indicated by score on EQ-5D VAS); reduced health-related quality of life (indicated by the score on the EQ-5D), increased frequency of concentration problems, poor workplace satisfaction, lower self-efficacy for performing daily tasks (indicated by Self-Efficacy Scale) and greater work-related stress (Effort-Reward Imbalance Scale). Thus, a mix of psychosocial and condition-related factors was associated with work ability in individuals with chronic WAD.

Table IV. *Results of step-wise regression model of factors associated with the Work Ability Index*

Variable	[a]Cum. adj. R^2	β	b	Standard Error b
NDI	0.46	–0.22	–0.11	0.36
EQ VAS	0.53	0.21	0.08	0.21
EQ 5D	0.57	0.19	5.18	1.52
FCP	0.60	–0.15	–1.06	0.44
WS	0.62	0.16	4.36	1.32
SES	0.64	0.18	0.34	0.12
ERI	0.65	–0.12	–2.97	1.25

Significance of the step-wise regression model: $p<0.01$.
Note: Dependent Variable was The Work Ability Index.
[a]Cumulative adjusted R-Squared value, this represents the cumulative variance of work ability, explained by the variables.
β = standardized regression coefficient.
b = unstandardized coefficient.
NDI: Neck Disability Index; EQ VAS: Euroqol Visual Analogue scale; EQ 5D: Euroqol Five Dimension scale; FCP: frequency of concentration problems; WS: workplace satisfaction; SES: Self-Efficacy scale; ERI: Effort-Reward Imbalance scale.

The work ability of individuals in this study with chronic WAD grades II–III is not optimal. The mean WAI score of 35.5 in our sample population of individuals with chronic WAD indicates moderate work ability, suggesting that improvement is possible and required. This score is lower than slaughterhouse workers with chronic upper limb pain with a mean work ability score of 39 (28). However, the distribution of participants scoring poor/moderate work ability (52.4%) was similar to those scoring good/excellent work ability (47.6%). A recent study assessing work ability in a general working population of 12,839 workers in Belgium revealed quite a different distribution of scores (29). This study by Fassi et al. (29) found that 19% of workers scored poor/moderate, while the majority, 81%, scored good/excellent self-rated work ability. The large proportion of workers with chronic WAD grades II–III in the poor/moderate category of work ability suggests that these individuals may be at greater risk of sick leave (30) and early retirement (31). Individuals who present with poor work ability may have difficulty achieving work tasks or experience ongoing symptoms aggravated by work, which could potentially prolong their recovery time. The results indicate that return to work does not mark the end of recovery for those with chronic WAD. Ongoing rehabilitation and improved support in the workplace are warranted to enhance the transition of those from poor/moderate work ability to good/excellent and reduce their risk of sickness absence and early retirement.

The level of neck pain and disability explained 46% ($p<0.01$) of the variance of the work ability in this population, indicating that increased disability due to neck pain is associated with reduced work ability. This is not surprising given that the mean score on the NDI was indicative of moderate neck pain and disability. This finding is consistent with previous studies, which have established an association between greater disability and pain with prolonged recovery (3, 5). Disability due to neck pain has been associated with patient burnout (32) (chronic depletion of energy levels) due to emotional, cognitive and physical fatigue. Individuals who have poor work ability and continue to work may be at risk of burnout. There are many potential reasons why an individual will continue to work despite disability due to neck pain, although the social security system may play a role. In Sweden where the present study was performed, it has become difficult to obtain long periods of sick-leave due to pain and disability, so people may have no option but to continue working despite pain. Further investigation is warranted to determine how best to support these individuals to remain at work with pain.

The findings from this study indicate that high self-efficacy for achieving daily tasks is associated with improved work ability. This is consistent with the findings of recent literature in which authors highlight the importance of self-efficacy in the return to work process (33). It is feasible that greater self-efficacy for daily life tasks would translate to the activity of work. According to the Bandura's social cognitive self-efficacy theory (34), one's belief in one's ability to successfully perform a task has a strong influence on behaviour. Thus, reduced ability to achieve work tasks may perpetuate poor self-efficacy and result in maladaptive behavioural changes. Furthermore, personal efficacy has been shown to predict individual coping strategies in WAD, such that those with high self-efficacy are less likely to use maladaptive or passive coping styles (35). High self-efficacy may also explain the lack of association between pain catastrophizing and work ability. Patients may have self-selected for this study as it involved participation in an exercise intervention. It is also possible that cultural and socio-political differences between countries may explain the lack of significance of pain catastrophizing. Another possible explanation is that participants were recruited from primary healthcare and not from pain clinics where patients with significant pain are specifically managed. Psychological interventions may be useful in the facilitation of behavioural changes through creating and strengthening self-efficacy (36). The results indicate that patients with chronic WAD may also benefit from learning adaptive and active coping strategies.

Our findings indicate that an increased frequency of concentration problems is associated with reduced work ability. This supports the results of existing literature in which concentration deficits have been found to be significantly associated with work disability (7). In addition, our results indicate that enhanced work satisfaction is related to improved work ability. The relationship between work satisfaction and work ability has been researched in the ageing workforce (37); however, a new finding is that it is also important in those with a chronic health condition, such as WAD. This is perhaps not that surprising with evidence suggesting that with work satisfaction, an individual experiences reduced work stress, which may increase work attendance and productivity (38).

The Effort-Reward Imbalance Scale evaluates work-related stress, and a high score indicates a discrepancy between high efforts spent and low rewards received (24). Our analysis found this to be significantly associated with work ability. Previous literature indicates that adverse health effects may be a consequence of this imbalance (23). This has implications for individuals who already have a chronic health condition, such as WAD, that may place them at greater risk of ill-health. Further investigation is required to investigate the long-term impact on health in those with chronic WAD.

It was interesting to note that the final model did not include work-specific variables, such as change in work hours/tasks, physical demands of work and workplace flexibility. The finding that workplace interventions were not associated with work ability is consistent with a previous study in which no change in pain and pain-related disability in the neck/shoulder and low back regions was reported following various ergonomic interventions, alterations to work tasks, hours or job organization (39). It is possible that condition-specific and psychosocial factors are more important in this group of patients and alterations to the work environment will have little impact. Our study did not find a relationship between the physical demands of work and work ability. However, the spread of occupational categories of participants would suggest that the results are generalizable. A possible explanation is that the Borg Scale was not sensitive or specific enough to evaluate the physical demands of work. A study of the general working population found a combination of physical work demands (neck flexion, neck rotation) and psychosocial factors were risk factors for sickness absence due to neck pain (40). However, video analysis of working postures was used to quantify the physical demands of work, which is not always possible (40).

There are limitations to this study. The large number of variables and relatively small sample size may limit the generalization of results to the population of patients with chronic WAD. In addition, the results can be generalized only to patients with WAD II and III. It is possible that patients with Grade I WAD may be less disabled for work, and hence report better work ability and, if included in this study, may have diluted the strength of the relationships found. As this study was cross-sectional in design and inferences about cause and effect cannot be made. A prospective study is needed to investigate such relationships. There are also potential problems with stepwise model building prone to over-fitting of the data. The best way to determine the accuracy of this model is to test in a different sample of patients with WAD. Despite these limitations, this study features several strengths, including the use of a validated scale to measure the complex domain of work ability, the well-defined inclusion criteria verified with clinical examination and the inclusion of patients with WAD III, which is less common.

In conclusion, several psychosocial and condition-related factors are associated with work ability in individuals with chronic WAD grades II–III. Despite having returned to work, these individuals seem to experience significant pain and disability, which may impact on their productivity and health. These results have implications for rehabilitation, suggesting that individuals with chronic WAD may benefit from appropriate follow-up to determine ongoing needs. Emphasis should be placed on the management of pain and disability, with greater support offered at the workplace to ensure that they remain at work. Future studies should consider the impact of interventions for symptom management on self-perceived work ability in people working with WAD grades II–III.

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