Predictors of Sickness Absence in Patients with a New Episode of Low Back Pain in Primary Care

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Abstract: This study examines predictors of sickness absence in patients presenting to a health practitioner with acute/subacute low back pain (LBP). Aims of this study were to identify baseline-variables that detect patients with a new LBP episode at risk of sickness absence and to identify prognostic models for sickness absence at different time points after initial presentation. Prospective cohort study investigating 310 patients presenting to a health practitioner with a new episode of LBP at baseline, three-, six-, twelve-week and six-month follow-up, addressing work-related, psychological and biomedical factors. Multivariate logistic regression analysis was performed to identify baseline-predictors of sickness absence at different time points. Prognostic models comprised ‘job control’, ‘depression’ and ‘functional limitation’ as predictive baseline-factors of sickness absence at three and six-week follow-up with ‘job control’ being the best single predictor (OR 0.47; 95%CI 0.26–0.87). The six-week model explained 47% of variance of sickness absence at six-week follow-up (p<0.001). The prediction of sickness absence beyond six-weeks is limited, and health practitioners should re-assess patients at six weeks, especially if they have previously been identified as at risk of sickness absence. This would allow timely intervention with measures designed to reduce the likelihood of prolonged sickness absence.

Key words: Low back pain, Sickness absence, Prospective cohort study, Prognosis, Predictors, Risk factors, Resources

Introduction

Most people experience acute low back pain (LBP) at least once in their lifetime1. The natural history of LBP is usually favourable and most individuals recover within two to four weeks; of the remainder, most resolve within twelve weeks2, 3. Those developing persistent LBP4 contribute to increasing socio-economic costs, e.g. due to sickness absence5, 6. According to Holtermann et al. approximately one fifth of those employees with a current episode of LBP will experience long-term sickness absence within the next two years due to LBP7, with a prevalence of LBP-related sickness absence in the first year after an acute episode of LBP of just under 10%8.

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There is common agreement about the necessity of an early identification of patients at risk of developing persistent LBP to prevent delayed recovery including LBP-related sickness absence\textsuperscript{6,10}. A wide range of screening instruments are available to identify patients at risk, such as the Örebro Musculoskeletal Pain Questionnaire\textsuperscript{9} or its modified version, the Örebro Musculoskeletal Screening Questionnaire\textsuperscript{11} which has been adapted for acute/subacute LBP working populations.

According to van den Heuvel \textit{et al.} LBP disability is a prognostic factor for LBP-related sickness absence\textsuperscript{2}, while IJzelenberg \textit{et al.} found that LBP and LBP-related sickness absence are associated with different risk factors\textsuperscript{13}. Moreover, sickness absence is a broader construct than LBP as it has multiple determinants. In longitudinal studies determinants of future sickness absences were previous sickness absence, work characteristics, negative life events, and personality traits (e.g. Kivimäki \textit{et al.}\textsuperscript{14}). Thus, critical time points for the identification of patients at risk of developing persistent LBP and for the identification of acute/subacute LBP patients at risk of sickness absence may differ.

There is a need to distinguish prognostic risk factor analyses with reference to early and longstanding courses of symptoms over time, as preliminary evidence shows differences between onset and persistence of back pain in their predictors\textsuperscript{15}. The repeated measurement of symptoms with more than one follow-up allows new insights into the reversibility of developments\textsuperscript{3}. The transition phases into and out of a chronic pain status should be the focus of future research endeavours\textsuperscript{17}. First evidence increases that specific types of psychosocial risk variables may relate to distinct developmental time frames, implying that assessment and intervention need to reflect these variables at a given time\textsuperscript{16}. More research is needed that addresses such issues, that may help clinicians to screen those patients who are at risk of developing chronic, non-specific spinal disorders as early and valid as possible\textsuperscript{17}. The goal is to improve the odds of getting the right patient to the right treatment at the right time. Then the next task is to translate best practice recommendations from high quality research into everyday clinical practice\textsuperscript{18}.

Although evidence for prognostic factors has increased and the need for screening on those at risk for permanent unemployment\textsuperscript{17} is beyond controversy, research has failed to generate any widespread changes in clinical practice, i.e. patient screening and early intervention strategies.

The aims of this study were twofold: (1) To identify prognostic baseline-variables that detect patients with a new LBP episode at risk of sickness absence; (2) To identify multivariate prognostic models for sickness absence at three, six, twelve weeks and six months after initial presentation. Consequently, our research questions were, first, “What are the prognostic baseline-factors for sickness absence in acute/subacute LBP patients?” and second, “Does a baseline-predictor model predict sickness absence at three, six, twelve weeks and six months?”

We hypothesised, that (1) the best predictive value for identifying patients with LBP-related sickness absence would be achieved by work-related factors\textsuperscript{12,19}, especially ‘fear-avoidance beliefs about work activity’\textsuperscript{3,5}. Furthermore, we hypothesised, that (2) a baseline-predictor model would most accurately predict short-term sickness absence.

Subjects and Methods

We performed a prospective cohort study investigating 310 patients presenting to a health practitioner with a new episode of acute/subacute LBP, or with recurrent LBP\textsuperscript{20}. Our study was conducted according to the recommendations of the Declaration of Helsinki (2008) and was approved by the local Lower South Regional Ethics Committee (LRS/08/03/008).

We defined acute LBP as LBP with a duration of up to six weeks, and subacute LBP as LBP lasting for no longer than twelve weeks\textsuperscript{21}. Recurrent LBP was defined according to Stanton \textit{et al.} as LBP with a minimum of 30 pain-free days between the last two LBP episodes and a pain score on the Visual Analogue Scale (VAS) higher than 20 out of a maximum of 100 points\textsuperscript{22}. The protocol of our study has been published previously\textsuperscript{20}.

Outcome measure

Sickness absence was assessed by the question: “During the last week, how many days did low back pain or leg pain keep you from going to work or school?” The number of days (range 0–x) was recoded into 0 (=no day) and 1 (one or more days).

Patients were consecutively recruited from 14 health practitioners (twelve general practitioners and two physiotherapists) across New Zealand from all districts from both North and South Island. We included patients between 18 and 65 yr of age, being able to read and write in English, and having provided written consent. Patients were excluded from our study when they were retired, were suffering from chronic LBP (defined as LBP > twelve weeks at time of first presentation to a health practitioner)\textsuperscript{23,24},...
had specific LBP (e.g. tumour, infection, etc.)\textsuperscript{21}, had a
comorbidity compromising their overall well-being (e.g. severe osteoarthritis of hip or knee joint), were pregnant,
were unable to complete questionnaires, or had no LBP at
the time of the screening interview.

The patient sample was representative for the New
Zealand population regarding occupation and employment
status. The typical approach for acute LBP management
in the clinical setting was pain medication in the first
instance; the extent of physical therapy was 30%; other
physical rehabilitation strategies included exercise therapy
(20%), osteopathy (11%), acupuncture (6%) and chiro-
practic (5%).

First, all potential participants were screened using at
standardised, structured telephone interview. If eligible
they were sent a baseline questionnaire which they were
asked to return within one week. Patients were followed
up at three, six and twelve weeks and at six months by
sending out questionnaires. Patients not returning a ques-
tionnaire were sent reminders after one and two weeks.
Ten dollar grocery, fuel or book vouchers were provided
as compensation for their time for each returned question-
naire.

\textit{Candidate predictor variables assessed}

We accessed potential work-related (‘fear-avoidance be-
liefs about work activity’, ‘job control’, ‘resigned attitude
towards the job’, ‘social support at work’), psychological
(‘depression’) and biomedical (‘functional limitation’, ‘physical health’) predictors of sickness absence.

The fear-avoidance beliefs questionnaire comprises a
seven-item work scale (range 0–42) addressing patients’
beliefs about how work activity affect their LBP; higher
scores are associated with higher amounts of fear-avoid-
ance beliefs\textsuperscript{25}.

A short self-report version of the Instrument for Stress
Oriented Task Analysis (ISTA) was used to describe job
control\textsuperscript{26}. All items have a five-point Likert format, ref-
lecting either intensity or frequency. Job control captures
aspects of method control (three items, e.g. independently
and organize one’s own work) and time control (two
items, e.g. influence on work pace and schedule).

Resigned attitude towards the job implies working in the
current position only because of a lack of alternatives\textsuperscript{27}. Resigned attitude towards one’s job is based on Brug-
gemann’s concept of ‘resigned job satisfaction’\textsuperscript{28}. For an
English description see Âüssing\textsuperscript{29}. Items ask, how often
one has thoughts like “my job is not ideal, but it could be
worse”, aiming at a defensive, or resentful, adaptation to
working conditions that are unfavourable\textsuperscript{30}. The scale
that contains four items has been shown to be a good predictor
of treatment outcome\textsuperscript{27}.

Social support at work was assessed using the scales by
Caplan \textit{et al.}\textsuperscript{31}. Questions ask how much people can be
relied on when things get tough at work, are willing to lis-
ten to work-related problems, are helpful for getting one’s
job done, and are willing to listen to personal problems.
They had to be answered with regard to one’s supervisor,
closest colleague, other colleagues and spouse/partner. The
answering format was a four-point scale ranging from 1
(not at all) to 5 (absolutely). The scale has been shown to
predict occupational LBP before\textsuperscript{32}.

Depression was assessed using the modified self-rating
Zung Depression Index (ZDI). The modified ZDI address-
es moods and sense of wellbeing over the last few weeks
in 13 items on a three-point scale ranging from 0 (rarely or
none of the time) to 3 (most of the time) and a maximum
score of 69 points\textsuperscript{33}.

The Oswestry Disability Index (ODI) assesses limita-
tions to various activities of daily living in ten categories:
pain intensity, personal care, lifting, walking, sitting,
standing, sleeping, sex life, social life and travelling\textsuperscript{34}.
The total possible score of the ODI is 100%, where 0% is
no or ‘minimal disability’.

Physical health was measured by the Physical Compo-
nent Scale of the Short Form 12 Health Survey Question-
naire (SF-12). The SF-12 is a generic questionnaire mea-
suring general health with two different scales, ‘physical’
and ‘mental well-being’. The minimal possible score of the
SF-12 is 0% with higher values meaning better well-being.
The SF-12 has been derived from the SF-36 by Ware, \textit{et al.}\textsuperscript{35}. Fifty SF-12 points were selected as cut-off point for
good health as fifty points equate to the average values for
both components within the general population\textsuperscript{36}.

Selection of the seven predictor variables was oriented
by own research and theoretical underpinnings\textsuperscript{37}. Selection
of predictors was also guided by the Socio-environ-
mental Model for Influencing Health Care Utilization and
Sickness Absence\textsuperscript{38} that includes social support at work
and other psychosocial factors, as precursors of sickness
absence.

\textit{Covariates}

We assessed age, gender, body mass index, blue and
white-collar occupation, and sickness absence in days
over the last year as covariates. Blue-collar occupations
(technicians, agricultural or fishery workers, craft or trades
worker, plant or machine operators, elementary workers

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and armed forces) were recoded into 1; white-collar occupations (legislators, senior officials, managers, professionals, clerks and service or sales worker) were recoded into 0 according to the classification by the National Institute for Occupational Safety and Health (http://www.cdc.gov/niosh/docs/2002–148/pdfs/2002–148.pdf).

**Statistical analysis**

Patients with self-reported sickness absence at three-, six- and twelve-week and at six-month follow-up were compared to patients without sickness absence at the same time points. However, due to restraints in study design in order to keep patients involved in the study, we could not assess all predictor variables at follow-ups. First univariate, then multivariate logistic regression analysis was performed for potential work-related, psychological and biomedical predictors of sickness absence, controlling for age, gender, body mass index, blue and white-collar occupation, and sickness absence in days over the last year. In the multivariate regression analysis all seven predictor variables entered the model simultaneously (enter modus). Sensitivity, specificity and overall predictive value for sickness absence were calculated for the final baseline-factor for sickness absence (sensitivity 47.8; specificity 94.7; overall predictive value 83.4). This model explained 43% of variance (Nagelkerke) of sickness absence ($p<0.001$; Table 4).

The three-week model included ‘job control’ (OR 0.61; 95%CI 0.39–0.93) as the only significant predictive baseline-factor for sickness absence (sensitivity 42.9; specificity 94.7; overall predictive value 83.4). This model explained 43% of variance (Nagelkerke) of sickness absence ($p<0.001$; Table 4).

The six-week model comprised ‘job control’, ‘depression’ and ‘functional limitation’ as significant predictive baseline-factors for sickness absence (sensitivity 47.8; specificity 97.9; overall predictive value 90.9) with ‘job control’ being the best single predictor (OR 0.47; 95%CI 0.26–0.88). This model explained 47% of variance (Nagelkerke) of sickness absence ($p<0.001$; Table 5).

Despite some univariate associations of baseline variables with sickness absence at twelve weeks and six months (Table 3), there were no significant predictors retained in the multivariate models (data not shown).

**Discussion**

The best prognostic baseline-factors to predict sickness absence in patients with a new episode of LBP were ‘job control’, ‘depression’ and ‘functional limitation’. This is in agreement with the common consensus on early identification of patients at risk of developing persistent LBP to prevent delayed recovery, including LBP-related sickness absence$^{9,10}$. Therefore, we could partially confirm Hypothesis 1 that the best predictive value for identifying acute/subacute
LBP patients with LBP-related sickness absence would be achieved by work-related factors, emphasized by our findings that ‘job control’ was the only variable that had a statistically significant association with sickness absence after controlling for other predictors.

‘Job control’ was found to be a significant predictor of sickness absence at three- and six-week follow-up. High ‘job control’ can be a powerful work resource against...
Table 2. Patient characteristics at baseline and different time points of follow-up

<table>
<thead>
<tr>
<th>Variables</th>
<th>Baseline (n=310)</th>
<th>3wk FU (n=252)</th>
<th>6wk FU (n=220)</th>
<th>12wk FU (n=191)</th>
<th>6mth FU (n=164)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sick leave days due to LBP last wk</td>
<td>N/A</td>
<td>0.6 (3%)</td>
<td>0.4 (2%)</td>
<td>0.3 (2%)</td>
<td>0.4 (3%)</td>
</tr>
<tr>
<td>Did not start work again due to LBP</td>
<td>7 (5%)</td>
<td>6 (3%)</td>
<td>7 (4%)</td>
<td>11 (7%)</td>
<td></td>
</tr>
<tr>
<td>ODI</td>
<td>22 (13)</td>
<td>20 (13)</td>
<td>18 (14)</td>
<td>17 (15)</td>
<td>15 (15)</td>
</tr>
<tr>
<td>Minimal disability (0–20)</td>
<td>166 (54%)</td>
<td>156 (62%)</td>
<td>137 (62%)</td>
<td>131 (69%)</td>
<td>124 (75%)</td>
</tr>
<tr>
<td>Moderate disability (21–40)</td>
<td>118 (38%)</td>
<td>77 (31%)</td>
<td>65 (30%)</td>
<td>42 (22%)</td>
<td>27 (16%)</td>
</tr>
<tr>
<td>Severe disability (41–60)</td>
<td>25 (8%)</td>
<td>17 (7%)</td>
<td>16 (7%)</td>
<td>15 (8%)</td>
<td>12 (7%)</td>
</tr>
<tr>
<td>Crippled (&gt;61)</td>
<td>1 (0.3%)</td>
<td>2 (1%)</td>
<td>2 (1%)</td>
<td>3 (2%)</td>
<td>2 (1%)</td>
</tr>
<tr>
<td>Fear-avoidance beliefs about work</td>
<td>13 (10)</td>
<td>12 (17)</td>
<td>11 (9)</td>
<td>10 (9)</td>
<td>9 (9)</td>
</tr>
<tr>
<td>Depression by ZUNG</td>
<td>22 (11)</td>
<td>21 (12)</td>
<td>20 (13)</td>
<td>18 (12)</td>
<td>16 (12)</td>
</tr>
</tbody>
</table>

Figures are given as mean ± SD or numbers (percentages) where appropriate; LBP=low back pain; ODI=Oswestry Disability Index; ZUNG=modified Zung Depression Index.

Table 3. Prognostic variables for sickness absence in univariate regression analysis

<table>
<thead>
<tr>
<th></th>
<th>B</th>
<th>SE</th>
<th>Wald</th>
<th>p</th>
<th>OR</th>
<th>CI (OR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sickness absence at three weeks</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Job control</td>
<td>–0.53</td>
<td>0.15</td>
<td>11.60</td>
<td>0.001</td>
<td>0.59</td>
<td>0.44–0.80</td>
</tr>
<tr>
<td>Resigned attitude towards the job</td>
<td>0.46</td>
<td>0.13</td>
<td>13.09</td>
<td>0.001</td>
<td>1.59</td>
<td>1.24–2.04</td>
</tr>
<tr>
<td>Fear-avoidance beliefs about work</td>
<td>0.08</td>
<td>0.02</td>
<td>18.66</td>
<td>≤0.001</td>
<td>1.08</td>
<td>1.04–1.12</td>
</tr>
<tr>
<td>Social support at work</td>
<td>–0.36</td>
<td>0.16</td>
<td>5.39</td>
<td>0.020</td>
<td>0.70</td>
<td>0.51–0.95</td>
</tr>
<tr>
<td>Depression</td>
<td>0.07</td>
<td>0.02</td>
<td>15.16</td>
<td>≤0.001</td>
<td>1.07</td>
<td>1.03–1.10</td>
</tr>
<tr>
<td>Functional limitation</td>
<td>0.08</td>
<td>0.02</td>
<td>27.09</td>
<td>≤0.001</td>
<td>1.09</td>
<td>1.05–1.12</td>
</tr>
<tr>
<td>Physical health</td>
<td>–0.10</td>
<td>0.02</td>
<td>23.01</td>
<td>≤0.001</td>
<td>0.90</td>
<td>0.87–0.94</td>
</tr>
<tr>
<td>Sickness absence at six weeks</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Job control</td>
<td>–0.83</td>
<td>0.21</td>
<td>16.07</td>
<td>≤0.001</td>
<td>0.43</td>
<td>0.29–0.65</td>
</tr>
<tr>
<td>Resigned attitude towards the job</td>
<td>0.49</td>
<td>0.16</td>
<td>9.83</td>
<td>0.002</td>
<td>1.63</td>
<td>1.20–2.21</td>
</tr>
<tr>
<td>Fear-avoidance beliefs about work</td>
<td>0.07</td>
<td>0.02</td>
<td>9.32</td>
<td>0.002</td>
<td>1.07</td>
<td>1.03–1.12</td>
</tr>
<tr>
<td>Social support at work</td>
<td>–0.22</td>
<td>0.20</td>
<td>1.17</td>
<td>0.280</td>
<td>0.81</td>
<td>0.55–1.19</td>
</tr>
<tr>
<td>Depression</td>
<td>0.09</td>
<td>0.02</td>
<td>14.54</td>
<td>0.001</td>
<td>1.09</td>
<td>1.04–1.14</td>
</tr>
<tr>
<td>Functional limitation</td>
<td>0.08</td>
<td>0.02</td>
<td>17.97</td>
<td>≤0.001</td>
<td>1.09</td>
<td>1.05–1.15</td>
</tr>
<tr>
<td>Physical health</td>
<td>–0.08</td>
<td>0.03</td>
<td>9.58</td>
<td>0.002</td>
<td>0.93</td>
<td>0.88–0.97</td>
</tr>
<tr>
<td>Sickness absence at twelve weeks</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Job control</td>
<td>–0.33</td>
<td>0.25</td>
<td>1.84</td>
<td>0.175</td>
<td>0.72</td>
<td>0.44–1.16</td>
</tr>
<tr>
<td>Resigned attitude towards the job</td>
<td>0.34</td>
<td>0.20</td>
<td>2.78</td>
<td>0.095</td>
<td>1.40</td>
<td>0.94–2.08</td>
</tr>
<tr>
<td>Fear-avoidance beliefs about work</td>
<td>0.07</td>
<td>0.03</td>
<td>5.24</td>
<td>0.022</td>
<td>1.07</td>
<td>1.01–1.13</td>
</tr>
<tr>
<td>Social support at work</td>
<td>–0.56</td>
<td>0.28</td>
<td>3.91</td>
<td>0.048</td>
<td>0.57</td>
<td>0.33–0.99</td>
</tr>
<tr>
<td>Depression</td>
<td>0.09</td>
<td>0.03</td>
<td>8.07</td>
<td>0.004</td>
<td>1.10</td>
<td>1.03–1.17</td>
</tr>
<tr>
<td>Functional limitation</td>
<td>0.15</td>
<td>0.04</td>
<td>16.37</td>
<td>0.001</td>
<td>1.16</td>
<td>1.08–1.24</td>
</tr>
<tr>
<td>Physical health</td>
<td>–0.14</td>
<td>0.04</td>
<td>13.23</td>
<td>0.001</td>
<td>0.87</td>
<td>0.80–0.94</td>
</tr>
<tr>
<td>Sickness absence at six months</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Job control</td>
<td>–0.49</td>
<td>0.24</td>
<td>4.23</td>
<td>0.040</td>
<td>0.61</td>
<td>0.38–0.98</td>
</tr>
<tr>
<td>Resigned attitude towards the job</td>
<td>0.26</td>
<td>0.20</td>
<td>1.68</td>
<td>0.195</td>
<td>1.29</td>
<td>0.88–1.90</td>
</tr>
<tr>
<td>Fear-avoidance beliefs about work</td>
<td>0.01</td>
<td>0.03</td>
<td>0.13</td>
<td>0.717</td>
<td>1.01</td>
<td>0.96–1.07</td>
</tr>
<tr>
<td>Social support at work</td>
<td>–0.31</td>
<td>0.28</td>
<td>1.27</td>
<td>0.260</td>
<td>0.73</td>
<td>0.42–1.26</td>
</tr>
<tr>
<td>Depression</td>
<td>0.10</td>
<td>0.03</td>
<td>9.67</td>
<td>0.002</td>
<td>1.10</td>
<td>1.04–1.17</td>
</tr>
<tr>
<td>Functional limitation</td>
<td>0.06</td>
<td>0.02</td>
<td>9.11</td>
<td>0.003</td>
<td>1.07</td>
<td>1.02–1.11</td>
</tr>
<tr>
<td>Physical health</td>
<td>–0.06</td>
<td>0.03</td>
<td>3.82</td>
<td>0.051</td>
<td>0.94</td>
<td>0.88–1.00</td>
</tr>
</tbody>
</table>

Criterion: Results are controlled for age, gender, body mass index, blue and white-collar occupation, and sickness absence in days over the last year; \( B = \) logistic regression coefficient; \( SE = \) standard error; \( \text{Wald} = \) logistic regression coefficient divided by \( SE \), squared; \( p = \) significance level of \( \text{Wald} \); \( OR = \) odds ratio; CI(OR)=95% confidence interval of odds ratio.
the development of persistent LBP. It includes both time control\textsuperscript{39} and method control\textsuperscript{40}. Time control captures the influence of work pace and schedule; method control focuses on job decision latitude containing such items as the ability to independently plan and organize one’s own work\textsuperscript{40}. Time and method control are considered to be background variables influencing the response to stressful events\textsuperscript{40}, such as an acute LBP episode that may go on to persistent LBP and prolonged sickness absence. Hence, our findings on ‘job control’ being the strongest predictive factor for sickness absence highlight the impact of low ‘job control’ on sickness absence in an acute/subacute LBP population.

However, Meier\textit{ et al.} recently reported on the double meaning of ‘job control’\textsuperscript{41}. In individuals with an internal locus of control, ‘job control’ predicted lower musculoskeletal pain, whereas in persons with an external locus of control, ‘job control’ was associated with higher musculoskeletal pain. In contrast, in a study by Elfering\textit{ et al.} employees in adult education with high ‘job control’ were experiencing high musculoskeletal pain\textsuperscript{42}. In the present study we did not assess locus of control, but we speculate that our study participants had a more internal locus of control and consequently, low ‘job control’ predicted LBP and LBP-related sickness absence.

Furthermore, psychological (‘depression’) and biomedical factors (‘functional limitation’) proved to be significant predictors of sickness absence. Wynne-Jones\textit{ et al.} showed in a general practitioner setting in the UK, that LBP consulters had higher depression scores when being on sick leave\textsuperscript{43}. This association between ‘depression’ and sickness absence was confirmed recently by Lexis\textit{ et al.}’s findings of a high relative risk for long-term sickness absence in depressed employees from a large general working population\textsuperscript{44}. Moreover, the association between ‘functional limitation’ and LBP-related sickness absence is

### Table 4. Baseline-predictor model of sickness absence at three weeks

<table>
<thead>
<tr>
<th>Baseline-predictor model</th>
<th>B</th>
<th>SE</th>
<th>Wald</th>
<th>p</th>
<th>OR</th>
<th>CI (OR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Job control</td>
<td>-0.50</td>
<td>0.22</td>
<td>5.24</td>
<td>0.022</td>
<td>0.61</td>
<td>0.39–0.93</td>
</tr>
<tr>
<td>Resigned attitude towards the job</td>
<td>0.18</td>
<td>0.17</td>
<td>1.25</td>
<td>0.263</td>
<td>1.20</td>
<td>0.87–1.66</td>
</tr>
<tr>
<td>Fear-avoidance beliefs about work</td>
<td>0.04</td>
<td>0.02</td>
<td>2.78</td>
<td>0.095</td>
<td>1.04</td>
<td>0.99–1.09</td>
</tr>
<tr>
<td>Social support at work</td>
<td>-0.25</td>
<td>0.20</td>
<td>1.46</td>
<td>0.227</td>
<td>0.78</td>
<td>0.52–1.17</td>
</tr>
<tr>
<td>Depression</td>
<td>0.02</td>
<td>0.03</td>
<td>0.91</td>
<td>0.340</td>
<td>1.03</td>
<td>0.98–1.08</td>
</tr>
<tr>
<td>Functional limitation</td>
<td>0.03</td>
<td>0.03</td>
<td>1.72</td>
<td>0.190</td>
<td>1.03</td>
<td>0.98–1.09</td>
</tr>
<tr>
<td>Physical health</td>
<td>-0.06</td>
<td>0.03</td>
<td>3.21</td>
<td>0.073</td>
<td>0.94</td>
<td>0.89–1.01</td>
</tr>
</tbody>
</table>

$R^2 = 0.43$ (Nagelkerke)

Model $\chi^2=62.8**$, $df=12$

Criterion: Results are controlled for age, gender, body mass index, blue and white-collar occupation, and sickness absence in days over the last year; $B$=logistic regression coefficient; $SE$=standard error; Wald=logistic regression coefficient divided by $SE$, squared; $p$=significance level of Wald; OR=odds ratio; CI(OR)=95% confidence interval of odds ratio; $df$=degree of freedom; ** = $p<0.001$; two-tailed.

### Table 5. Baseline-predictor model of sickness absence at six weeks

<table>
<thead>
<tr>
<th>Baseline-predictor model</th>
<th>B</th>
<th>SE</th>
<th>Wald</th>
<th>p</th>
<th>OR</th>
<th>CI (OR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Job control</td>
<td>-0.75</td>
<td>0.31</td>
<td>5.67</td>
<td>0.017</td>
<td>0.47</td>
<td>0.26–0.88</td>
</tr>
<tr>
<td>Resigned attitude towards the job</td>
<td>0.22</td>
<td>0.24</td>
<td>0.82</td>
<td>0.365</td>
<td>1.25</td>
<td>0.77–2.02</td>
</tr>
<tr>
<td>Fear-avoidance beliefs about work</td>
<td>0.06</td>
<td>0.03</td>
<td>2.74</td>
<td>0.098</td>
<td>1.06</td>
<td>0.99–1.13</td>
</tr>
<tr>
<td>Social support at work</td>
<td>0.24</td>
<td>0.34</td>
<td>0.50</td>
<td>0.478</td>
<td>1.27</td>
<td>0.66–2.45</td>
</tr>
<tr>
<td>Depression</td>
<td>0.08</td>
<td>0.04</td>
<td>4.46</td>
<td>0.035</td>
<td>1.09</td>
<td>1.01–1.17</td>
</tr>
<tr>
<td>Functional limitation</td>
<td>0.07</td>
<td>0.03</td>
<td>3.99</td>
<td>0.046</td>
<td>1.07</td>
<td>1.01–1.14</td>
</tr>
<tr>
<td>Physical health</td>
<td>0.04</td>
<td>0.05</td>
<td>0.73</td>
<td>0.392</td>
<td>1.04</td>
<td>0.95–1.14</td>
</tr>
</tbody>
</table>

$R^2 = 0.47$ (Nagelkerke)

Model $\chi^2=50.1**$, $df=12$

Criterion: Results are controlled for age, gender, body mass index, blue and white-collar occupation, and sickness absence in days over the last year; $B$=logistic regression coefficient; $SE$=standard error; Wald=logistic regression coefficient divided by $SE$, squared; $p$=significance level of Wald; OR=odds ratio; CI(OR)=95% confidence interval of odds ratio; $df$=degree of freedom; ** = $p<0.001$; two-tailed.
in accordance with findings from the literature\textsuperscript{5,12}). When patients with acute/subacute LBP go on to develop persistent LBP some, though not all, of the significant prognostic factors of sickness absence change. Young et al. showed, in a recent study on patients attending a general practitioner with persistent LBP lasting three months or longer, that ‘physical health’ was the strongest predictor for interference with sickness absence\textsuperscript{45}. Another significant factor in the previous study was ‘depression’, a factor also found as baseline-predictor for sickness absence at six weeks in our study. Unlike the current study, Young et al. did not identify ‘functional limitation’ as a predictor for sickness absence, whereas both studies concurred that ‘social support’ was not a predictor. The other three variables assessed in our study (‘job control’, ‘resigned attitude towards the job’, ‘fear-avoidance beliefs’) had not been by investigated by Young et al.\textsuperscript{45}. This comparison of the influence of acute/subacute and persistent LBP on sickness absence underlines the paramount importance of ‘depression’ for LBP-related sickness absence, disregarding the duration of the LBP episode.

The baseline-predictor model accurately predicted short-term (≤ six weeks) sickness absence. Thus, Hypothesis 2 could be confirmed. This finding is in agreement with a framework and formal mathematical model of aggregation times in which the duration of a condition such as LBP determines the appropriate aggregation period: “Increasing aggregation time enhances the size of the chronic LBP-absence connection (positive moderator), but reduces the acute LBP-absence connection”\textsuperscript{46}; i.e. for patients with acute/subacute LBP defined by LBP up to twelve weeks duration baseline-assessment can predict sickness absence up to twelve-week time point (or short-term aggregation time).

One might argue that this categorisation is arbitrary\textsuperscript{47}. However, the currently most commonly used categorisation of LBP into acute, subacute and chronic LBP is arbitrary as well, and matches the proposed time frames of the aggregation periods, with acute/subacute LBP corresponding with the short-term aggregation period and chronic LBP being equivalent to mid-term\textsuperscript{47}. Therefore, it appears reasonable to use the model by Harrison and Martocchio\textsuperscript{47}. In the present study, no significant baseline-predictors could be identified in the multivariate model for sickness absence at a time point beyond the six-week follow-up. According to Harrison and Martocchio\textsuperscript{47} work stressors have their greatest effect on sickness absence in the short-term interval. With the established link between stress and ‘job control’ (as previously stated) it seems reasonable that ‘job control’ was found to be the strongest predictor of short-term sickness absence.

Hence, health practitioners have an important role to play at their initial contact with patients reporting with an acute/subacute episode of LBP, to identify those at risk of sickness absence. As there was less support for baseline-prediction of mid- or long-term sickness absence in our study compared to short-term prediction, health practitioners should monitor risk factors during treatment. For instance, further assessment of risk factors at twelve weeks may be warranted, with health practitioners balancing the additional time requirements against prolonged sickness absence, which is an important cost driver for indirect health care costs associated with LBP-related sickness absence\textsuperscript{48}. Indirect health care costs could be even higher when accounting for reduced work productivity due to LBP-related presenteeism\textsuperscript{49,50}.

Additional practical implications of our findings are that an early identification of acute/subacute LBP patients with LBP-related sickness absence allows early intervention to prevent future sickness absence. This strategy has proven effectiveness from a meta-analysis\textsuperscript{46}, and a recent study on employees with depressive complaints and a high risk of long-term sickness absence\textsuperscript{51}.

A limitation of this study is potential attrition bias. Posthoc power calculations with df=11 and largest follow-up sample size of 252 after three weeks and smallest sample size of 165 after six months for the first predictor variable job control reveal power that is lower than recommended 0.80, but ranges between (0.55 and 0.66). Thus, given the study attrition, the power of the study was a limitation and some predictors might have failed to show significant contributions to prediction of WA because of the small sample size. A further limitation is bias from common source variance that may have boosted correlations in this study. All assessments were done by questionnaire. Thus, employees may have perceived more absence days in the same way as they perceived their work characteristics to be more negative – just because they are more pessimistic than others about everything in their life\textsuperscript{52}. Therefore, further studies should also refer to organizational documents of absenteeism and observation of work characteristics. Another limitation to take into consideration is that we did not collect cumulative data on sickness absence between baseline and different time points of follow-up. This has implications on the reliability of any predictions and has to be accounted for when drawing conclusions from our findings.

A strength of our study is that baseline characteristics of
participants and individuals lost to follow-up did not show significant differences, except for a higher depression score and lower mental health for those individuals lost to follow-up. This is typical for study populations where the healthier individuals stay in the study. Without this bias that caused variance restriction in depression within prediction of sickness absence, it is likely that the predictive value of depression would have been even higher.

Further research is warranted investigating assessment at different time points, to identify the optimal time at which to re-assess at risk acute/subacute LBP patients in order to accurately predict sickness absence.

Conclusions

The best prognostic baseline-factors to predict sickness absence in patients with a new episode of LBP were ‘job control’, ‘depression’ and ‘functional limitation’. For patients with acute/subacute LBP, models have predictive ability for sickness absence at three and six weeks after initial presentation to a health practitioner. The prediction of sickness absence beyond six weeks is limited, and health practitioners should re-assess patients before that time point, especially if they have previously been identified as at risk of sickness absence. However, this should be considered with caution as no cumulative data on sickness absence between baseline and different time points of follow-up were collected in the present study. Should further research confirm our preliminary findings that the prediction of sickness absence beyond six weeks is limited, this would ask for timely interventions with measures designed to reduce the likelihood of prolonged sickness absence.

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