International Journal of Occupational Safety and Ergonomics

Publication details, including instructions for authors and subscription information:
http://www.tandfonline.com/loi/tose20

Effects of Physical and Personal Risk Factors on Sick Leave Due to Musculoskeletal Disorders

Majid Motamedzade[a], Mohammad Amin Faghih[a], Rostam Golmohammadi[a], Javad Faradmal[a] & Heidar Mohammadi[a]

[a] School of Public Health and Research Centre for Health Sciences, Hamedan University of Medical Sciences, Hamedan, Iran

Published online: 08 Jan 2015.

To cite this article: Majid Motamedzade, Mohammad Amin Faghih, Rostam Golmohammadi, Javad Faradmal & Heidar Mohammadi (2013) Effects of Physical and Personal Risk Factors on Sick Leave Due to Musculoskeletal Disorders, International Journal of Occupational Safety and Ergonomics, 19:4, 513-521

To link to this article: http://dx.doi.org/10.1080/10803548.2013.11077012

International Journal of Occupational Safety and Ergonomics (*JOSE*) 2013, Vol. 19, No. 4, 513–521

Effects of Physical and Personal Risk Factors on Sick Leave Due to Musculoskeletal Disorders

Majid Motamedzade
Mohammad Amin Faghih
Rostam Golmohammadi
Javad Faradmal
Heidar Mohammadi

School of Public Health and Research Centre for Health Sciences, Hamedan University of Medical Sciences, Hamedan, Iran

*The purpose of this study was to investigate the effects of physical and personal risk factors on sick leave due to musculoskeletal disorders in an Iranian car company. In this cross-sectional study, 234 workers participated and all of them had sick leave due to musculoskeletal disorders in the past year. A physical risk factor checklist and personal information questionnaire were used as data-gathering tools. There was no significant relationship between physical risk factors and sick leave (*p > *.05). Cigarette smoking (*p = *.045), body mass index >30 (*p = *.046) and age (*p = *.044) showed a significant relationship with sick leave. Workers with lumbar deviation of 20°–60° (*OR *1.10) and >60° (*OR *1.11) were at greater risk. The ratios for workers with repetitive work (*OR *1.30) and workers with force exertion (*OR *1.36) were greater than for other workers. Taking preventive actions to improve the ergonomic working conditions of assembly workers and their lifestyle seems crucial.*

sick leave physical risk factors musculoskeletal disorders assembly workers car manufacturing

1. INTRODUCTION

Musculoskeletal disorders (MSDs) are among key factors for sick leave, which is common around the world [1]. An Iranian local authority classified MSDs as the most prevalent disease among Iranian workers; MSDs are considered as a leading factor in disabilities and absenteeism, reduced production and increased costs. Although they are considered to be a serious risk factor, reliable statistics on MSD prevalence are not available [2].

Absence due to illness occurs in various degrees in industry, services and other sectors. According to some statistics in industry, sick leave due to illness constitutes two thirds of total sick leave [3]. Occupational diseases and injuries, which lead to a high rate of sick leave in workplaces, have been increasing. Prevalence rates are diverse in industries, and they are higher among workers in large companies than in small ones [3].

Relations between sick leave and MSDs have been studied and documented in the literature. Hartman, Oude Vrielink, Huirne, et al. showed that MSDs were the major reason for a significant part of sickness absences [4]. Seferlis, Németh, Carlsson, et al. showed that sick leave episodes related to MSDs were fourfold more frequent in workers that suffered from chronic low back pain [5]. Some of the risk factors mentioned in other studies include hard physical work [6, 7]; force exertion [6]; personal factors (age, smoking and obesity) [8, 12, 13, 14]; marital status [9] and low job satisfaction [10, 11].

Correspondence should be sent to Majid Motamedzade, Ergonomics Department, School of Public Health and Research Centre for Health Sciences, Hamedan University of Medical Sciences, Hamedan, Iran. E-mail: motamedzade@yahoo.com.

In industrially developing countries, like Iran, the problem of work-related MSDs is extremely serious and the socioeconomic conditions are worse than in developed countries. Also, studies reflecting the situation are sparse there, so this publication seeks to fill this research gap.

The investigated car company with 18 000 workers is one of the largest car companies in Iran. According to the statistics of the company, 7279 working days were lost due to MSDs in 2010. With regard to the economic importance of this issue and since there have been no studies of the relationship between MSDs and sick leave in this company, this comprehensive study was conducted at the assembly plant with the following objectives: (a) to evaluate physical and individual risk factors in assembly workers and (b) to search for relations between these risk factors and MSD-related sick leave.

2. METHODS

This cross-sectional study was conducted at an assembly plant where all operational jobs were held by male workers. In total, 234 workers were randomly selected from a group who had MSD-related sick leave in the past year.

2.1. Information of Workers' Sick Leave

The first step of the study consisted in collecting information on MSD-related sick leave in the past year. In addition, information on the duration of sick leave was acquired, based on workers' records.

2.2. Personal and Ergonomics Data

All tasks were analysed during workers' activity. That information was used to design a checklist as a data collection instrument for physical ergonomics risk factors. Personal information was obtained through interviews with workers. The information included age, job tenure in the present job, education, job satisfaction, marital status, cigarette smoking, stature and weight. A checklist was used to assess physical ergonomics risk factors: posture (feet, lumbar spine, arms and shoulders, neck and wrists); lifting, pushing and pulling; grip; hand–arm vibration; manual material handling and repetitive work. This checklist was completed on the basis of observation of workers' activity.

2.3. Data analysis and Statistical Procedures

Statistical analyses were performed with SPSS version 16 and R version 2.13.1 software[1] χ^2, Mann–Whitney and Kruskal–Wallis tests were used to assess the association between risk factors (physical and personal) and MSD-related sick leave. A logistic regression analysis was performed for combined effects leading to MSD-related sick leave.

TABLE 1. Demographic Characteristics of the Studied Population (*N* = 234)

Variable	*M* (*SD*)	
Age (years)		
<30	107	(45.7)
≥30	127	(54.3)
Education		
secondary and lower	214	(91.5)
university	20	(8.5)
BMI		
≤20	16	(6.8)
21–25	130	(55.6)
26–30	83	(35.5)
>30	5	(2.1)
Marital status		
single	34	(14.5)
married	200	(85.5)
Job tenure (years)		
≤10	229	(97.9)
>10	5	(2.1)
Satisfaction		
low	210	(89.7)
moderate	24	(10.3)
high	0	(0)
Cigarette smoking		
smoker	87	(37.2)
nonsmoker	147	(62.8)

Notes. BMI = body mass index.

[1] http://www.r-project.org

3. RESULTS

Table 1 summarizes demographic characteristics of the subjects. Their mean (*SD*) age was 31.5 (3.6) years, 54.3% were under 30. Regarding education, secondary education was most frequent among the workers (91.5%). The body mass index (BMI) of 55.6% of the workers was 20–25 (normal category). Married people accounted for 85.5% of the subjects. Low job satisfaction was reported by 90% of the workers with over 10 years of experience**.** The mean (*SD*) and maximum sick leave were 7.5 (9.5) and 53 days, respectively. Most workers had under 3 days of sick leave in the past year (Figure 1).

Among the significant factors associated with sick leave, low back pain was its major cause (Table 2). The mean (*SD*), minimum and maximum of the sick leave it caused was 5.4 (6.1), 1 and 45 days, respectively. Knee and upper extremity pain were the other major causes.

Table 3 illustrates the association between body posture and sick leave. There was no significant relationship between sick leave and legs/feet, low back, arms and shoulders, neck and hands/wrists.

No significant association was detected between sick leave and force exertion, manual material handling, repetitive work, posture, grip, hand–arm vibration, lifting, and pushing and pulling (Table 4). In contrast, cigarette smoking and age

TABLE 2. Sick Leave Due to Various Types of Musculoskeletal Disorders (*N* = 234)

Diagnosis	*n*	*M* ± *SD*[a]	Range
Low back pain	153	5.4 ± 6.1	1–45
Spine trauma	3	7.7 ± 6.4	3–15
Knee injury or knee pain	19	10.6 ± 11.4	2–49
Wrist pain	6	11.0 ± 7.7	4–22
Upper extremity injury	15	8.2 ± 11.2	1–35
Upper extremity fractures without surgery	7	26.6 ± 18.1	3–53
Lower extremity injury	8	6.7 ± 4.5	3–14
Shoulder pain	7	5.3 ± 3.5	3–13
Lower extremity, unclassified	5	11.4 ± 21.6	1–50
Upper extremity, unclassified	1	N/A	N/A
Lower extremity fractures without surgery	2	25.5 ± 6.4	21–30
Lower extremity sprain	5	18.8 ± 15.6	3–38
Lower extremity joint pain (except knee)	2	2.5 ± 0.7	2–3
Any type of upper extremity surgery	1	N/A	N/A
total	234	7.5 ± 9.5	1–53

Notes. a = mean and standard deviation of days of sick leave; N/A = not applicable.

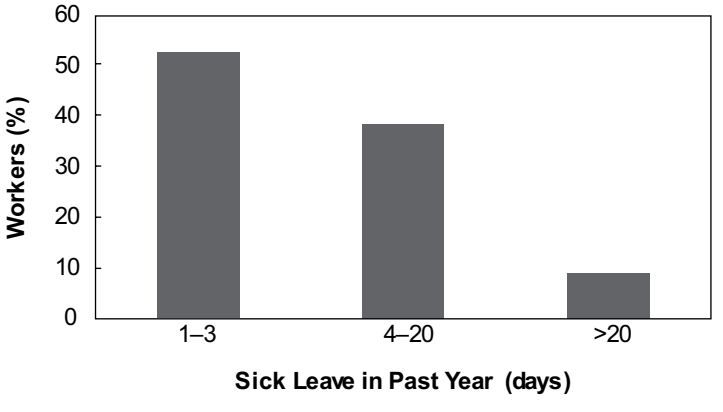

Figure 1. Distribution of the number of sick leave days among workers (*N* = 234)

TABLE 3. Relationship Between Body Posture and Sick Leave Among Workers (*N* = 234)

Posture	Frequency (%)	$M \pm SD$[a]	p*
Waist posture			.750
<20° forward	65 (27.8)	8.5 ± 10.8	
20°–60° forward	120 (51.3)	7.5 ± 9.7	
>60° forward	29 (12.4)	6.2 ± 5.9	
bent to a side	20 (8.5)	6.7 ± 7.8	
total	234 (100)	7.5 ± 9.5	
Arms and shoulders			.296
both arms from shoulders down	63 (26.9)	7.5 ± 8.3	
shoulder height or higher in one or both arms	38 (16.2)	7.9 ± 11.5	
stretching forwards or to a side	105 (44.9)	8.0 ± 10.1	
one or both arms above shoulders and away from trunk	28 (12.0)	5.1 ± 6.1	
total	234 (100)	7.5 ± 9.5	
Neck			.800
straight or ≤10° forward	103 (44.0)	8.3 ± 10.7	
forward >10°	89 (38.0)	7.4 ± 8.3	
bending or rotation	42 (18.0)	5.9 ± 8.4	
total	234 (100)	7.5 ± 9.5	
Hands/wrists			.658
wrists bent up or down	35 (15.0)	7.1 ± 6.7	
wrist deviation to a side	88 (37.6)	7.26 ± 9.1	
wrist rotation	111 (47.4)	7.9 ± 10.6	
total	234 (100)	7.5 ± 9.5	
Legs/feet			.424
sitting	25 (10.7)	7.5 ± 11.4	
standing	51 (21.8)	10.2 ± 11.8	
squatting	22 (9.4)	4.75 ± 3.2	
walking	136 (58.1)	9.0 ± 10.8	
total	234 (100)	7.5 ± 9.5	

Notes. a = mean and standard deviation of days of sick leave; * = χ^2 test.

showed a significant relationship with sick leave (Table 5).

Results of regression for the effects of physical and personal factors on sick leave showed that cigarette smoking was significantly associated with sick leave (Table 6). The analysis showed that the ratio of sick leave for nonsmokers was lower than for smokers and it was lower among workers over 30 in comparison to workers under 30.

The ratio of sick leave taken by various workers compared to reference workers (lumbar deviation <20°) was analysed through logistic regression. According to this model, the chance of getting sick leave for workers with lumbar deviation 20°–60° was higher than for reference workers. The chance of getting sick leave for workers with lumbar deviation >60° was also higher than for reference workers. Similarly, this chance among workers with bent posture was greater than for reference workers. Among workers with repetitive work, the chance was greater than among workers with no repetitive work, while among workers with repetitive work and force exertion, it was higher than among workers with none of these factors. Also, in the regression model, the reference group included workers with BMI ≤ 20.

TABLE 4. Relationship Between Physical Risk Factors and Sick Leave Among Workers (*N* = 234)

Variable	Frequency (%)		*M* ± *SD*[a]	p
Force exertion				
no	13	(5.5)	7.6 ± 7.3	.279[b]
yes	221	(94.4)	7.5 ± 9.6	
Manual material handling				
no	202	(86.3)	7.5 ± 9.3	.871[b]
yes	32	(13.7)	7.8 ± 10.9	
Repetitive work				
no	51	(21.8)	5.7 ± 5.7	.355[b]
yes	183	(78.2)	8.0 ± 10.2	
Posture				
standing	180	(76.9)	7.7 ± 9.7	.808[b]
sitting	54	(23.1)	7.1 ± 8.8	
Grip				
no grip	55	(23.5)	8.8 ± 12.6	.769[c]
balanced power grip	88	(37.6)	7.48 ± 8.4	
unbalanced power grip	75	(32.1)	6.9 ± 8.5	
pinch grip	16	(6.8)	6.1 ± 6.6	
Hand–arm vibration (h)				
no	135	(57.7)	7.7 ± 10.1	.796[c]
<4	21	(9.0)	7.9 ± 8.1	
4–8	78	(33.3)	7.2 ± 8.7	
Pushing and pulling (kg)				
no	211	(90.2)	7.3 ± 9.3	.383[c]
0–5	16	(6.8)	11.7 ± 12.0	
5–10	7	(3.0)	3.4 ± 1.0	
Lifting (kg)				
no	140	(59.9)	7.8 ± 10.1	.902[c]
0–10	61	(26.0)	6.4 ± 6.8	
10–20	21	(9.0)	6.4 ± 8.1	
>20	12	(5.1)	11.6 ± 14.9	

Notes. a = mean and standard deviation of days of sick leave, b = Mann–Whitney test, c = Kruskal–Wallis test.

Chances of getting sick leave were insignificantly higher for workers with $20 < BMI \leq 25$, $25 < BMI \leq 30$ and significantly higher for those with $BMI > 30$ than for the reference group.

4. DISCUSSION

This study of risk factors for MSD-related sick leave among car assembly workers revealed that low back pain was the major cause (66%) of their sick leave. As some recent studies show, back pain is an important problem at work and it can generate diverse costs [15]. In the present study, back pain led to many sick leave absences and many lost working days. This could be attributed to the nature of the workers' tasks, manual work, force exertion, awkward postures, repetitive work, inappropriate workstations, etc. The high rate of low back pain revealed in this study is in agreement with the results of other studies [16, 17].

According to Diaz-Ledezma, Urrutia, Romeo, et al. [3] and Murtezani, Hundozi, Orovcanec, et al. [14], there is a relationship between sick leave and workers who suffer from acute low back pain. These results were only partly confirmed in the present study, as 81.2% of the workers who

TABLE 5. Relationship Between Individual Factors and Sick Leave Among Workers (*N* = 234)

Variable	Frequency (%)	*M* ± *SD*[a]	*p*
Marital status			
single	34 (14.8)	7.0 ± 7.6	.856[b]
married	200 (86.2)	7.6 ± 9.7	
Cigarette smoking			
smoker	87 (37.2)	9.1 ± 11.46	.045[b]
nonsmoker	147 (62.8)	6.6 ± 8.0	
Satisfaction			
low	210 (89.7)	7.6 ± 9.4	.292[b]
moderate	24 (10.3)	6.96 ± 10.4	
Education			
secondary and lower	214 (91.5)	7.6 ± 9.7	.777[b]
university	20 (8.5)	6.9 ± 7.1	
Age (years)			
<30	107 (45.7)	8.7 ± 10.4	.044[c]
≥30	127 (54.3)	6.5 ± 8.5	
BMI			
≤20	16 (6.8)	3.3 ± 3.1	.212[c]
21–25	130 (55.6)	7.9 ± 10.0	
26–30	83 (35.5)	7.8 ± 9.7	
>30	5 (2.1)	6 ± 2	
Job tenure (years)			
≤10	229 (97.9)	7.6 ± 9.5	.666[c]
>10	5 (2.1)	4.4 ± 3.4	

Notes. a = mean and standard deviation of days of sick leave, b = Mann–Whitney test, c = Spearman correlation; BMI = body mass index.

TABLE 6. Simultaneous Impact of Individual and Physical Factors on Sick Leave Among Workers (*N* = 234)

Variable	β	*SE*	Wald	*df*	*p*	*OR*	95% CI for EXP(β)
Waist posture[a]							
20°–60° forward	0.099	0.210	0.220	1	.639	1.10	[0.73, 1.66]
>60° forward	–0.076	0.301	0.064	1	.800	0.927	[0.51, 1.67]
bent to a side	0.104	0.360	0.084	1	.772	1.11	[0.56, 2.24]
Force exertion							
yes	0.306	0.408	0.563	1	.453	1.36	[0.61, 3.01]
Repetitive work							
yes	0.269	0.236	1.300	1	.254	1.30	[0.82, 2.07]
Age							
≥30 years	–0.167	0.182	0.844	1	.358	0.84	[0.59, 1.20]
Cigarette smoking							
nonsmoker	–0.382	0.191	3.970	1	.046	0.68	[0.47, 0.99]
BMI[b]							
20–25	–0.080	0.373	0.046	1	.830	0.92	[0.44, 1.91]
26–30	–0.219	0.381	0.329	1	.566	0.80	[0.38, 1.69]
>30	–1.230	0.620	3.980	1	.046	0.29	[0.07, 0.98]

Notes. a = reference group: deviation <20°, b = reference group: ≤20 years; BMI = body mass index.

suffered from low back pain had sick leave despite nonsignificant association. Monteiro, Alexandre, Ilmarinen, et al. found that the presence of MSDs affected several aspects of work ability, including sick leave [18].

Body postures and physical factors were not associated with sick leave (Tables 3–4). In this study, we observed a randomly selected activity cycle, which may not have been a good representative. Workers may start to work in correct posture but with an increase in workload and fatigue, their posture may deteriorate. The findings of the present study are similar to the results of other ones [19, 20, 21]. However, in the present study, some factors were different from those in Hartman, Oude Vrielink, Huirne, et al., e.g., the nature of tasks, diverse ergonomics risk factors, data collection instrument, working conditions, the subjects (only male workers in the present study) and different study design [13]. Data on ergonomics risk factors were collected through the observation method and were recorded in the designed cheklist.

Like in other studies, age and smoking were associated with MSD-related sick leave. The mean (*SD*) total sick leave for smokers was 9.1 (11.5) days. Perhaps smokers have several problems such as respiratory disease or lower physical fitness than nonsmokers and, therefore, have lower tolerance for assigned work. Therefore, they need sick leave to rest and because of their health problems. Some studies reported a high prevalence of sick leave among smokers [8, 12, 13, 14]. Furthermore, Nathel, Malmberg, Lundbäck, et al. found that smoking was a determinant factor for sick leave [22]. Hartman, Oude Vrielink, Metz, et al. demonstrated the combined effects between physical and personal factors [23]. Table 6 shows that cigarette smoking was significantly related to sick leave. Chances of getting sick in nonsmokers were lower than in smokers.

Married workers (85.5%) had on average more sick leave days than single workers. Probably the reason is that married people have specific problems, such as economic ones, are required to be present at family gatherings, have to support their families, pay attention to their children's demands, often have second jobs, etc. Our findings, however, showed that education and marital status were not significantly associated with sick leave. These findings are in line with Holmberg and Thelin [19] and contrast with Allebeck and Mastekaasa [12].

In several studies, age was positively related to increased sick leave [4, 12, 24]. In contrast, our findings show that the chance of getting sick leave for younger workers was higher than for older ones. The mean age of the workers under study was 31 years, i.e., it was a rather young population. According to the fitting model, the chance of getting sick leave for workers over 30 was lower than for workers under 30 ($p = .358$, *OR* 0.85). Younger workers might have many problems, including financial ones, insufficient experience, attend university or have a second job. These problems could lead to young workers seeking sick leave. On the other hand, the frequency of MSDs may be higher at older ages than at young ages, whereas microtraumas are accumulated in the long term. Anyway, it seems that older workers adapt to the working conditions much better.

About 90% of the workers who had low job satisfaction had sick leave, but there was no significant difference between workers with high and low job satisfaction. Thus, low job satisfaction could be a possible factor for sick leave among the participants in this study. According to Laaksonen, Pitkäniemi, Rahkonen, et al., job dissatisfaction could prolong sickness absence [10]; the present study obtained a similar result. This finding is in agreement with other studies [10, 11, 16].

Table 6 presents the combined effects between BMI and sick leave. Chances of getting sick leave were significantly higher only for workers with BMI > 30 than for the reference group. Our findings show no significant association between lower BMI and sickness absence. Of the studied workers, 55.6% have $20 \leq \text{BMI} < 25$. Our findings confirm the results of other studies [14, 25, 26, 27].

Job tenure (≥10 years) was another possible factor for sick leave. This finding confirmed other studies [14, 25, 27]. No predictive role was detected for work history for acute back pain leading to sick leave.

5. CONCLUSIONS

The physical and personal risk factors that could lead to MSD-related sick leave were lumbar deviation and bending, marital status, smoking, low job satisfaction, BMI > 30 and younger age. Taking preventive or modifying actions to improve the ergonomic working conditions of assembly workers and their lifestyle seems crucial.

REFERENCES

1. Alexanderson K, Norlund A. Swedish Council on Technology Assessment in Health Care (SBU). Chapter 1. Aim, background, key concepts, regulations, and current statistics. Scand J Public Health Suppl. 2004:63:12–30.
2. Direct Treatment Department. Annual Report of Direct Treatment Department. Tehran, Iran: Social Security Organization; 1999. In Persian.
3. Diaz-Ledezma C, Urrutia J, Romeo J, Chelen A, Gonzàlez-Wilhelm L, Lavarello C. Factors associated with variability in length of sick leave because of acute low back pain in Chile. Spine J. 2009;9(12): 1010–5.
4. Hartman E, Oude Vrielink HHE, Huirne RBM, Metz JHM. Sick leave analysis among self-employed Dutch farmers. Occup Med (Lond). 2003;53(7):461–8. Retrieved July 3, 2013, from: http://occmed.oxfordjournals.org/content/53/7/461.long.
5. Seferlis T, Németh G, Carlsson AM, Gillström P. Acute low-back-pain patients exhibit a fourfold increase in sick leave for other disorders: a case-control study. J Spinal Disord. 1999;12(4):280–6.
6. Gheldof E, Vinck J, Vlaeyen JW, Hidding A, Crombez G. The differential role of pain, work characteristics and pain-related fear in explaning back pain and sick leave in occupational settings. Pain. 2005;113(1–2): 71–81.
7. Bot SDM, Terwee CB, van der Windt DAWM, van der Beek AJ, Bouter LM, Dekker J. Work-related physical and psychosocial risk factors for sick leave in patients with neck or upper extremity complaints. Int Arch Occup Environ Health. 2007;80(8):733–41. Retrieved July 3, from: http://link.springer.com/article/10.1007%2Fs00420-007-0186-z.
8. Hartman E, Frankena K, Oude Vrielink HHE, Nielen M, Metz JHM, Huirne RBM. Risk factors associated with sick leave due to work-related injuries in Dutch farmers: an exploratory case-control study. Saf Sci. 2004;42(9):807–23.
9. Lievense AM, Bierma-Zeinstra SM, Verhagen AP, van Baar ME, Verhaar JA, Koes BW. Influence of obesity on the development of osteoarthritis of the hip: a systematic review. Rheumatology (Oxford). 2002;41(10):1155–62. Retrieved July 3, 2013, from: http://rheumatology.oxfordjournals.org/content/41/10/1155.long.
10. Laaksonen M, Pitkäniemi J, Rahkonen O, Lahelma E. Work arrangements, physical working conditions, and psychosocial working conditions as risk factors for sickness absence: Bayesian analysis of prospective data. Ann Epidemiol. 2010; 20(5):332–8.
11. Nakata A, Takahashi M, Irie M, Ray T, Swanson NG. Job satisfaction, common cold, and sickness absence among white-collar employees: a cross-sectional survey. Ind Health. 2011;49(1):116–21.
12. Allebeck P, Mastekaasa A. Swedish Council on Technology Assessment in Health Care (SBU). Chapter 5. Risk factors for sick leave—general studies. Scand J Public Health Suppl. 2004; 63:49–108.
13. Hartman E, Oude Vrielink HHE, Huirne RBM, Metz JHM. Risk factors for sick leave due to musculoskeletal disorders among self-employed Dutch farmers: a case-control study. Am J Ind Med. 2006;49(3):204–14.
14. Murtezani A, Hundozi H, Orovcanec N, Berisha M, Meka V. Low back pain predict sickness absence among power plant workers. Indian J Occup Environ Med. 2010;14(2):49–53. Retrieved July 3, 2013, from: http://www.ijoem.com/article.asp?issn=0019-5278;year=2010;volume=14;issue=2;spage=49;epage=53;aulast=Murtezani.
15. Nyman T, Grooten WJ, Wiktorin C, Liwing J, Norman L. Sickness absence and concurrent low back and neck–shoulder pain: result from the MUSIC-Norrtälje

study. Eur Spine J. 2007;16(5):631–3. Retrieved July 3, 2013, from: http://link.springer.com/article/10.1007%2Fs00586-006-0152-6.

16. Hoogendoorn WE, Bongers PM, de Vet HC, Ariëns GA, van Mechelen W, Bouter LM. High physical workload and low job satisfaction increase the risk of sickness absence due to low back pain: results of a prospective cohort study. Occup Environ Med. 2002;59(5):323–8. Retrieved July 3, 2013, from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1740286/.
17. Reme SE, Hagen EM, Eriksen HR. Expectations and physiotherapy predict prolonged sick leave in subacute low back pain. BMC Musculoskelet Disord. 2009; 10:139. Retrieved July 3, 2013, from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2780378/.
18. Monteiro MS, Alexandre NMC, Ilmarinen J, Rodrigues CM.Work ability and musculoskeletal disorders among workers from a public health institution. International Journal of Occupational Safety and Ergonomics (JOSE). 2009;15(3):319–24. Retrieved July 3, 2013, from: http://www.ciop.pl/31331.
19. Holmberg SAC, Thelin AG. Predictors of sick leave owing to neck or low back pain: a 12-year longitudinal cohort study in a rural male population. Ann Agric Environ Med. 2010;17(2):251–7. Retrieved July 3, 2013, from: http://www.aaem.pl/pdf/17251.pdf.
20. IJzelenberg W, Molenaar D, Burdorf A. Different risk factors for musculoskeletal complaints and musculoskeletal sickness absence. Scand J Work Environ Health. 2004;30(1):56–63.
21. Steenstra IA, Verbeek JH, Heymans MW, Bongers PM. Prognostic factors for duration of sick leave in patients sick listed with acute low back pain: a systematic review of the literature. Occup Environ Med. 2005; 62(12):851–60. Retrieved July 3, 2013, from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1740930/.
22. Nathel L, Malmberg P, Lundbäck B, Nygren A. Is asthma underestimated as a cause of sick leave? Respir Med. 2000; 94(10):977–82.
23. Hartman E, Oude Vrielink HHE, Metz JHM, Huirne RBM. Exposure to physical risk factors in Dutch agriculture: effect on sickleave due to musculoskeletal disorders. Int J Ind Ergon. 2005;35(11):1031–45.
24. Thomson L, Griffiths A, Davison S. Employee absence, age and tenure: a study of nonlinear effects and trivariate models. Work Stress. 2000;14(1):16–34.
25. Alexopoulos EC, Konstantinou EC, Bakoyannis G, Tanagra D, Burdorf A. Risk factor for sickness absence due to low back pain and prognostic factors for return to work in a cohort of shipyard workers. Eur Spine J. 2008;17(9):1185–92. Retrieved July 3, 2013, from: http://link.springer.com/article/10.1007%2Fs00586-008-0711-0.
26. Horneij EL, Jensen IB, Holmström EB, Ekdahl C. Sick leave among home-care personnel: a longitudinal study of risk factors. BMC Musculoskelet Disord. 2004;5(1):38. Retrieved July 3, 2013, from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC539270/.
27. Morken T, Riise T, Moen B, Hauge SHV, Holien S, Langedrag A, et al. Low back pain and widespread pain predict sickness absence among industrial workers. BMC Musculoskelet Disord. 2003;4:21. Retrieved July 3, 2013, from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC200978/.