

A clinical study of musculoskeletal dysfunction in targets of workplace bullying

Kristin Buhaug (✉ kristin.buhaug@helse-bergen.no)

Haukeland Universitetssjukehus <https://orcid.org/0000-0003-2894-4751>

Nils Magerøy

Haukeland Universitetssjukehus

Ståle Einarsen

Universitetet i Bergen

Jörg Assmus

Haukeland Universitetssjukehus

Alice Kvåle

Høgskulen på Vestlandet Avdeling for helse- og sosialfag

Research article

Keywords: workplace, bullying, harassment, musculoskeletal, dysfunction

Posted Date: January 9th, 2020

DOI: <https://doi.org/10.21203/rs.2.20473/v1>

License:   This work is licensed under a Creative Commons Attribution 4.0 International License.

[Read Full License](#)

Version of Record: A version of this preprint was published at European Journal of Physiotherapy on January 10th, 2021. See the published version at <https://doi.org/10.1080/21679169.2020.1865451>.

1 **Title page**

2

3 **A clinical study of musculoskeletal dysfunction in targets of workplace**

4 **bullying**

5 Kristin Buhaug, Nils Magerøy, Ståle Einarsen, Jörg Assmus and Alice Kvåle

6

7 **Correspondence to:**

8 **Kristin Buhaug** kristin.buhaug@helse-bergen.no

9 Department of occupational medicine, Haukeland University Hospital, N-5021 Bergen,

10 Norway, mobile phone: +4790950359 / office phone: +4755973874 fax no: +4755975137

11

12

13 **Co-authors:**

14 **Nils Magerøy**, Bjørgvin District Psychiatric Center, Haukeland University Hospital, Bergen,

15 Norway

16 **Ståle Einarsen**, Department of psychosocial science, University of Bergen, Bergen, Norway

17 **Jörg Assmus**, Center for Clinical Research, Haukeland University Hospital, Bergen, Norway

18 **Alice Kvåle**, Faculty of Health and Social Sciences, Western Norway University of Applied

19 Sciences, Bergen, Norway

20

21

22 **Abstract**

23 **Background** – Previous studies have shown musculoskeletal problems among targets of
24 workplace bullying, yet only based on self-report data. There is a lack of clinical assessment
25 in this group of patients. This study was designed to examine whether patients exposed to
26 workplace bullying have clinically evident dysfunction in their musculoskeletal system,
27 comparing them with existing data on healthy adults and patients with diagnosed
28 musculoskeletal disorders (MSD). Secondly, we wanted to investigate whether patients' self-
29 report of health problems, both musculoskeletal symptoms and mental health symptoms, were
30 related to the clinical findings.

31 **Results** – Altogether 144 patients were included in the study, whereof 65 (45%) had an
32 ongoing MSD. Mean scores on the physiotherapy examination (GPE-52) showed dysfunction
33 in nine of 13 subdomains. The total GPE-52 sum-score was comparable to patients sick-listed
34 with long-lasting MSD, and significantly higher (worse) than in healthy persons. The physical
35 examination indicated that the bullied patients had reduced flexibility and ability to relax, as
36 well as restricted respiration and tense and painful muscles. The total GPE-52 sum-score as
37 well as the main domains Movement and Muscle had significant correlations with all self-
38 reported health variables. The strongest correlations were found between Movement and
39 Muscle, and mental health symptoms ($r \geq 0.32$).

40 **Conclusions** – Patients exposed to workplace bullying had a high degree of clinically evident
41 dysfunction in the musculoskeletal system, comparable to patients with MSD. These findings
42 confirm previous questionnaire studies on physical health in workers exposed to workplace
43 bullying. The extent of the musculoskeletal problems revealed in our study clearly indicates
44 that future health services to these patients should be multi-dimensional and include bodily
45 assessment.

46 **Key words:** workplace, bullying, harassment, musculoskeletal, dysfunction

47 **A clinical study of musculoskeletal dysfunction in targets of workplace**

48 **bullying**

49 **Buhaug K., Magerøy N., Einarsen S., Assmus J., Kvåle A.**

50

51 **Background**

52 Workplace bullying has been documented as a serious threat to health and well-being among
53 those exposed, being related to a range of mental health problems, psychosomatic complaints
54 as well as musculoskeletal complaints [1]. Prevailing data show a wide range of highly
55 detrimental outcomes in affected workers such as deterioration in health, substance abuse,
56 sick leave, loss of employment, in addition to a range of negative outcomes for companies,
57 the victims' families and the society at large [2-4]. Hence, the existing literature on individual
58 health outcomes of bullying and harassment is quite extensive [1, 5], describing vast mental
59 health outcomes, including anxiety, depression and even posttraumatic stress symptoms
60 (PTSS) [6]. Although physical and psychosomatic outcomes have been studied to a lesser
61 degree, a number of studies describe self-reported musculoskeletal complaints. These studies
62 mostly, however, focus on complaints that are rather unspecific and quite prevalent in the
63 population, such as backaches, muscular pain and headache [7, 8]. A notable exception is
64 Kivimäki et al., who studied the association between stress at work, including bullying, and
65 newly diagnosed fibromyalgia in hospital employees [9]. Being a target of bullying at work
66 was associated with a fourfold risk of physician-diagnosed fibromyalgia, as reported in a
67 questionnaire by the study participants.

68

69 Yet, published data on potential musculoskeletal health problems in targets of workplace
70 bullying are mainly based on surveys with self-reports of symptomology employing
71 predefined inventories or check lists. Clinical assessments and observational data are

72 therefore highly needed to obtain objective health data for workers suffering from workplace
73 bullying [4]. Health outcome relationships are well documented based on the targets' own
74 perceptions, but clinical validation of these perceptions and clinical description of potential
75 health impairment are still lacking. In the present study, we have therefore clinically evaluated
76 the prevalence and nature of musculoskeletal dysfunction among targets of bullying seeking
77 healthcare. To the best of our knowledge, no such study exists on the musculoskeletal system
78 of workers exposed to workplace bullying. The study is therefore important as a validation of
79 earlier findings employing self-report data. In addition, the knowledge we provide on health
80 status and symptomatology in these victims is important for practitioners, be it physicians or
81 physiotherapists in general practice or in hospital settings.

82

83 **Exposure to workplace bullying and bodily manifestations**

84 Workplace bullying is one of many stressors often included in studies on psychosocial risk
85 factors and health [10]. Also referred to as harassment, emotional abuse, mistreatment and
86 "mobbing" [11], bullying denotes a situation with repeated and on-going exposure to negative
87 behaviours from ones colleague(s) or superiors [12]. This predicament typically lasts and
88 escalates over a period of months to years, distinguished from a mere conflict situation by the
89 target's inability to defend him- or herself in the actual situation, often due to a formal or
90 informal perceived imbalance of power between the parties [12].

91

92 The inherent lack of predictability and control poses a threat to the victims' basic assumptions
93 of the world as a benevolent place and the self as worthy [13], as well as to basic needs of
94 belonging and meaning. Such an ongoing situation, generally evaluated as extremely harmful
95 or threatening by the targets, is found to be a source of chronic or even traumatic stress [6].

96 This has been shown in animal studies as well as in studies on human experiences. Exposing

97 rats to continuing non-violent social defeat - as an animal model for bullying - showed
98 inhibited weight gains and epigenetic changes that indicated inflammatory changes associated
99 with pain [14]. Subsequent tests employing human data, revealed relevant genetic moderators
100 of the relationship between exposure to bullying and perceived pain [15].

101

102 Bodily reactions to acute and chronic social stress have also been investigated by focusing on
103 well-known physiological effects of altered secretion of cortisol; an end-product of the
104 hypothalamic-pituitary-adrenocortical (HPA) axis [16]. Two articles, in 2011 and 2012 by a
105 Danish research group, concluded that bullying might well have such measureable
106 physiological consequences [17, 18].

107

108 Part of the bullying experience for many targets involves the threat of social exclusion
109 accompanied with severe social pain [19]. Social pain includes experiences in which a
110 relationship is threatened or lost because the self is devalued [20], as often is the case in
111 targets of workplace bullying. The social pain/physical pain overlap theory (SPOT), suggests
112 that social and physical pain might rely on overlapping neural processes in the form of a
113 common neural alarm system [21]. This might explain why targets of bullying so frequently
114 describe musculoskeletal complaints, where bodily pain is the main symptom.

115

116 Several physiotherapy approaches are based on the relationship between emotional life and
117 body characteristics in patients [22]. Norwegian psychomotor physiotherapy (NPPT)
118 emphasize the body as a source of information where both mental and physical strain can
119 manifest as muscular tension and influence respiration, posture and movement [23]. Within
120 this tradition several validated examination methods have been developed in order to

121 document where and to what extent the body reacts to long-lasting strain. This approach, not
122 previously applied on targets of bullying, was utilized in the present study.

123

124 **Aims of the study**

125 The main aim of the present study was to examine whether patients exposed to workplace
126 bullying have clinically evident dysfunction in their musculoskeletal system, comparing these
127 patients with existing data on healthy adults and patients with diagnosed musculoskeletal
128 disorders (MSD). Secondly, we wanted to investigate whether patients' self-report of health
129 problems, both musculoskeletal symptoms and mental health symptoms, were related to the
130 clinical findings.

131

132

133 **Methods**

134 This is a clinical cross-sectional study among patients seeking treatment at an outpatient clinic
135 for targets of workplace bullying.

136

137 **Participants**

138 All patients (n=161) assessed at a clinic for targets of workplace bullying, Jobbfast, in the
139 period from August 2011 throughout February 2017, were invited to participate in the study.
140 Jobbfast was part of the Outpatient clinic at the Department of Occupational Medicine,
141 Haukeland University Hospital in Bergen, where patients from all over Norway were referred
142 because of health problems due to experiences of bullying or harassment in their workplace.
143 Over a period of three consecutive days, the patients went through a clinical program by a
144 team of doctors, a psychologist, a physiotherapist and an occupational consultant [24].

145

146 **Self-administered questionnaires**

147 Prior to the physical examination, all patients answered a battery of pen and pencil
148 questionnaires. We used the revised version of the Negative Acts Questionnaire 22 (NAQ-22)
149 [25] to assess the patients' exposure to workplace bullying. This is a validated questionnaire
150 often used in studies on workplace bullying. NAQ-22 is also an example of the behavioural
151 experience method for measurement of workplace bullying. The questionnaire consists of 22
152 items where the patients are asked to rate how often they have experienced different specific
153 negative acts at work over the past 6 months. A number of patients were sick-listed at the time
154 of assessment, and had not experienced negative acts the previous 6 months. They were asked
155 to rate their exposure to negative acts when their exposure to bullying was at its worst. The
156 response alternatives are "never", "now and then", "monthly", "weekly" and "daily". A sum
157 score is calculated, with a range from 22 to 110 points. The cut-off is set at 33 points for low
158 intensity and 45 for high intensity bullying [26]. In this study, "being a victim of bullying"
159 was defined as having a score of 33 or more.

160
161 The participants were also asked to rate their health with an instrument for assessment of
162 subjective health complaints, previously used in a study performed at the National institute of
163 occupational health in Norway [27]. We used the instrument to assess the intensity and
164 duration of musculoskeletal and psychological symptoms the preceding 14 days prior to
165 assessment. The intensity is rated on a four-point scale (0 = not troubled, 1 = a little troubled,
166 2 = quite troubled, 3 = seriously troubled), the duration has three dimensions (1= 1-5 days, 2
167 = 6-10 days, 3 = 11-14 days). We computed two of the complaint-severity indices (index
168 range 0–9): musculoskeletal (MSI) and psychological (PI). MSI constitutes the following 12
169 items: Headache, neck pain, pain in left shoulder or upper arm, pain in right shoulder or upper
170 arm, pain in left forearm, pain in right forearm, pain in left wrist or hand, pain in right wrist or

171 hand, pain in upper back, pain in lower back, chest pain and pain in lower extremities.
172 Included in the PI are five items: Sleep disturbances, fatigue, vertigo, depressed mood or
173 depression, and anxiety or restlessness.
174
175 In a pain drawing, the patients indicated pain the previous 14 days prior to the physiotherapy
176 examination. (The drawing is an outline of the human body with a frontal and a posterior
177 view.)[22]. According to pain localization, we categorized the patients into three groups:
178 group 1: head/neck and shoulders, group 2: lower back/legs, and group 3: widespread pain,
179 i.e. pain located both in the upper and lower body. Patients who reported any bodily pain were
180 asked to state the average pain intensity during the last 14 days on a visual analogue scale
181 (VAS) going from 0 (no pain) to 10 (worst possible).
182
183 The Hospital anxiety and depression scale (HADS) was used to rate symptoms of anxiety and
184 depression. This is a validated, frequently used instrument in clinical studies [28]. It consists
185 of seven items for anxiety (HADS-A) and seven for depression (HADS-D). Each item is
186 scored on a four-point scale from 0 (not present) to 3 (considerable), giving subscale scores
187 on HADS-A and HADS-D from 0 to 21. A sum-score of 8 points is suggested cut-off for
188 possible disorder on both scales.
189
190 Posttraumatic stress symptoms (PTSS) were assessed with the 22-item revised version of the
191 Impact of events scale (IES-R) [29], with a five-point response scale ranging from 0 (not at
192 all) to 4 (very high degree) with respect to how distressing each item has been during the past
193 week, and the total score range is 0 to 88 [30]. The patients reported symptoms during the last
194 7 days in relation to difficult experiences at work. A suggested cut-off for patients with
195 posttraumatic stress disorder (PTSD) is set at 33 in a review [31].

196

197 **Clinical examination**

198 One of two experienced physiotherapists examined the patients in order to assess the degree
199 of physical aberrations. Prior to the examination, a physician had assessed the patients, and
200 medical history including ongoing MSD were noted. Except for general information on which
201 patients were referred to the clinic, and the sex of the patient, the physiotherapist had no
202 information on patient history, diagnoses or self-reported mental health scores. The
203 physiotherapist was briefly informed if there was a history of known sexual abuse, since the
204 examination requires bodily touch and palpation. The examination was performed according
205 to the Global Physiotherapy Examination-52 (GPE-52) [32, 33]. GPE-52 was developed to
206 document where and to what extent the patient has bodily problems and resources, and is
207 intended for patients with MSD and/or psychiatric or psychosomatic disorders. The method is
208 based upon the notion that the whole body may react to long-lasting physical and/or
209 psychological problems with resulting changes in muscle tension, movements, respiration and
210 posture [32].

211

212 The examination consists of 52 standardized items that yield information in 13 subdomains
213 and five domains within Posture, Respiration, Movement, Muscle and Skin [33]. Postural and
214 respirational items are observed both in standing and supine positions. The Movement domain
215 includes passive tests of range of motion (ROM), flexibility and relaxation in standing and
216 supine, as well as active movements performed by the patient. Included in the examination of
217 the Muscle and Skin domains are stretch and pressure palpation. GPE-52 has been found to be
218 a reliable and valid examination method [33]. Every item is scored according to an
219 empirically defined standard or ideal, given the score 0, and deviations from the standard can
220 go in two directions; decreased or increased with a range from -2.3 to + 2.3. The scores of

221 each item are summed to 13 subdomain sum-scores (each subdomain consisting of the
222 absolute sum-score from four of the 52 items) and to five main domain sum-scores, in
223 addition to the GPE-52 sum-score. The maximum possible score is 119.6. The examination
224 takes 30-45 minutes.

225

226 The results of the physiotherapy examination were compared to results in a previous study
227 where 104 healthy individuals and 247 patients diagnosed with long-lasting MSD had been
228 assessed with the GPE-52 [32]. Based on data from the healthy subjects the following
229 categories have been defined in the 13 subdomains: score < 3.0: normal or adequate function,
230 score \geq 3.0 - 6.0: moderate dysfunction and score > 6.0: major dysfunction.

231

232 **Statistics**

233 Descriptive methods were used to characterize the sample. GPE-52 and its subdomains were
234 compared between the three groups using ANOVA. The associations between GPE-52 and its
235 main- and subdomains on one side and MSI, PI, HADS and IES-R on the other were assessed
236 by Spearman correlations. Due to the low number of men included in the study the analyses
237 were performed with all patients as one sample. The general significance level was set to
238 0.05. Accounting for multiple comparisons we used the Bonferroni adjustment for 19 tests
239 (GPE-52 and all main- and subdomains) leading to a marginal level of 0.0026. The
240 computation was done in SPSS 24 (IBM Inc., Armonk, NY) and Matlab 9.5 (Mathworks,
241 Natick, MA), the graphics was derived using Matlab 9.5.

242

243

244 **Results**

245 Altogether 155 patients (96%) agreed to participate, of whom 147 met the criteria for being a
 246 victim of workplace bullying. 144 of these went through the physiotherapy examination and
 247 were included in the study. Table 1 shows descriptive characteristics and outcomes in the
 248 study participants.

249

250

251 **Table 1** Sample characteristics, n=144

252

Characteristics	Valid N	Value
Age (years) ¹	144	52 [27-64]
Female patients ²	144	117 (81%)
Ongoing musculoskeletal disorder ²	144	65 (45.1%)
Pain, VAS ³	142	4.6 (2.3)
Pain drawing (number of marked squares) ¹	142	14 [0 - 84]
No pain		5 (3.5%)
Pain - head/neck/shoulder		18 (12.7%)
Pain - lower back/legs		9 (6.3%)
Pain - widespread		110 (77.5%)
Musculoskeletal symptoms (MSI) ³	137	1.46 (1.4)
Psychological symptoms (PI) ³	133	3.21 (2.2)
HADS ⁴ Anxiety score ³	144	10.3 (4.4)
HADS ⁴ Depression score ³	142	8.4 (4.6)
History of sexual abuse	144	18 (12.5%)
Negative Acts Questionnaire (NAQ)	144	52 [33 - 101]
No bullying (<33)		0
Low intensity bullying (33-44)		43 (29.9%)

High intensity bullying (≥ 45) 101 (70.1%)

IES-R⁵ Total score (PTSS) 144 42.9 (15.4)

253 ¹Median [minimum-maximum]. ²N (%). ³Mean (SD). ⁴HADS: Hospital anxiety and depression scale. ⁵IES-R:

254 Impact of events scale, revised version. PTSS: Posttraumatic stress symptoms.

255

256 Eighty-one percent of the study participants were women, and median age of sample was 52

257 years. At the time of assessment, 65 patients (45%) reported ongoing MSD. As many as

258 77.5% of the patients reported widespread bodily pain on the pain drawing. Only five of the

259 patients reported no pain. The prevalence of sexual abuse history was comparable to what is

260 seen in the general population [34].

261

262 It is noteworthy that 70% had a NAQ score ≥ 45 indicating high intensity bullying. The

263 remaining 43 patients scored above the lower threshold for bullying exposure (≥ 33). In the

264 questionnaire on subjective health complaints, 42 patients (29%) indicated to be quite

265 troubled or seriously troubled with muscle pain (score ≥ 2 on the MSI subscale). Eighty-seven

266 patients (60%) reported psychological symptoms of comparable magnitude on the PI

267 subscale. Only one patient had no mental health complaints (score of zero) on the PI subscale.

268 The mean scores on HADS anxiety and depression were in the range of possible disorder

269 [28]. The Impact of events scale revised version showed a mean score suggestive of PTSD

270 [31]; 68 % of the patients had a score ≥ 33.0 .

271

272 The results of the physiotherapy examination were compared to results in a previous study

273 where 104 healthy individuals and 247 patients diagnosed with long-lasting MSD had been

274 assessed with the GPE-52, [32] see Figure 1.

275 **Insert Figure 1 about here**

276

277 Among the patients in our study, mean scores were ≥ 3.0 for nine of 13 subdomains. In most
278 of these, the score was above or equal to the score for the MSD patients, and generally higher
279 than the scores reported for healthy persons, illustrated in figure 1 [32]. The results were most
280 prominent in the two main domains Movement and Muscle. The subdomains Flexibility and
281 Reaction to stretch palpation had the highest scores: (4.6 for both) well above the scores for
282 the healthy persons (3.0 for both).

283 Mean GPE-52 total scores for healthy persons was 33.9 (SD: 6.4), whereas the MSD patients'
284 mean was 46.9 (SD: 8.0), equivalent to the bullied patients' mean [32].

285

286 **Insert Figure 2 about here**

287 Figure 2 illustrates the correlations between bullied patients' self-reported symptoms and the
288 clinical findings in the physiotherapy examination. The total GPE-52 sum-score, as well as
289 the main domains Movement and Muscle, had significant correlations with the scores on all
290 five questionnaires, MSI, PI, HADS-anxiety, HADS-depression and IES. The strongest
291 correlations were between Movement and HADS-A ($r=0.36$), and between Movement and
292 Muscle and PI ($r=0.32$).

293 The correlations between four of the GPE-52 subdomains (Flexibility, Passive ROM, Stretch
294 palpation of muscle and Reaction to stretch palpation) and the variables from the self-report
295 questionnaires (MSI, PI, HADS-A, HADS-D and IES-R), were generally strong. The
296 correlations for Flexibility being even stronger than the correlations between the total GPE-52
297 sum score and all five self-report variables (MSI, PI, HADS-A, HADS-D and IES-R).

298 Posture, Respiration and Skin had overall lower or no significant correlations to the
299 questionnaires, except for a significant correlation between Respiration supine and depression
300 (HADS-D) and reported stress symptoms (IES-R).

301

302

303 **Discussion**

304 The present study shows that patients exposed to workplace bullying have clinically evident
305 dysfunction in their musculoskeletal system comparable to patients with long-lasting MSD.

306 The clinical findings in the physiotherapy examination confirm the patients' self-report,
307 where 77.5% of the bullied patients reported widespread pain (see Table 1). This is a very
308 high proportion; even higher than in the study on MSD patients where 55% reported
309 widespread pain [32]. Only five of the bullied patients reported no pain.

310 The GPE-52 total sum-score for bullied patients was comparable to what is previously found
311 in patients sick-listed due to long-lasting MSD [32] and also in patients with dizziness [35].

312 The main domain Movement, especially tests representing reduced flexibility, mobility and
313 ability to relax, and tests in Muscle, representing tense and painful muscles, showed the
314 highest aberration. In addition, Respiration in the standing position was more affected (i.e.
315 tense and restricted) in our patient group than in patients with MSD.

316 We found a significant correlation between the physical aberrations, particularly dysfunction
317 in Flexibility and mental health; especially psychological symptoms (PI, HADS and IES-R).
318 Tense and painful muscles and a restricted respiration in supine were also associated with
319 reported distress.

320

321 The results of the physiotherapy examination imply that bullied patients have a bodily
322 function characterized by restrained breathing, reduced flexibility and ability to relax, and a
323 painful muscular system. These are unequivocal findings that confirm previous results in
324 several surveys where bullied workers reported musculoskeletal symptoms [36-38]. The
325 findings could very well be the result when the individual has been in a state of physiological
326 stress for a long time. A model of the interplay between psychological defenses and bodily

327 conditions, describes how repression and denial of emotional experiences manifest in patterns
328 of less flexibility/mobility and a restrained respiration as well as increased muscle tension [39,
329 40]. This relationship has not, according to the authors' knowledge of the literature, been
330 systematically investigated in bullied patients before.

331 The GPE-52 sum-score was significantly correlated with all self-reported health variables;
332 MSI, PI, HADS-anxiety, HADS-depression and IES-R. The patients had a high degree of
333 posttraumatic stress symptoms; mean score on the IES-R was 42.9, well above the suggested
334 cut-off at 33 points for PTSD [31]. This confirms previous studies on bullied workers where
335 posttraumatic stress symptoms are frequently reported; at an average, 68 % of victims
336 reported symptoms of PTSD above thresholds for caseness [6].

337 In a former study of patients with MSD, patients with widespread long-lasting pain had strong
338 correlations between the precursor of GPE-52 and several MMPI-2 subscales (MMPI-2:
339 Revised Minnesota Multiphasic Personality Inventory), indicating a psychosomatic V-profile
340 with affective disturbances and somatic problems [22]. Patients with anxiety and depression
341 often suffer from physical health conditions, including musculoskeletal health problems. As
342 the patients in our study had outcomes on HADS indicating anxiety and depression, this has
343 to be taken into consideration when trying to explain the relationship between workplace
344 bullying and musculoskeletal aberrations. One explanation could be that workplace bullying
345 first impacts psychological health, which again results in physical health aberrations. Yet, the
346 present results indicate that the self-reported musculoskeletal symptoms reported by victims
347 of bullying in fact reflects bodily dysfunction and are not simply correlates of other mental
348 health problems.

349

350 In a cohort study from Finland [9] the authors state that "*the study provides prospective*
351 *evidence that stress at work is predictive of newly diagnosed fibromyalgia. The strongest*

352 *association was found between workplace bullying and incidence of fibromyalgia.*” This
353 indicates that bullying has long-lasting effects on the musculoskeletal system, even when
354 patients with depression at baseline were excluded, as was the case in the latter study.

355
356 Thus, an alternative explanation to mental symptoms being related to bodily dysfunction
357 could be that workplace bullying per se results in physical health aberrations; regardless of
358 any coexistent mental health condition. Studies have shown that ostracism - which can be a
359 central element of bullying - may activate neural regions in the brain that also are activated by
360 physical pain [20, 21]. When healthy participants were subjected to an experimental situation
361 involving ostracism, magnetic resonance imaging showed activation of pain receptor areas in
362 the brain [41]. Whether this also imposes long-term pain, remains to be shown, but if so, this
363 may be an explanation for the clinical findings in our study.

364

365 **Strengths and limitations**

366 As this study has a cross-sectional design, it is not possible to conclude on a possible causal
367 relationship between workplace bullying and musculoskeletal dysfunction. It is therefore
368 advisable that future research should include studies with a longitudinal design. Although the
369 study population is a highly selected group of patients referred to our department by their
370 family physician, the high response rate strengthens the study. Another strength of the study
371 was the use of standardized instruments in the assessment of the patients. The two
372 physiotherapists were specially trained for using the method GPE-52, minimizing any
373 interpersonal variation in methods and measurement. The physiotherapists examined the
374 patients without any information regarding patient history, work situation or self-reported
375 health as measured in the questionnaires. This again strengthens the results in our study.

376

377 The majority of patients in this study had been exposed to high intensity bullying; 101 of 144
378 had a NAQ score above the threshold value of 45, with the rest scoring above the threshold of
379 33 indicative of low intensity bullying (Table 1). A study published in 2012 indicated that
380 only 2.1 % of the Norwegian workforce had a score ≥ 45 [26], clearly indicating that our
381 study population consists of individuals with a high exposure to workplace bullying. This
382 might explain the extent of the bodily problems in the patient group. To clarify the extent of
383 physical dysfunction in patients exposed to less intense bullying, further studies are needed.

384

385 Even though the physical aberrations in the patient group as a whole are quite convincing,
386 there were individuals with a normal result on the GPE-52, as illustrated with the standard
387 deviation in figure 1. Furthermore, findings in our study could also support the use of only
388 parts of GPE-52, as examination of Posture and Skin not seemed too informative, but
389 examination of Respiration, Movement and Muscle was.

390

391 Noteworthy, this is not a study of bullying from a legal perspective, hence, we are looking at
392 patients that together with their family or occupational physician had sought treatment for
393 health problems that they perceived to be caused by bullying and harassment. Yet, the
394 inclusion criteria was based on the patients' information on their exposure to specific negative
395 acts, typical for victims of bullying employing national cut off scores.

396

397 **Implications**

398 The results in our study indicate that future health services to bullied patients should be based
399 on a multi-dimensional approach. A thorough clinical examination of both psychological and
400 physical health, including physiotherapy examination is advisable. Patients with documented
401 physical aberrations may benefit from a follow-up that includes an exercise and body

402 awareness program promoting improved flexibility, ability to relax, improved breathing and
403 less muscle tension. Improvement in these areas could represent a form of coping that also
404 could influence their general health condition, including their mental health. Treatment
405 programs having a multidisciplinary approach needs to be further developed and evaluated.

406

407

408 **Conclusions**

409 The present study, the first to address objective findings of musculoskeletal problems among
410 workers exposed to bullying by use of a validated and reliable clinical assessment method,
411 underscores the severe health problems suffered by victims of workplace bullying. The
412 physiotherapy examination GPM-52 showed a high degree of musculoskeletal dysfunction in
413 these patients, in support of previous questionnaire studies on physical health in workers
414 exposed to workplace bullying. The extent of the musculoskeletal problems revealed in our
415 study clearly indicates that future health services to these patients should be multi-
416 dimensional and multi-disciplinary and should include bodily assessments. Further studies are
417 needed to conclude whether workplace bullying is in fact causing these problems and to what
418 extent mental health problems are mediating factors.

419

420 **List of abbreviations**

421 PTSS: posttraumatic stress symptoms; HPA: hypothalamic-pituitary-adrenocortical; SPOT: The social pain
422 physical pain overlap theory; NPPT: Norwegian psychomotor physiotherapy; MSD: musculoskeletal disorders;
423 NAQ-22: The revised version of the Negative Acts Questionnaire 22; MSI: musculoskeletal; PI: psychological;
424 VAS: Visual analogue scale; HADS: The Hospital anxiety and depression scale; HADS-A: Anxiety score on the
425 HADS; HADS-D: Depression score on the HADS; IES-R: the 22-item revised version of the Impact of events
426 scale; PTSD: Posttraumatic stress disorder; GPE-52: Global Physiotherapy Examination -52; ROM: range of
427 motion; MMPI-2: revised Minnesota Multiphasic Personality Inventory.

428

429 **Declarations**

430 **Ethics approval and consent to participate**

431 All subjects were thoroughly informed by personal instruction, and written consent was obtained at inclusion. It
432 was emphasized that participation was voluntary, and a refusal to participate or withdraw from the study later on
433 would have no consequences for treatment. The study was approved by The Regional Committee for Medical
434 and Health Research Ethics Western Norway (REK Vest, REK no 2014/53), and by the Norwegian Social
435 Science Data Services (NSD).

436

437 **Consent for publication**

438 Not applicable.

439

440 **Availability of data and materials**

441 Readers who want access to data should contact the first author. Data will be made available in line with data
442 protection procedures of the said hospital.

443

444 **Competing interests**

445 The authors declare that they have no competing interests.

446

447 **Funding**

448 This work was completed at the Department of Occupational Medicine, Haukeland University Hospital without
449 any external funding.

450

451 **Authors' contributions**

452 KB, NM, SE and AK have planned and carried out the study, and participated in the interpretation of the data
453 analysis, and reviewed and revised the manuscript. JA planned and performed statistical analyses. All authors
454 read and approved the final manuscript.

455

456 **Acknowledgements**

457 We would like to thank colleague and physiotherapist Astrid Aalvik for contributing in the examination of
458 patients, and Mr Øystein Hoprekstad for entering the data used in this study.

459

460

461 **References**

- 462 1. Nielsen MB, Einarsen S: **Outcomes of exposure to workplace bullying: A meta-**
463 **analytic review.** *Work & Stress* 2012, **26**(4):309-332.
- 464 2. Bowling NA, Beehr TA: **Workplace harassment from the victim's perspective: a**
465 **theoretical model and meta-analysis.** *The Journal of applied psychology* 2006,
466 **91**(5):998-1012.
- 467 3. Kivimaki M, Virtanen M, Vartia M, Elovainio M, Vahtera J, Keltikangas-Jarvinen L:
468 **Workplace bullying and the risk of cardiovascular disease and depression.**
469 *Occupational and environmental medicine* 2003, **60**(10):779-783.
- 470 4. Nielsen MB, Mageroy N, Gjerstad J, Einarsen S: **Workplace bullying and**
471 **subsequent health problems.** *Tidsskrift for den Norske laegeforening : tidsskrift for*
472 *praktisk medicin, ny raekke* 2014, **134**(12/13):1233-1238.
- 473 5. Hogh A ME, Hansen ÅM: **Individual consequences of workplace**
474 **bullying/mobbing.** . In: *Bullying and harassment in the workplace Development in*
475 *theory, research, and practice.* Einarsen S, Hoel H, Zapf D, Cooper CL. edn. Edited
476 by Press C. Boca Raton, FL: Taylor & Francis Group; 2011: 107-128.
- 477 6. Nielsen MB, Tangen T, Idsoe T, Matthiesen SB, Magerøy N: **Post-traumatic stress**
478 **disorder as a consequence of bullying at work and at school. A literature review**
479 **and meta-analysis.** *Aggress Violent Beh* 2015, **21**(0):17-24.
- 480 7. Takaki J, Taniguchi T, Hirokawa K: **Associations of workplace bullying and**
481 **harassment with pain.** *International journal of environmental research and public*
482 *health* 2013, **10**(10):4560-4570.
- 483 8. Nixon AE, Mazzola JJ, Bauer J, Krueger JR, Spector PE: **Can work make you sick?**
484 **A meta-analysis of the relationships between job stressors and physical**
485 **symptoms.** *Work & Stress* 2011, **25**(1):1-22.
- 486 9. Kivimaki M, Leino-Arjas P, Virtanen M, Elovainio M, Keltikangas-Jarvinen L,
487 Puttonen S, Vartia M, Brunner E, Vahtera J: **Work stress and incidence of newly**
488 **diagnosed fibromyalgia: prospective cohort study.** *Journal of psychosomatic*
489 *research* 2004, **57**(5):417-422.
- 490 10. Schutte S, Chastang JF, Malard L, Parent-Thirion A, Vermeylen G, Niedhammer I:
491 **Psychosocial working conditions and psychological well-being among employees**
492 **in 34 European countries.** *International archives of occupational and environmental*
493 *health* 2014, **87**(8):897-907.
- 494 11. Aquino K, Thau S: **Workplace victimization: aggression from the target's**
495 **perspective.** *Annual review of psychology* 2009, **60**:717-741.
- 496 12. Einarsen S, Hoel H, Zapf D, Cooper CL: **The concept of bullying and harassment at**
497 **work: The European tradition.** In: *Bullying and harassment in the workplace*
498 *Developments in theory, research, and practice.* Einarsen, S. Hoel,H. Zapf, D. Cooper,
499 CL. edn. Boca Raton, FL.: Taylor & Francis group. ; 2011: 3 - 39.

- 500 13. Janoff-Bulman R: **Shattered assumptions. Towards a new psychology of trauma.**
501 New York: The Free Press; 1992.
- 502 14. Jacobsen DP, Eriksen MB, Rajalingam D, Nymoer I, Nielsen MB, Einarsen S,
503 Gjerstad JJS: **Exposure to workplace bullying, microRNAs and pain; evidence of a**
504 **moderating effect of miR-30c rs928508 and miR-223 rs3848900.** *Stress* 2019;1-10.
- 505 15. Jacobsen DP, Nielsen MB, Einarsen S, Gjerstad J: **Negative social acts and pain:**
506 **evidence of a workplace bullying and 5-HTT genotype interaction.** *Scandinavian*
507 *journal of work, environment and health* 2018, **44** (3):283 - 290.
- 508 16. McEwen BS: **Physiology and neurobiology of stress and adaptation: central role**
509 **of the brain.** *Physiological reviews* 2007, **87**(3):873-904.
- 510 17. Hansen AM, Hogh A, Persson R: **Frequency of bullying at work, physiological**
511 **response, and mental health.** *Journal of psychosomatic research* 2011, **70**(1):19-27.
- 512 18. Hogh A, Hansen AM, Mikkelsen EG, Persson R: **Exposure to negative acts at work,**
513 **psychological stress reactions and physiological stress response.** *Journal of*
514 *psychosomatic research* 2012, **73**(1):47-52.
- 515 19. Einarsen S, Hoel H, Zapf D, Cooper CL: **Bullying and harassment in the workplace**
516 **Developments in theory, research, and practice.**, 2nd edn. Boca Raton: CRC Press
517 2011.
- 518 20. Eisenberger NI: **The pain of social disconnection: examining the shared neural**
519 **underpinnings of physical and social pain.** *Nat Rev Neurosci* 2012, **13**(6):421-434.
- 520 21. Eisenberger NI, Lieberman MD: **Why it hurts to be left out: The neurocognitive**
521 **overlap between physical and social pain.** In: *The social outcast: Ostracism, social*
522 *exclusion, rejection, and bullying.* edn.; 2005: 109-130.
- 523 22. Kvåle A, Ellertsen B, Skouen JS: **Relationships between physical findings (GPE-**
524 **78) and psychological profiles (MMPI-2) in patients with long-lasting**
525 **musculoskeletal pain.** *Nordic journal of psychiatry* 2001, **55**(3):177-184.
- 526 23. Dragesund T, Råheim M: **Norwegian psychomotor physiotherapy and patients**
527 **with chronic pain: patients' perspective on body awareness.** *Physiotherapy theory*
528 *and practice* 2007, **24**(4):243-254.
- 529 24. Buhaug K, Aasen TB, Einarsen S, Mageroy N: **Health care related to workplace**
530 **bullying.** *Tidsskrift for den Norske laegeforening : tidsskrift for praktisk medicin, ny*
531 *raekke* 2013, **133**(20):2129-2130.
- 532 25. Einarsen S, Hoel H, Notelaers G: **Measuring exposure to bullying and harassment**
533 **at work: Validity, factor structure and psychometric properties of the Negative**
534 **Acts Questionnaire-Revised.** *Work Stress* 2009, **23**(1):24-44.
- 535 26. Notelaers G, Einarsen S: **The world turns at 33 and 45: Defining simple cutoff**
536 **scores for the Negative Acts Questionnaire-Revised in a representative sample.**
537 *Eur J Work Organ Psy* 2013, **22**(6):670-682.
- 538 27. Steingrimsdottir OA, Vollestad NK, Roe C, Knardahl S: **Variation in reporting of**
539 **pain and other subjective health complaints in a working population and**
540 **limitations of single sample measurements.** *Pain* 2004, **110**(1-2):130-139.
- 541 28. Zigmond AS, Snaith RP: **The hospital anxiety and depression scale.** *Acta*
542 *psychiatrica Scandinavica* 1983, **67**(6):361-370.
- 543 29. Weiss D, Marmar C: **The Impact of Event Scale - Revised.** In: *Assessing*
544 *psychological trauma and PTSD.* edn. Edited by Keane JWTM; 2006: 399-411.
- 545 30. Beck JG, Grant DM, Read JP, Clapp JD, Coffey SF, Miller LM, Palyo SA: **The**
546 **Impact of Event Scale-Revised: Psychometric properties in a sample of motor**
547 **vehicle accident survivors.** *Journal of anxiety disorders* 2008, **22**(2):187-198.
- 548 31. Creamer M, Bell R, Failla S: **Psychometric properties of the impact of event**
549 **scale—revised.** *Behaviour research and therapy* 2003, **41**(12):1489-1496.

- 550 32. Kvåle A, Skouen JS, Ljunggren, AE: **Discriminative Validity of GFM-52 in**
551 **Patients with Long-Lasting Musculoskeletal Pain versus healthy persons.** *Journal*
552 *of Musculoskeletal Pain* 2003, **11(3):23-35.**
- 553 33. Kvåle A, Skouen JS, Ljunggren AE: **Sensitivity to change and responsiveness of the**
554 **global physiotherapy examination (GPE-52) in patients with long-lasting**
555 **musculoskeletal pain.** *Physical therapy* 2005, **85(8):712-726.**
- 556 34. Stoltenborgh M, Van Ijzendoorn MH, Euser EM, Bakermans-Kranenburg MJJCm: **A**
557 **global perspective on child sexual abuse: meta-analysis of prevalence around the**
558 **world.** *Child Maltreatment* 2011, **16(2):79-101.**
- 559 35. Kvåle A, Wilhelmsen K, Fiske H: **Physical findings in patients with dizziness**
560 **undergoing a group exercise program.** *Physiotherapy research international : the*
561 *journal for researchers and clinicians in physical therapy* 2008, **13(3):162-175.**
- 562 36. Min JY, Park SG, Kim SS, Min KB: **Workplace injustice and self-reported disease**
563 **and absenteeism in South Korea.** *American journal of industrial medicine* 2014,
564 **57(1):87-96.**
- 565 37. Kaaria S, Laaksonen M, Rahkonen O, Lahelma E, Leino-Arjas P: **Risk factors of**
566 **chronic neck pain: a prospective study among middle-aged employees.** *European*
567 *journal of pain (London, England)* 2012, **16(6):911-920.**
- 568 38. Janssens H, Clays E, De Clercq B, Casini A, De Bacquer D, Kittel F, Braeckman L:
569 **The relation between psychosocial risk factors and cause-specific long-term**
570 **sickness absence.** *European journal of public health* 2014, **24(3):428-433.**
- 571 39. Reich W: **Character analysis.** New York: Farar, Strauss & Giroux; 1969.
- 572 40. Monsen K, Havik OE: **Psychological functioning and bodily conditions in patients**
573 **with pain disorder associated with psychological factors.** *The British journal of*
574 *medical psychology* 2001, **74 Part 2:183-195.**
- 575 41. Eisenberger NI, Lieberman MD, Williams KD: **Does rejection hurt? An fMRI study**
576 **of social exclusion.** *Science* 2003, **302(5643):290-292.**

577
578
579 **Figure legends**

580 **Figure 1**

581 **Title: Global Physiotherapy Examination (GPE-52): Mean (\pm SD) for total score and all**
582 **main and subdomains for all groups with p-value for ANOVA (all groups equal vs. not**
583 **all groups equal)**
584

585 **Legend**

586 Mean values and standard deviations of the Global Physiotherapy Examination (GPE-52)
587 within five main domains, 13 subdomains, and total sum score. Scores for bullied patients
588 (shown in red) compared to reference scores from patients with long-lasting musculoskeletal
589 disorders (MSD) (yellow) and healthy persons (green).

590

591 **Figure 2**

592 **Title: Relation between physical and mental symptoms and Global Physiotherapy**

593 **Examination (GPE-52) in bullied patients.**

594 Legend

595 Correlations ($\pm 95\%$ CI) for total score and all main and subdomains of GPE-52 with self-

596 reported symptoms MSI (musculoskeletal), PI (psychological), HADS-anxiety, HADS-

597 depression, IES-R (posttraumatic stress symptoms).

598 Abbreviations: HADS: Hospital anxiety and depression scale, IES-R: Impact of events scale revised
599 version.

600

601

Figures

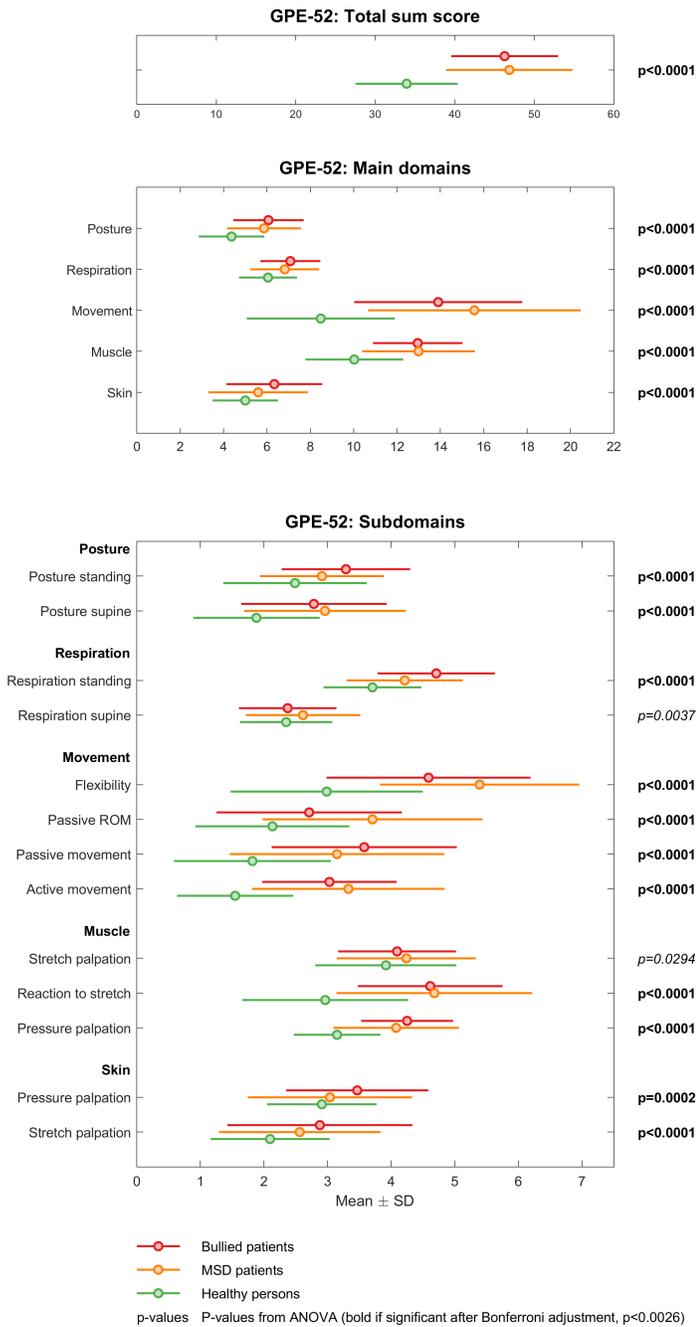


Figure 1

Global Physiotherapy Examination (GPE-52): Mean (±SD) for total score and all main and subdomains for all groups with p-value for ANOVA (all groups equal vs. not all groups equal) Mean values and standard deviations of the Global Physiotherapy Examination (GPE-52) within five main domains, 13

subdomains, and total sum score. Scores for bullied patients (shown in red) compared to reference scores from patients with long-lasting musculoskeletal disorders (MSD) (yellow) and healthy persons (green).

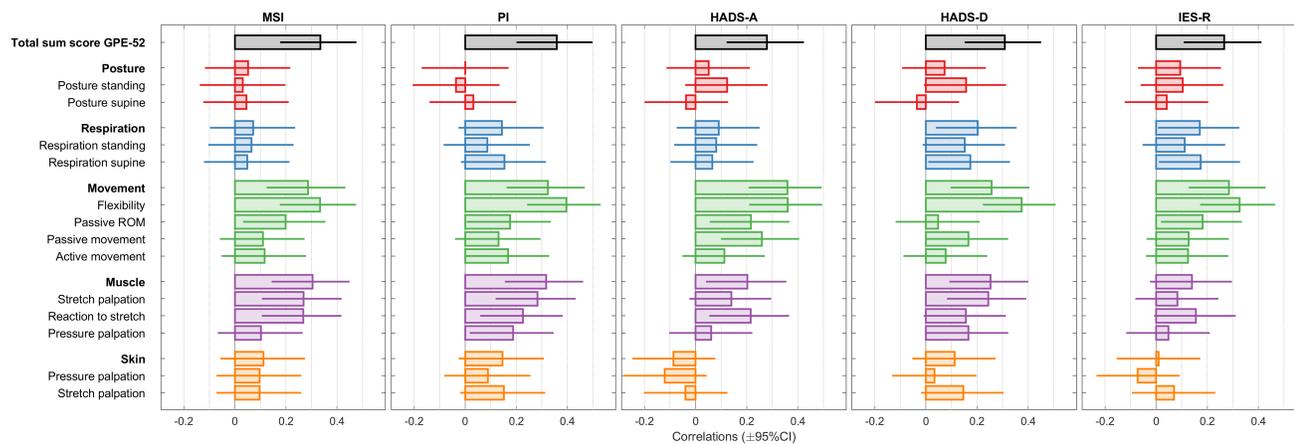


Figure 2

Relation between physical and mental symptoms and Global Physiotherapy Examination (GPE-52) in bullied patients. Correlations ($\pm 95\%$ CI) for total score and all main and subdomains of GPE-52 with self-reported symptoms MSI (musculoskeletal), PI (psychological), HADS-anxiety, HADS597 depression, IES-R (posttraumatic stress symptoms). Abbreviations: HADS: Hospital anxiety and depression scale, IES-R: Impact of events scale revised version.