

# BMJ Open Musculoskeletal health climate is associated with musculoskeletal pain and sickness absence among workers: a cross-sectional study

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## ABSTRACT

**Objectives** This study aimed to investigate whether a musculoskeletal health climate, expressing the shared perceptions among workers concerning musculoskeletal health, is associated with number of musculoskeletal pain sites and sickness absence.

**Design** Cross-sectional study.

**Setting** Six slaughterhouses from 2 companies in Denmark and 6 home-nursing units and 12 nursing homes from 1 municipality in Jutland, Denmark.

**Participants** A total of 1092 slaughter house workers and 410 care workers completed an online questionnaire from February to October 2019.

**Outcome measures** The exposure variable was musculoskeletal health climate assessed by two domains; (1) perceived management priority of musculoskeletal health measured by a modified subscale from the Nordic Safety Climate Questionnaire and (2) work group pain acceptance which was a modified version of the activity engagement subscale of the chronic pain acceptance scale. Outcomes variables were number of musculoskeletal pain sites (0–6) and days with sickness absence.

**Results** The associations between the two subscales, number of musculoskeletal pain sites and sickness absence were calculated using mixed linear and generalised estimating equation regression models. Higher perceived management priority scores were associated with a lower number of musculoskeletal pain sites across both job groups:  $\beta = -.57$  (95% CI  $-0.91$  to  $-0.23$ ) and sickness absence (>5 days) due to musculoskeletal pain prevalence ratio (PR) 0.79 (95% CI 0.57 to 1.08). In contrast higher work group pain acceptance scores were associated with higher number of musculoskeletal pain sites:  $\beta = 0.38$  (0.11 to 0.66), whereas associations with sickness absences seemed to be modified by job groups; PR 1.59 care workers and PR 0.86 slaughterhouse workers.

**Conclusion** The observed relationship between musculoskeletal health climate, musculoskeletal pain sites and sickness absence indicate that cultural factors should receive increased attention in work place preventive interventions.

## INTRODUCTION

Musculoskeletal (MSK) pain of the back, neck and upper limb are the main cause

## Strengths and limitations of this study

- We examined and compared associations between musculoskeletal health climate and number of musculoskeletal pain sites and sickness absence across two different job groups in a large sample of workers (n=1502).
- Our novel measure of musculoskeletal health climate should be further evaluated and supplemented by qualitative information.
- The cross-sectional design, the moderate participation rate, and the limited number of variables available for adjustments are the main limitations of this study.

of disability for work in Europe.<sup>1</sup> Low back pain was the leading cause globally of years lived with disability in 2016.<sup>2</sup> Most previous studies have been focused on ergonomic and individual psychological risk factors. Risk factors for the development, persistence and/or recurrence of MSK pain and disability includes occupational tasks which mechanically load the spine or arm (eg, heavy lifting, awkward positions, forceful movements of shoulder and hand),<sup>3–6</sup> low mood,<sup>7</sup> tendency to worry about common somatic symptoms (somatising tendency)<sup>8</sup> and adverse beliefs about the prognosis.<sup>9</sup> However, despite this knowledge successful interventions based on these individual approaches are sparse and not scientifically supported.<sup>10–12</sup> Therefore, other factors may be important to understand and prevent MSK pain at the work place.

An organisational approach to MSK pain, where pain also is seen as a product of organisational activities, may offer a broader understanding of the complex nature of MSK pain. When analysing organisational activities three interrelated elements are often in focus: structure, processes and culture. Structure reflects formal organisational

goals and strategies and how tasks are distributed and should be performed. Processes are the activities that individuals and groups perform when they carry out the organisational tasks, while culture reflects the shared norms and values that guide behaviour. Organisational activities and effectiveness stems from the combinations of these three elements.<sup>13</sup> Research on MSK pain has so far primarily focused on the structure and process elements, while culture has drawn very little attention, although the importance of workplace culture is well documented within other work environment research areas. For instance, the literature on prevention of occupational injuries has a long tradition of focusing on organisational safety culture,<sup>14</sup> where safety climate is a key concept describing the shared perceptions among workers concerning the safety-related procedures, practices and behaviours that get rewarded and supported by management. Leadership is a central antecedent of safety climate and both concepts are closely linked to organisational safety performance.<sup>15 16</sup>

Coggon *et al* are some of the few researchers that have studied cultural influences on MSK pain.<sup>17–20</sup> In the Cultural and Psychosocial Influences on Disability (CUPID) study, they demonstrated wide international variation in the prevalence of disabling MSK pain among working populations in 18 countries across six continents, even among workers carrying out similar occupational activities across 47 occupational groups (mostly nurses, office staff using computers and workers carrying out repetitive manual tasks with their hands or arms). They also found number of MSK pain sites to be an important determinant of the development disabling low back, including sickness absence. The drivers of disabling pain are largely unknown, but to some extent cultural factors must be at stake, as observed differences in pain prevalence between countries do not seem to be explained by the classical ergonomic risk factors or individual psychological factors. Furthermore, MSK pain seems to have increased despite the elimination of traditional ergonomic hazards at the workplace. Thus, it remains unclear if and how cultural differences in more homogeneous settings, for example, different workplaces, could enlighten our understanding of which factors that are related to the general propensity to pain. Based on this we wanted to investigate whether a MSK health climate, expressing the shared perceptions among workers concerning procedures, practices and behaviours in relation to MSK pain, could be identified as a new complementary explanation model for understanding and prevention of MSK pain. The MSK health climate would be a manifestation of a more general MSK health culture that probably exists at both the societal level as seen in the CUPID-study and the workplace level, which is our interest. The current study aimed to examine the association between MSK health climate, number of MSK pain sites and sickness absence among two job groups with high level of MSK pain; that is, slaughterhouse workers and elderly care workers.

## METHODS

### Design and study population

The study is part of a larger research project (MSK-Culture) using a mixed method design to investigate the existence of a MSK health climate and its impact on MSK pain and sickness absence. The current study was a cross sectional survey conducted at six slaughterhouses from two companies in Denmark and 6 home-nursing units and 12 nursing homes from 1 municipality in Jutland, Denmark. Data collection was conducted from February to October 2019 via an electronic questionnaire. For this part of the study only workers, who were able to complete the questionnaire in Danish were included. Two main approaches were used for data collection. In the slaughterhouses, the questionnaire was embedded into a working environment survey, which is conducted by the companies every second year. Here the working environment representative randomly selects workers to complete the questionnaire on a tablet during working hours. The aim is to recruit at least 20% of the workers from each work unit. For this particular study, we only focused on four major working units that is, packing, slaughter line, trimming and cutting, which in total includes about 2800 Danish speaking workers. In the nursing sector the care workers are distributed on different locations and have external units that service the community. Thus, the Health and Care office of the Municipality forwarded a list of 721 workers in all work units to the research team, and workers were invited to participate via their work email.

### Measurements

The questionnaire included sections on demographic characteristics, psychosocial and organisational aspect of work based on previously employed single items or scales adapted, as needed. We included single items on sex, age, years of seniority (<1, 1–5, 6–10 and >10), perceived mental health (very good, good, not that good, poor). As self-reported data on physical exposure often is imprecise,<sup>21</sup> we chose to include biomechanical demands of the respective work unit rather than individual reports—that is, packing, slaughter line, trimming, cutting, nursing home and home care under the assumptions that biomechanical demands are fairly similar in these work units. As MSK health climate is a new concept no previous instrument exists to measure it. Therefore, we developed a measure specifically for this study that contained subscales covering two dimensions of MSK health climate: perceived management priority and work group pain acceptance (see online supplemental appendix A for items). The perceived management priority was a modified subscale from the Nordic Safety Climate Questionnaire<sup>22</sup> capturing perceived management priority of workers MSK health compared with other organisational goals such as productivity. The scale included five items scored 1–4 from strongly disagree to strongly agree—with higher scores representing positive views on management priority. The work group pain acceptance scale was a

modified version the activity engagement subscale of the chronic pain acceptance scale.<sup>23</sup> Five items were created to capture worker's views on whether pain is considered as an accepted part of the job—scored 1–4 from strongly disagree to strongly agree—with higher scores representing more acceptance of pain as a part of the job at the work place. Structural validity and internal consistency of the two subscales were established by explorative factor analysis and calculation of Cronbach's Alpha.<sup>24</sup> (For details, see online supplemental appendix B).

For the two outcomes of interest the questionnaire included information on MSK pain experienced during the past 4 weeks (not at all, a little, quite a lot, a lot) for each of six anatomical regions (low back, neck, shoulder, elbow/wrist/ hand and hip/knee) and sickness absence in the past 12 months (0, 1–5, 6–30 and >30 days) because of MSK pain and other illness.<sup>17</sup> The longer duration for the outcome sickness absence was chosen due to a relative low prevalence of this outcome.<sup>19</sup>

### Participants and public involvement statement

Participants and or public were not involved in the planning or design of the study.

### Statistical analysis

For the six anatomical regions (low back, neck, shoulder, elbow/wrist/ hand and hip/knee), we calculated the total number of anatomical sites reported to be painful the last 4 weeks ( $\geq$  a little). Sickness absence was classified according to whether it exceeded 5 days for both MSK pain and other illness, separately. Descriptive statistics were calculated for all variables for the total sample and stratified according to job group—that is, slaughterhouse workers and health care workers. Missing values were inspected. As missing values besides sex were limited (<2%) and displayed a random pattern across variables, no attempts were made to correct missing values. Item scores of the two subscales of MSK health climate—that is, perceived management priority and work group pain acceptance were summarised and average scores calculated. Next, we examined associations between the two subscales and number of MSK pain sites by mixed linear and generalised estimating equation regression models for sickness absence. Models were adjusted for the covariates age, seniority, work unit, mental health, possible work place cluster effect and calculated with robust standard errors. In these analyses the categories <1 year and 1–5 years for seniority were collapsed due to low numbers in the first mentioned category. Analyses were repeated stratified according to the two job groups (slaughterhouse and care workers). In stratified analysis of sick absence regression models for care workers were only partly adjusted (work unit, mental health and workplace clusters) due to small number of cases, and the impact of age and seniority was explored in separate models. Associations were summarised as beta coefficients and prevalence ratios (PR) with 95% CIs. All statistical analyses were performed using STATA V.16 (StataCorp).

### RESULTS

A total of 1092 (38%) of the slaughterhouse workers and 410 (57%) of the care workers completed the online questionnaire. The characteristics of the sample are presented in table 1. Slaughterhouse and care workers contrasted with respect to sex, perceived mental health and sickness absence because of MSK pain and scores of the perceived management priority of MSK health and work group pain acceptance scales, whereas only small differences were observed with respect to number of MSK pain sites and other variables.

Table 2 presents the associations between the scales of perceived management priority and work group pain acceptance, number of pain sites and sickness absence.

Higher perceived management priority scores were associated with a lower number of pain sites. Consequently, for the perceived management priority score the predicted number of pain sites was in average reduced by –1.7 point (95% CI –2.7 to –0.7) from the lowest score (1.0) to the highest possible score (4.0).

In contrast higher pain acceptance scores were associated with an increase in the number of pain sites; 1.2 (95% CI 0.3 to 2.0) from the lowest score (1.0) to the highest possible score (4.0). For the management priority scores the strength of associations were quite consistent across the two job groups, whereas for the work group pain acceptance scores associations were strongest among care workers. Higher management priority scores were associated with lower prevalence of sickness absence related to MSK pain corresponding to a 21% per 1.0-unit increase (table 2) – these findings differ little across the two job groups. For work group pain acceptance scores the associations with sickness absence were modified by job groups, with higher prevalence being observed for care workers, and lower prevalence for slaughterhouse workers (table 2). Further exploration of the impact of omitted covariates (ie, age and seniority) in stratified analysis among care workers did not change these findings (results not shown).

### DISCUSSION

In this study, we found that our novel measure of MSK health climate was associated with number of MSK pain sites and sickness absence reported by workers. MSK health climate was measured by scales for perceived management priority of workers' MSK health and work group pain acceptance. Perceived management priority seems to provide the most consistent results across the two job groups, whereas work group pain acceptance associations were modified by job group.

We chose to study two job groups that traditionally have been viewed as having high occurrence of MSK pain. Slaughterhouse workers have an elevated risk from the upper limb<sup>25</sup> and care workers from the lower limb, especially from the low back.<sup>26</sup> In our study the two groups had the same level of MSK pain. Regarding physical exposures at work, several papers have pointed

**Table 1** Characteristics of workers

	Total N=1502 N (%)	Slaughterhouse workers n=1092 n (%)	Care workers n=410 n (%)
<b>Sex</b>			
Women	566 (37.7)	167 (15.3)	399 (97.3)
Men	838 (55.8)	827 (75.7)	11 (2.7)
Missing	98 (6.5)	98 (9.0)	0 (0.0)
<b>Age group, years</b>			
18–30	175 (11.7)	133 (12.2)	42 (10.2)
30–46	473 (31.5)	345 (31.6)	128 (31.2)
46–60	687 (45.7)	493 (45.1)	194 (47.3)
>60	164 (10.9)	118 (10.8)	46 (11.2)
Missing	3 (0.2)	3 (0.3)	0 (0.0)
<b>Seniority, years</b>			
<1	69 (4.6)	47 (4.3)	22 (5.4)
1–5	280 (18.6)	207 (19.0)	73 (17.8)
6–10	227 (15.1)	167 (15.3)	60 (14.6)
>10	923 (61.5)	668 (61.2)	255 (62.2)
Missing	3 (0.2)	3 (0.3)	0 (0.0)
<b>Work unit</b>			
Packing	271 (18.0)	271 (24.8)	N/A
Slaughter line	308 (20.5)	308 (28.2)	N/A
Trimming	285 (19.0)	285 (26.1)	N/A
Cutting	200 (13.3)	200 (18.3)	N/A
Nursing home	207 (13.8)	N/A	207 (50.5)
Home care	203 (13.5)	N/A	203 (49.5)
Missing	28 (1.9)	28 (2.6)	0 (0.0)
<b>Mental health</b>			
Very good	592 (39.4)	494 (45.2)	98 (23.9)
Intermediate	748 (49.8)	483 (44.2)	265 (64.6)
Poor	153 (10.2)	111 (10.2)	42 (10.2)
Missing	9 (0.6)	4 (0.4)	5 (1.2)
Perceived management priority, mean (SD)	2.7 (0.6)	2.5 (0.5)	3.0 (0.6)
Work group pain acceptance, mean (SD)	2.6 (0.6)	2.7 (0.6)	2.3 (0.5)
<b>Sickness absence MSK pain</b>			
≤5 days	1295 (86.2)	933 (85.4)	362 (88.3)
>5 days	193 (12.8)	155 (14.2)	38 (9.3)
Missing	14 (0.9)	4 (0.4)	10 (2.4)
<b>Sickness absence other illness</b>			
≤5 days	1302 (86.7)	958 (87.7)	344 (83.9)
>5 days	186 (12.4)	130 (11.9)	56 (13.7)
Missing	14 (0.9)	4 (0.4)	10 (2.4)
No of pain sites, mean (SD)	3.0 (2.0)	3.0 (2.0)	3.1 (1.9)

MSK, musculoskeletal; N/A, not available.

to high exposure and exposure-response relationships among slaughterhouse workers in studies with objective measurements of the bio-mechanical exposure.<sup>27 28</sup> With objective measurements there were no associations

between resident handling in eldercare and risk of low back pain over 1 year.<sup>29</sup> Physical exposures have probably been overstated as potential causes of MSK pain and the results from the CUPID study found that differences in



**Table 2** Results multivariable regression analyses of relationship between MSK health climate, number of MSK pain sites and sickness absence

	n	No of pain sites 0–6*		Sickness absence MSK >5 days†		Sickness absence other >5 days†	
		β	95% CI	PR	95% CI	PR	95% CI
<b>All workers‡</b>	1458						
Perceived management priority		−0.57	−0.91 to −0.23	0.79	0.57 to 1.08	0.92	0.74 to 1.16
Work group pain acceptance		0.38	0.11 to 0.66	0.96	0.80 to 1.17	1.09	0.84 to 1.42
<b>Slaughterhouse workers‡</b>	1058						
Perceived management priority		−0.56	−1.01 to −0.11	0.78	0.52 to 1.16	0.89	0.70 to 1.13
Work group pain acceptance		0.22	0.02 to 0.43	0.86	0.75 to .99	1.09	0.79 to 1.49
<b>Care workers‡</b>	400						
Perceived management priority		−0.52	−0.92 to −0.12	0.74§	0.40 to 1.36	1.02§	0.62 to 1.65
Work group pain acceptance		0.94	0.69 to 1.19	1.59§	0.87 to 2.92	1.08§	0.68 to 1.70

\*Analysed by mixed linear models.

†Analysed by generalised estimating equation models.

‡Adjusted for age, seniority, work unit, mental health and cluster effect of work place.

§Adjusted for work unit, mental health and cluster effect of work place only due to few number of cases.

MSK, musculoskeletal; PR, prevalence ratio.

general propensity to MSK pain is a major driver of large international variation in the prevalence of MSK pain among people of working age, and that we must look for the causes of general propensity to MSK pain. Coggon has suggested that ‘Much more plausible is the possibility that culturally determined differences in health-related beliefs and behaviours in some way modify awareness of, and responses to, pain; perhaps through changes in the central processing of sensory information’.<sup>30</sup>

The same apparently objective working conditions generate widely different responses from workers in the same organisation, or between workers in different organisations or fields. This cannot be easily explained by individual differences or mechanistic models. Furthermore, a mechanistic interpretation of MSK pain as injuries caused by physical exposure has not been very successful in either prevention or treatment of these ailments. Our findings suggest that perceived management priority and work group pain acceptance is associated with the number of MSK pain sites reported by workers and its related sickness absence and supports an organisational approach to MSK pain, where pain has to be understood in a broader context as a product of not only organisational structures and processes, but also culture, which is, however, often missing in current research. For instance, a recent study of eldercare workers found no association between multisite pain and organisational and ward-level structural factors,<sup>31</sup> which were measures from the managers on factual conditions such as staff cutbacks, structural changes, frequency of work health and safety assessments (organisational level) and type of ward, ergonomic coaches, number of residents (ward level). While these structural measures could probably affect the MSK health climate; they will not capture the shared norms and values of the organisation that guide behaviour. This

cannot be elucidated without involving the participating workers. In line with our findings associations between a negative individual perception of the workplace’s health and safety climate and the degree of work-related MSK pain across occupations has previously been demonstrated.<sup>32</sup> Furthermore results from a recent Danish qualitative study indicate that considerable variation exists in the perception of the current culture on the handling of MSK pain among department managers in the nursing sector.<sup>33</sup> A work-related exposure may be perceived as manageable or even acceptable in a particular professional group, because a work group may construct shared meanings to explain why it is worthwhile to take risks. For slaughterhouse workers, it could be the wage and the traditionally strong collective while care workers might construct their professional pride and accomplishment on the basis of reducing suffering in eldercare. This could very well explain why associations for work group pain acceptance were modified by job groups, as slaughterhouse workers often have no formal education and therefore may accept to work with pain, as options to change to other well paid jobs are limited.<sup>34</sup>

We offer a complementary broader explanation model based on an organisational approach where cultural factors also are considered, because MSK pain must be interpreted in the broader context of the ways we understand MSK pain in our work place and society. The magnitude of the observed associations is comparable to other known risk factors for MSK pain and sickness absence.<sup>19 35 36</sup> The average predicted number of pain sites was two points lower and prevalence of sickness absences 60% lower for workers with the highest possible score on perceived management priority, when compared with workers with lowest score.



The social construction of MSK pain and suffering at work can be understood as the result of management practices, labour union strategies, theories of psychologists or doctors, news magazine articles, public health policies and so on. Our MSK health climate measures capture some part of this broader cultural narrative about MSK pain in the work place, but certainly only a part.

The stronger association between work group pain acceptance and number of MSK pain sites observed among care workers in our study, and the inverse association found between the two job groups with respect to sickness absence due to MSK pain adds support to our understanding that cultural factors affect MSK pain. Each group develops a collective understanding of what counts as difficult and how such difficulties should be managed. These differences are social ones, not individual ones, and they are shared in the collective.

Strengths of the study are the large sample size and the representation of two distinct job groups, with slaughterhouse workers being predominately male and working in the private sector while elderly care workers are predominately females and employed in the public sector.<sup>25 37</sup> The study has some limitations. The recruitment and sample selection differed for the two job groups; for slaughterhouse worker's recruitment was administrated by local working environment representative, whereas all care workers were invited via e-mail by the research team. This resulted in different response rates, and we cannot exclude that some selection could have occurred in the recruitment of slaughterhouse workers. Based on a wide distribution from different slaughterhouses and different job tasks we do not believe that the associations found in this study are severely biased. For the outcome of sickness absence our findings should be interpreted with some caution due to the relative low prevalence of sickness absence. Small numbers did not allow for analysis across categories or full adjustment of stratified analyses among care workers. The cut-off level ( $\geq 5$  days) was guided by previous studies in the field,<sup>19 38</sup> but could have resulted in loss of information. Furthermore, the associations found in this study are based on cross-sectional comparisons with a limited number of variables available for adjustments, and these findings should be further explored in follow-up studies. Our measure of MSK health climate should be further scrutinised and supplemented by qualitative information from participants from the two work groups in our study.

## CONCLUSION

Overall, our study established a link between MSK health climate and MSK pain sites and sickness absence across two different job groups, suggesting that the cultural elements in our measure of MSK health climate are of importance in the broader understanding of MSK pain and should be further investigated and evaluated as possibly useful for prevention.

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**Contributors** DHC, KJN, DRA and JHA designed the study and data collection. DHC performed the statistical analysis, and DHC, KJN and JHA drafted the manuscript. All authors contributed to interpretation of data and critical revision of the manuscript, approved the final manuscript. DHC stand by the integrity of the entire work.

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**Patient consent for publication** Not applicable.

**Ethics approval** This study involves human participants but Under Danish law this study did not need ethics approval (Act on Research Ethics Review of Health Research Projects). Participation in the study was based on informed consent and registered at the notification system for research projects conducted under the responsibility of Central Denmark Region ID number 1-16-02-33-19.

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**Data availability statement** Data are available on reasonable request. The data underlying this article cannot be shared publicly for the privacy of individuals that participated in the study. The data will be shared on reasonable request to the corresponding author.

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