

Productivity Loss at Work; Health-Related and Work-Related Factors

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Abstract *Introduction* Productivity loss is an increasing problem in an aging working population that is decreasing in numbers. The aim of this study is to identify work-related and health-related characteristics associated with productivity loss, due to either sickness absence or reduced performance at work. *Methods* In this cross-sectional study, data of the Netherlands Working Conditions Survey of 2007 were used, which includes a national representative sample of 22,759 employees aged 15 to 64 years. Demographic characteristics, health-related and work-related factors were assessed with a questionnaire. Logistic regression analyses were carried out to study the relationship of work-related and health-related factors with low performance at work and sickness absence in the past 12 months. *Results* Poor general health, the number of longstanding health conditions, and most types of longstanding health conditions were associated with productivity loss. Health-related factors were in general stronger associated with sickness absence than with low performance at work. Performance: poor health OR 1.54 CI 1.38–1.71, >1 health conditions OR 1.21 CI 1.09–1.35; sickness absence: poor health OR 2.62 CI 2.33–2.93, >1 health conditions OR 2.47 CI 2.21–2.75. Of the different types of longstanding health conditions, only psychological complaints and to a small extent musculoskeletal symptoms, were associated with low performance (respectively OR 1.54 CI 1.27–1.87; OR 1.09 CI 1.00–1.18). Low performance at work was less likely among employees with high physically demanding work

(shift work OR 0.70 CI 0.63–0.76, using force OR 0.78 CI 0.72–0.84, and repetitive movements OR 0.74 CI 0.70–0.79). Psychosocial factors were stronger associated with low performance at work than with sickness absence (performance: job autonomy OR 1.28 CI 1.21–1.37, job demands OR 1.23 CI 1.16–1.31, emotionally demanding work OR 1.73 CI 1.62–1.85; sickness absence: job autonomy ns, job demands OR 1.09 CI 1.03–1.17, emotionally demanding work OR 1.09 CI 1.02–1.16). *Conclusion* Except for psychological complaints, workers with a longstanding health condition generally perform well while being at work. Nevertheless, the likelihood of taking sick leave is increased. Among work-related factors, psychosocial work characteristics have the strongest relation with productivity loss, mostly with performance while at work.

Keywords Productivity · Presenteeism · Performance · Sickness absence · Psychosocial factors

Introduction

With the aging of the population in Western societies, the working population is decreasing in numbers, and both healthy persons and persons with a chronic health condition are needed to ensure the productivity of the work force. Apart from the decrease the working population will more and more consist of older workers, who may encounter health problems more frequently than younger workers. Health problems may lead to a decreased work productivity. On the one hand, work productivity may decrease because workers are not able to be present at work due to health problems. On the other hand, work productivity may decrease because health problems cause a

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reduced performance at work. While the first phenomenon is known as sickness absence, the latter phenomenon is often called sickness presenteeism [1, 2]. Thus, work productivity loss due to health problems consists of two components, sickness absence (days off work) and sickness presenteeism (reduced performance at work).

The extent of sickness presenteeism has been studied less extensively compared to sickness absence. However, this does not imply its unimportance. On the contrary, the effect of sickness presenteeism may occur more frequently and may be larger than the effect of sickness absence. Steward et al. [3] showed that among workers with common pain conditions such as arthritis, headache and musculoskeletal pain, productivity loss due to sickness absence and sickness presenteeism corresponded to 3.5 and 5.5 h per week. Only about 1 h resulted from sickness absence, while the remainder was caused by a reduced performance while being present at work. A similar result was found for workers with depression [4]. Van den Heuvel et al. [5] showed that among workers with upper extremity problems productivity losses were mainly due to sickness presenteeism (57–89%), and to a lesser extent due to sickness absence (11–43%). As a consequence, sickness presenteeism may strongly influence the indirect costs to society. Li et al. [6] for example calculated that 41% of the costs of arthritis can be attributed to a reduced performance at work (i.e. sickness presenteeism), whereas only 12% is accounted for by a decrease in working hours (i.e. sickness absence).

Although in this framework sickness absence and presenteeism is defined as a result of health problems, other factors may also influence performance at work and the occurrence of days off work registered as sick leave. Previous research has shown that, apart from health problems, sickness absence is influenced by factors at a personal level (health, age, gender, social economic status), work-related factors (physical and psychosocial working conditions), and societal factors, such as the insurance system and unemployment rates [7–9].

Fewer studies have focused on determinants of sickness presenteeism. Recently, some studies examined the relation between health problems and reduced performance. Alavinia et al. [10] showed that having a diagnosed disease was associated with lower productivity at work. However, this result was not statistically significant after adjustment for individual and work-related factors and other health indicators. Lerner et al. [11] found that depression was an independent predictor of decreased performance at work. Meerding et al. [12] found that in a population of workers with heavy physical work, about 20% of the workers experienced limitations at work due to a health problem in the past 2 weeks, but only 5–10% of the workers were absent from work due to these health problems. Low performance was associated with musculoskeletal complaints

in the last 6 months, and with worse mental or physical health.

Some other studies have examined the relation between work-related factors and reduced performance at work. Low job control [10], high time demands, high physical demands, high output demands [11], and high psychosocial load [12] have been found to be associated with a reduced performance at work.

All in all, reduced work productivity is an important issue. Consequently, it is important to know which factors could have a favorable impact on productivity, in particular factors that are amendable to change. Till now the main focus was on factors influencing sickness absence, while only limited attention has been paid to factors related to sickness presenteeism or reduced performance at work. Therefore, the aim of the present study is to identify work-related and health-related characteristics associated with productivity loss, due to either sickness absence or reduced performance at work.

Methods

Study Population

In the present cross-sectional study, data of The Netherlands Working Conditions Survey (NWCS) of 2007 were used. The NWCS is currently the largest survey on quality of work and working conditions available in the Netherlands. It constitutes a representative sample of the Dutch workforce in the 15–64 year age group, but excludes self-employed individuals [13].

In total 80,000 individuals were sampled from the Dutch working population database of Statistics Netherlands (<http://www.cbs.nl/nl-NL/menu/informatie/beleid/catalogi/catalogus-microdatabestanden-thema/arbeid-sociale-zekerheid/default.htm>). This database contains information on all jobs, which fall under employee national insurance schemes, and are liable to income tax. Sampling was random, except for a 50% over-sampling of employees aged younger than 23 years and of employees with a non-western background, since the response rate in these two groups was expected to be relatively low.

Individuals in the sample received the written questionnaire by mail at their home address in the first week of November 2007. The questionnaire could be filled out with a pencil (PAPI), or via Internet (CAWI) using a personal code that was printed on the questionnaire. After 2 to 3 weeks, a written reminder was sent to the majority of those who, at that time, had not yet responded. Data collection was stopped after 2 months. Respondents could choose between a chance to win € 25 euros (odds one out of ten) or to support a good cause (e.g. WWF, Amnesty) with € 2.50.

In total, questionnaires of 32.8% of the employed sampled individuals were available for analysis ($n = 22,759$). In order to let the sample distribution correspond to the distribution of all employees in the Netherlands, responses were weighted for age, gender, educational level, ethnic origin, sector, urbanization level, and geographic region [13].

Measurement

Demographic, Work-Related, and Health-Related Variables

Age and gender were asked. Full-time employment was defined as working at least 36 h per week according to the contract. Workers were asked whether they had a temporary or permanent contract, and whether they were a supervisor. Shift work, working during the evening or at night, and overtime were asked by single questions with answer categories on a 3-point scale (never, sometimes, frequently). Due to the overlap between shift work and working in the evening/night (Spearman $r = 0.58$), only shift work was included in the statistical analysis.

Using force was assessed by a single question on pushing, pulling, or using force with work tools, with answers on a 3-point scale (no, sometimes, frequently). The variable was dichotomized in no/sometimes and frequently. The same procedure was followed for repetitive movements. The number of hours of visual display work was assessed and dichotomized based on the median number of hours into frequent and non-frequent.

Job autonomy was asked by 5 questions on a 3-point scale (no, sometimes, frequently). Job demands (4 items) and variation in activities at work (3 items) were assessed, with answers on a 4-point scale ranging from never to always. Three questions on emotional demands of the job with the same answer scale were asked, i.e. does your job get you into emotionally difficult situations, is your job emotionally demanding, are you emotionally involved at work [14]. Sum scores of the scales job autonomy, job demands, variation, and emotionally demanding work were dichotomized based on the median value of the study sample.

Workplace violence and harassment by supervisors or colleagues and workplace violence and harassment by customers (or patients, students, passengers, etc.) during the past 12 month were assessed by separate questions on unwanted sexual attention, intimidation, and physical violence. A dichotomous variable was constructed, assigning a positive score if at least one of these three questions was 'yes'.

Three types of variables were constructed with regard to health. They refer to the general state of health, the type of health condition, and the number of conditions. General

state of health was asked with a single question, with five answer categories ranging from excellent to poor. Persons reporting moderate or poor health were categorized as poor health. The type of health conditions was assessed by asking employees whether they had one or more longstanding disease, condition, or handicap. The answer categories are presented in Table 2. Finally, the number of conditions was categorized into no longstanding health condition, one condition, or two or more conditions.

Performance at Work and Sickness Absence

Performance at work was assessed using three questions, i.e. 'I achieve all objectives of the job', 'job-related tasks come easily to me', and 'I perform well in my job', which were derived from the task performance items used by Goodman and Svyantek [15]. Answers were given on a 5-point scale, ranging from totally agree to totally disagree, and a sum score was calculated (Cronbach's alpha 0.83). Because of its skewed distribution, the sum score was dichotomized into low and high on the median value of the study sample. Sickness absence was assessed with a question on the occurrence of sick leave during the past 12 months (yes/no), and a question on the total number of days off work because of sick leave in the past 12 months. In this study, sick leave was defined as at least 1 day of sickness absence during the past 12 months.

Statistical Analysis

Logistic regression analysis was used to study the association of demographic, work-related, and health-related variables with the performance at work and sickness absence. First, univariate logistic regression analyses were performed with one independent variable and performance at work or sick leave as outcome measure. The measure of association was expressed by the odds ratio (OR) and 95% confidence interval. The independent variables with a P -value ≤ 0.05 in the univariate regression analyses with either performance at work or with sickness absence were selected for further analyses.

Second, multivariate logistic regression analyses were performed with demographic, work-related, and health-related factors as independent variables and the performance at work or sickness absence as dependent variables. Backward selection was used to construct the multivariate models. All variables with a P -value ≤ 0.05 in the model of performance at work or sickness absence were retained in both models. After the construction of the final multivariate models, we determined whether independent variables were excluded correctly by including them one by one in the models of performance at work and sick leave,

and evaluated their influence on the overall fit of both models.

General health, the type of health condition and the number of health conditions all were strongly associated. Therefore, we decided against retaining them in one model, and started the statistical analyses by only including the number of health conditions. All work-related variables were included since the multivariate analyses showed they were all significantly associated ($P \leq 0.05$) with either performance at work or sickness absence.

To examine the influence of general health and the type of health condition on performance at work and sick leave, these variables were separately included in the final multivariate models, replacing the variable indicating the number of health conditions. Similarly, using force at work was strongly associated with visual display work. Hence, the initial models included only using force, and the influence of visual display work was studied by including it in the final multivariate models replacing using force. Statistical analyses were performed with the statistical package SPSS 14.0 for Windows.

Results

Table 1 presents the demographic and work-related characteristics of 22,759 employees. Sickness absence in the past 12 months was reported by 50% of the employees, and the median (IQR) number of days off work among those with sickness absence was 5 (9) days. The association between sickness absence and performance at work was low. About 48% of the employees with a high performance at work reported sick leave, whereas 52% of those with a low performance at work reported sick leave.

Table 2 shows that 35% of the employees had one or more longstanding health conditions, and 8.5% reported poor health. The number of longstanding health conditions and perceived health were strongly associated, with 3% of the workers without health conditions experiencing poor health, 15% of those with one health condition, and 32% of those with two or more health conditions. The most frequently reported health condition was musculoskeletal complaints.

In univariate regression analyses, all work-related variables were significantly associated with performance at work (Table 3). After adjustment for demographic, work-, and health-related variables in the multivariate regression analysis, shift work (OR 0.70), frequently using force (OR 0.78), and frequent repetitive movements (OR 0.74) reduced the likelihood of low performance, whereas employees with a temporary contract (OR 1.32), low job autonomy (OR 1.28), high job demands (OR 1.23), and high emotionally demanding work (OR 1.73) were more

likely to report low performance (Table 3). Workplace violence was also associated with low performance, but less strongly. When visual display work instead of using force was included in the model, frequent visual display work increased the likelihood of low performance (OR 1.35).

The associations between work-related variables and sickness absence differed from the pattern found for the performance at work (Table 3). In the multivariate analysis, having a temporary contract increased the likelihood of low performance at work, but decreased the likelihood of sickness absence (OR 0.76). Shift work, frequently using force, and frequent repetitive movements decreased the likelihood of low performance, whereas frequent repetitive movements increased the likelihood of sick leave (OR 1.18), and shift work and using force were not significantly associated with sick leave. High emotionally demanding work was strongly associated with low performance, but only weakly associated with sickness absence (OR 1.08). In contrast, workplace violence was weakly associated with low performance, but strongly associated with sick leave (OR 1.18 and OR 1.42). Table 3 also shows that, after adjustment for work-related and health-related variables, older workers (55–65 years) were less likely to report a low performance at work, and were also less likely to report sick leave of at least 1 day in the past 12 months.

Health-related variables were also associated with the performance at work (Table 4). After adjustment for demographic and work-related variables, workers with two or more health conditions and those with poor general health were more likely to report a low performance (OR 1.21 and OR 1.54). Of the specific health conditions, psychological complaints increased the likelihood of a low performance (OR 1.54), in common with musculoskeletal complaints, although the association with the latter was very weak (OR 1.09).

In general, health-related variables were stronger associated with sick leave than with performance at work (Table 4). Having one (OR 1.77) or two or more health conditions (OR 2.47) and poor general health (OR 2.62) both strongly increased the likelihood of sick leave. In line with the findings for performance at work, workers with musculoskeletal complaints (OR 1.55) or psychological complaints (OR 2.66) were more likely to report sick leave. However, several other health conditions were also significantly associated with an increased likelihood of sick leave (Table 4).

In the analyses presented above, sickness absence was defined as absence of at least 1 day in the past 12 months. If an absence of at least 5 days was used as outcome measure, results were quite similar. In general, independent variables had more influence on sickness absence. In contrast to the results with the outcome measure sickness

Table 1 Demographic and work-related characteristics of the study population (*n* = 22,759)

Characteristics	
Demographic factors	
Age (years) (mean, SD)	40 (12)
Women (%)	46
Work-related factors	
Full-time work (≥ 36 h/week) (%)	57
Temporary contract (%)	17
Frequent shift work (%)	12
Frequent overtime (%)	28
Supervisor (%)	29
Frequently using force (%)	18
Frequent repetitive movements (%)	36
Visual display work (h/day) (median, IQR)	4.0 (5.0)
Job autonomy (1–3) (median, IQR) ^a	2.6 (0.8)
Job demands (1–4) (median, IQR) ^a	2.3 (0.8)
Variation in working tasks (1–4) (median, IQR) ^a	2.7 (1.0)
Emotionally demanding work (1–4) (median, IQR) ^a	1.7 (1.0)
Workplace violence by supervisors/colleagues ≥ 1 time (%)	17
Workplace violence by customers ≥ 1 time (%)	24
Performance at work and sickness absence	
Performance at work (1–5) (median, IQR) ^b	4.7 (1.0)
Sickness absence in past 12 months (%)	50
Days off among those with sickness absence (median, IQR)	5 (9)

^a Higher score indicates more autonomy, higher job demands, higher variation, or more emotionally demanding work

^b Higher score indicates better performance at work

SD standard deviation, QR interquartile range

absence of at least 1 day, workers aged 55 to 65 years were more likely to report sickness absence of at least 5 days (OR 1.20 (1.03–1.40)), and workers using force were more likely to report sick leave of at least 5 days (1.20 (1.09–1.32)).

Discussion

Poor health was associated with both low performance at work and sickness absence, but the association with performance was less strong. Except for psychological complaints and to a lesser degree musculoskeletal complaints, longstanding health conditions did not seem to hamper performance at work, whereas most health conditions were associated with increased sickness absence.

Workers with physically more demanding work (shift work, using force, repetitive movements) less often reported a low performance. Psychosocial work characteristics, in particular low job autonomy, high job demands, and emotionally demanding work were stronger associated with low performance at work than with sickness absence.

The association between poor health and productivity loss has been established before [2, 5, 10, 12, 16]. A noticeable result of the present study was that longstanding health conditions were not strongly associated with performance at work. Only psychological complaints, and to a

lesser extent musculoskeletal complaints, were significantly associated with low performance at work, whereas other specific longstanding health conditions were not. Therefore, our study suggests that many employees with a longstanding health condition are capable of dealing with their condition while performing at work.

A possible explanation for this phenomenon could be that employees with a longstanding health condition adapt their job in such a way that their health conditions do not hamper their performance at work. Another explanation may be that workers with a longstanding health conditions will not be selected for jobs that are not suitable for them. Nevertheless, as expected they reported sick leave more often.

Employees with psychological complaints were more likely to report a low performance at work. Psychological complaints may be less easy to cope with at work. A recent review concludes that the results in studies on sickness presenteeism and mental health consistently show that mental health and a decreased productivity are associated [2]. A longitudinal study that measured the impact of health on effectiveness at work found that depression has a substantial and persistent negative influence on workplace productivity that was even higher than the effect on sickness absence [17].

The results of the present study show that workers with physically demanding work (blue collar workers) are less

Table 2 Health-related characteristics of the study population ($n = 22,759$)

Characteristics	%
Poor general health	8.5
Number of chronic health conditions	
None	64.7
One	26.2
Two or more	9.1
Type of health condition ^a	
Musculoskeletal complaints	14.6
Migraine or severe headache	5.5
Respiratory disease	5.2
Stomach or intestine disorder	3.4
Cardiovascular disease	2.5
Psychological complaints or disorder	2.4
Problems with hearing	2.2
Diabetes	2.1
Problems with vision	2.1
Severe skin disease	0.8
Life threatening disease (e.g. cancer, AIDS)	0.7
Epilepsy	0.4

^a One worker could report more than one health condition

inclined to report a low performance at work than workers with more mentally demanding work (white collar workers). A possible explanation might be that employees in jobs with these characteristics have fewer opportunities to adapt their activities at work to their health condition. White collar workers on the other hand may have more opportunities to temporarily adapt their tasks or their pace. Therefore, they may go to work, although performing lower, while blue collar workers take sick leave.

Our findings seem to be in contrast with the results of Alavinia et al., who found that white-collar workers reported less productivity loss at work than blue collar workers [10]. In this study, the quantity and/or quality of the work performance on the last working day was asked, whereas the present study assessed the role performance at work without a time indication. Hence, the dissimilarity may be caused by the different outcome measures.

Unfavorable psychosocial work characteristics, in particular emotionally demanding work, were associated with low performance, and to a lesser extent with sickness absence. In agreement with previous studies [5, 6, 10–12], these findings demonstrate the importance of psychosocial factors for the productivity of employees.

In the light of the aging workforce, the results on the influence of age and health are of special interest. However, the relation between age and performance is complicated, particularly in a study population of workers. In

this study, workers aged 55 to 65 were less likely to report a low performance at work. Furthermore, they were less likely to report sickness absence in the past 12 months. This finding probably reflects the healthy worker effect, meaning that workers with (limitations due to) health problems will have left the workforce. Additional analyses showed that workers aged 55 to 65 were more likely to report sickness absence of more than 5 days. This finding suggests that with the aging of the workforce longer sickness absence may need to be anticipated. In conclusion, in this study population it is not possible to estimate the effect of an aging workforce on productivity.

Methodological Issues

Self-reported data on sickness absence are usually considered to be reliable and valid [18]. However the measurement of performance at work is still a major challenge for research. Only for some jobs a clear and objective output measure of performance or productivity is available. An example is number of telephone calls in a call center, or number of processed characters in a data entry unit. The lack of a true account of an employee's performance makes the validity of performance measures difficult to establish. Therefore, in a large-scale survey, comprising all kinds of occupations, researchers have to depend on self-reported performance.

Lately, several attempts have been made to develop instruments to measure work productivity. Until now, most studies examining the influence of health and/or work factors used a measure to indicate performance related to a health condition. The most common approach is assessment of perceived impairment, accomplished by asking employees how much their illnesses hinder them in performing common mental, physical, and interpersonal activities and in meeting job demands. Other instruments measure comparative productivity. They assess how an employee's performance differs from that of others or from his or her usual performance [18]. An example of the first type is the Work Limitations Questionnaire (WLQ) [19], an example of the latter type is the Health and work Performance Questionnaire (HPQ) [20]. In a recent review [2] was concluded that these two instruments are moving to the forefront in popularity. They have relatively strong validity and reliability testing results, have been used in a variety of workplace settings and with a variety of health risks and conditions.

Nevertheless, both type of instruments have their drawbacks. The first type, measurement of perceived impairment, is unfit to compare the performance of healthy workers and workers with health problems. Moreover, the influence of work-related factors cannot be examined if health problems are absent. The second type, measuring

Table 3 Associations between demographic and work-related factors with the performance at work and sick leave in logistic regression analysis ($n = 22,759$)

	Low performance at work OR (95% CI)		Sickness absence OR (95% CI)	
	Univariate	Multivariate ^a	Univariate	Multivariate ^a
Demographic factors				
Age				
15–24 year	1.00	1.00	1.00	1.00
25–54 year	1.03 (0.95–1.12)	0.98 (0.89–1.08)	1.30 (1.20–1.41)*	1.19 (1.08–1.31)*
55–65 year	0.92 (0.83–1.02)	0.82 (0.72–0.93)*	0.96 (0.86–1.06)	0.77 (0.68–0.87)*
Gender				
Men	1.00	1.00	1.00	1.00
Women	0.87 (0.83–0.92)*	0.77 (0.72–0.83)*	1.37 (1.30–1.44)*	1.29 (1.20–1.39)*
Work-related factors				
Full-time work	1.11 (1.05–1.17)*	1.00 (0.93–1.07)	0.86 (0.82–0.91)*	1.08 (1.00–1.16)*
Temporary contract	1.22 (1.13–1.31)*	1.32 (1.21–1.43)*	0.77 (0.71–0.82)*	0.77 (0.71–0.83)*
Frequent shift work	0.77 (0.71–0.84)*	0.70(0.63–0.76)*	1.20 (1.11–1.30)*	1.06 (0.97–1.17)
Frequent overtime	1.11 (1.05–1.18)*	0.93 (0.87–1.00)*	0.82 (0.77–0.87)*	0.82 (0.77–0.88)*
Supervisor	1.13 (1.06–1.20)*	1.00 (0.94–1.08)	0.78 (0.73–0.82)*	0.81 (0.76–0.87)*
Frequently using force	0.77 (0.72–0.82)*	0.78 (0.72–0.84)*	1.17 (1.09–1.25)*	1.02 (0.94–1.10)
Frequent repetitive movements	0.74 (0.70–0.78)*	0.74 (0.70–0.79)*	1.36 (1.29–1.44)*	1.18 (1.10–1.26)*
Frequent visual display work	1.34 (1.27–1.41)*	1.35 (1.27–1.44)* ^b	1.11 (1.05–1.17)*	1.15 (1.08–1.22)* ^b
Low job autonomy	1.17 (1.11–1.23)*	1.28 (1.21–1.37)*	1.19 (1.13–1.26)*	1.04 (0.97–1.10)
High job demands	1.38 (1.31–1.46)*	1.23 (1.16–1.31)*	1.17 (1.11–1.24)*	1.09 (1.03–1.17)*
Low variation in working tasks	0.88 (0.83–0.93)*	1.02 (0.96–1.08)	1.15 (1.09–1.21)*	1.09 (1.02–1.16)*
High emotionally demanding work	1.80 (1.71–1.90)*	1.73 (1.62–1.85)*	1.24 (1.17–1.30)*	1.09 (1.02–1.16)*
Workplace violence by sup/colleagues	1.28 (1.20–1.38)*	1.10 (1.02–1.20)*	1.69 (1.57–1.81)*	1.42 (1.31–1.54)*
Workplace violence by customers	1.25 (1.17–1.33)*	1.06 (0.99–1.14)	1.40 (1.31–1.49)*	1.18 (1.10–1.27)*

OR odds ratio, CI confidence interval

* Significant association ($P \leq 0.05$)

^a Odds ratios adjusted for demographic variables, work-related variables, and the health-related variable ‘number of health conditions (0, 1, 2 or more)’. The work-related variable ‘frequent visual display work’ was not included in the analyses

^b Value reflects odds ratio when ‘frequent visual display work’ instead of ‘frequently using force’ was included in the multivariate regression analysis

comparative performance, is less suitable for workers with longstanding health problems. If workers were asked to compare their present performance to their normal or former performance, it is unclear what should be their normal performance if their state of health has been the same for a longer time. Therefore, we concluded that these type of instruments are not suitable to measure performance in our study population. This conclusion was supported by a Dutch evaluation report of the WLQ and HPQ. In contrast to the conclusion of the review mentioned above, the authors concluded that both questionnaires were unfit to use in a population of healthy workers [21].

Performance measures are not only used in research concerning health and productivity. In business practice performance measures are used as well, to assess the performance of employees. In the present study a measure

derived from business practice was used. This measure enabled the comparison of healthy workers and workers with health problems and the analysis of the influence of work-related factors, irrespective of the presence of health problems. Drawback is the lack of tested validity and reliability. However, the establishment of validity of the usual instruments is limited as well, since it is generally impossible to establish validity by comparison with objective data [18].

Another point is that it should be acknowledged that workers with a longstanding health condition may adapt objectives and tasks of their job to their condition. As a consequence, they may not report poor performance at work in their adapted job, whereas their performance would have been lower in an unadjusted job. Further research is needed to address this issue.

Table 4 Associations between health-related factors and performance at work and sick leave in logistic regression analysis ($n = 22,759$)

	Low performance at work OR (95% CI)		Sickness absence OR (95% CI)	
	Univariate	Multivariate ^a	Univariate	Multivariate ^a
Poor general health	1.61 (1.46–1.77)*	1.54 (1.38–1.71)*	2.72 (2.45–3.01)*	2.62 (2.33–2.93)*
Number of chronic health conditions				
None	1.00	1.00	1.00	1.00
One	1.07 (1.01–1.14)*	1.06 (1.00–1.14)	1.85 (1.74–1.97)	1.77 (1.65–1.89)*
Two or more	1.25 (1.14–1.37)*	1.21 (1.09–1.35)*	2.68 (2.43–2.97)*	2.47 (2.21–2.75)*
Type of health condition ^b				
Musculoskeletal complaints	1.07 (1.00–1.16)	1.09 (1.00–1.18)*	1.78 (1.65–1.93)*	1.55 (1.43–1.69)*
Migraine or severe headache	1.17 (1.04–1.32)*	1.11 (0.98–1.26)	2.32 (2.05–2.63)*	1.85 (1.61–2.12)*
Respiratory disease	1.08 (0.95–1.21)	1.03 (0.91–1.17)	1.41 (1.45–1.85)*	1.42 (1.25–1.63)*
Stomach or intestine disorder	1.09 (0.94–1.26)	1.01 (0.86–1.18)	2.00 (1.72–2.33)*	1.61 (1.36–1.91)*
Cardiovascular disease	0.94 (0.80–1.12)	0.93 (0.77–1.12)	1.64 (1.19–1.68)*	1.46 (1.20–1.78)*
Psychological complaints or disorder	1.74 (1.46–2.08)*	1.54 (1.27–1.87)*	3.34 (2.72–4.08)*	2.66 (2.13–3.33)*
Problems with hearing	1.17 (0.98–1.41)	–	1.18 (0.98–1.41)	–
Diabetes	0.76 (0.63–0.92)*	0.79 (0.63–0.97)*	1.33 (1.10–1.60)*	1.25 (1.01–1.55)*
Problems with vision	1.21 (1.00–1.46)*	–	1.24 (1.03–1.49)*	–
Severe skin disease	1.27 (0.94–1.70)	–	1.41 (1.05–1.90)*	–
Life threatening disease (e.g. cancer, AIDS)	1.16 (0.85–1.59)	1.18 (0.84–1.66)	2.63 (1.85–3.72)*	2.34 (1.61–3.40)*
Epilepsy	0.99 (0.63–1.55)	–	1.80 (1.14–2.82)*	–

OR odds ratio, CI confidence interval

* Significant association ($P \leq 0.05$)

^a Odds ratios adjusted for demographic and work-related variables presented in Table 3. For the analyses on type of health condition, odds ratios were additionally adjusted for other specific health conditions in the model (i.e. not marked with ‘–’)

^b One worker could report more than one health condition

In this study a cross-sectional design was used. A drawback of such a design is that dependent and independent variables are measured at the same time, and information bias may have affected the results. Also, the direction of potential causality could not be determined. For example, low performance might have caused the reporting of poor health or adverse psychosocial work characteristics.

Conclusions

The results of this study show that poor health is related to low performance at work and sick leave, as expected. It also shows that workers with a longstanding health condition generally perform well at work, although they will take sick leave more often. Workers with psychological complaints seem to be the exception; psychological complaints increased the likelihood of low performance at work. This result and the association between adverse psychosocial work characteristics and low performance, underline the importance of a healthy psychosocial climate at work.

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