



Workplace bullying and subsequent psychotropic medication: a longitudinal cohort study with register linkages

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ABSTRACT

Objectives: We aimed to examine longitudinally whether workplace bullying was associated with subsequent psychotropic medication among women and men.

Design: A prospective cohort study

Setting: Helsinki, Finland

Participants: Employees of the City of Helsinki, Finland (N=6606, 80% women) 40-60 years at baseline in 2000-2002, and a register-based follow-up on medication

Primary and secondary outcome measures: Workplace bullying comprised questions about current and earlier bullying as well as observing bullying. The Finnish Social Insurance Institution's register data on purchases of prescribed reimbursed psychotropic medication were linked with the survey data. All psychotropic medication (N06A, N06B, N06C) three years prior to and five years after the baseline survey was included. Covariates included age, prior psychotropic medication, childhood bullying, occupational class, and body-mass index. Cox regression analysis was used to calculate hazard ratios (HR) and their 95% confidence intervals (CI).

Results: Workplace bullying was associated with subsequent psychotropic medication after adjusting for age and prior medication among women (HR 1.51, 95% CI 1.18-1.93) and men (HR 2.15, 95% CI 1.36-3.41). Also observing bullying was associated with subsequent psychotropic medication among women (HR 1.53, 95% CI 1.25-1.88) and men (HR 1.92, 95% CI 1.23-2.99). The associations only modestly attenuated after full adjustment.

Conclusion: Our findings highlight the significance of workplace bullying to subsequent psychotropic medication reflecting medically confirmed mental problems. Tackling workplace bullying likely helps prevent mental problems among employees.

Data sharing statement: There is no additional data available

Article summary

Article focus

- 1) Workplace bullying is a prevalent problem, which is associated with poorer mental health based on some previous studies using self-reported measures.
- 2) There are no previous studies on workplace bullying and psychotropic medication using longitudinal data and objectively measured, register-based outcome.
- 3) We hypothesized that workplace bullying is associated with the risk of psychotropic medication among both women and men, and that these associations are found both for victims of bullying and the bystanders. Moreover, we hypothesized that the associations remain even after considering key covariates

Key messages

- 1) This study showed that workplace bullying contributes to the risk of subsequent psychotropic medication among women and men who were victims or observers of bullying at their workplace. Also earlier exposures to bullying were associated with psychotropic medication over the five year follow-up
- 2) The associations remained after prior psychotropic medication, childhood bullying, occupational class and body mass index had been taken into account.
- 3) These findings further suggest that tackling workplace bullying helps prevent mental health problems among employees.

Strengths and limitations

- 1) A strength of this study was the use of register-linkages. Thus the data on medication were objective and covered all reimbursed psychotropic medication. Furthermore, we were able to consider prior psychotropic medication three years before baseline, as well as had a five year follow-up. The data were large and comprised both women and men.
- 2) A limitation of this study was that measures of bullying were based on single items and we were unable to examine duration and intensity of bullying.

INTRODUCTION

Workplace bullying is a prevalent problem in the workforce. In Finland, bullying affects roughly five to 10% of employees.^{1,2} However, the prevalence of bullying depends on the definition and varies between workplaces and cohorts.³ Albeit there are differences in the definitions and measures of workplace bullying, similar phenomena are likely captured. In general, workplace bullying is about situations at work, where the victims are in an unequal position with respect to their bully, and unable to defend themselves against the negative actions.^{4,5} Such workplace bullying also is systematic and typically persists over longer periods of time.

Workplace bullying occurs in many different contexts, and its forms can be either mental or even physical towards the victim.^{4,6} As a consequence, bullying causes psychosocial stress, but the victims of bullying also have a higher risk of both mental and physical health problems.^{1,2,4} However, few longitudinal studies have been conducted, and both bullying and its health-related consequences have been self-reported. In a previous cross-sectional study in France associations between workplace bullying and self-reported use of psychotropic medication such as sleep medication, tranquilizers, and medication for mental health problems were reported.⁷ Furthermore, a dose-response was suggested: the longer the exposure to bullying and the higher its frequency, the stronger the associations. Also in some other cross-sectional studies, similar associations between workplace bullying and self-reported psychotropic medication have been reported.^{1,8-10} Interpersonal conflicts at work have even been associated with higher risk of more severe mental disorders such as long term psychosis and psychiatric hospital treatment in a prospective Finnish study.¹¹ Our previous studies have shown that workplace bullying at baseline is associated with subsequent self-reported common mental disorders¹² and sleep problems¹³ at follow-up. Earlier prospective

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3 findings suggest that victims of bullying also have a higher risk for sickness absence.¹⁴ All
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5 these previous studies highlight the adverse consequences of bullying for employee health in
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7 general and mental health in particular, as well as productivity at workplaces.^{15,16}
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12 In addition to adverse consequences among the bullied employees, it has been suggested that
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14 even observers of bullying may be at risk of health problems.^{1, 7, 17} Our previous study
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16 included observing bullying at workplace as an indicator of 'workplace climate' alongside
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18 various psychosocial and other working conditions.¹⁸ However, the study did not focus on
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20 bullying, and the variable was treated as a dichotomous one. Observing bullying was
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22 associated particularly with antidepressant medication among men. Some previous studies
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24 also highlight the significance of earlier bullying to subsequent health, and ¹⁹ even bullying in
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26 childhood may contribute to bullying in adulthood.²⁰
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32 Our aim was to examine whether workplace bullying at baseline is associated with subsequent
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34 psychotropic medication reflecting medically confirmed mental problems over the follow-up.
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36 Covariates, such as prior medication, occupational class, body-mass index and childhood
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38 bullying were included for robust evidence about the contribution of workplace bullying to
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40 subsequent psychotropic medication.^{2, 7, 14, 20} As earlier studies have been mainly cross-
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42 sectional and based on self-reported mental health, our study with more objective register-
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44 based psychotropic medication as outcome allows confirming the previous findings relying on
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46 self reports.
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METHODS

Data

The baseline data were derived from the Helsinki Health Study cohort mail questionnaire surveys among 40 to 60 year old employees of the City of Helsinki, Finland, in 2000-2002 (n=8960, response rate 67%).²¹ According to our non-response and attrition analyses, the data are broadly representative of the target population,²¹⁻²³ except men, younger participants, manual workers, and those with long sickness absence spells are slightly overrepresented among the non-respondents. A flow diagram of the study and further details of non-response and attrition are reported elsewhere.²¹ The City of Helsinki is the largest employer in Finland, and there are around 200 different non-manual and manual occupations.

Psychotropic medication

Psychotropic medication data were derived from the prescription register of the Social Insurance Institution, Finland. These data include all purchases of prescribed reimbursed psychotropic medication, psychotropic medication for short. The Social Insurance Institution's register data on medication are classified according to the World Health Organization Anatomical Therapeutic Chemical (ATC) classification.²⁴ For the present study, all psychotropic medication coded as N05 (psycholeptics) and N06 (psychoanaleptics) was included except medication for dementia (N06D) was excluded. Prior psychotropic medication three years before the baseline survey was adjusted for as a covariate, and the follow-up time after the baseline survey was five years or until the first purchase of psychotropic medication, or death (censored).

The psychotropic medication data were linked with the baseline survey data among those who had given an informed written consent for such linkages (n=6606, 74%). In Finland, each resident has a unique personal identification number which can be used to such register data

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3 linkages. After exclusion of participants with current psychotropic medication at baseline
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5 (n=319), the data about eligible participants for this study amounted to 6287. Due to item
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7 non-response to covariates and workplace bullying (approximately 0.5-1.5% per item), the
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9 final data used in the analyses comprised 4681 women and 1315 men.
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12 According to our earlier analyses non-consenters to data linkages were slightly younger, in
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14 lower socioeconomic positions, and with more medically certified sickness absence spells
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16 than non-consenters.^{21, 25} Based on these analyses, the data are representative and consenters
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18 and non-consenters to data linkages are broadly similar.
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21 22 **Workplace bullying**

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25 We used two questions on workplace bullying in line with previous studies.^{2, 26} The
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27 questionnaires included an instruction before the actual questions: “Mental violence or
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29 workplace bullying means isolation of a member of the organization, underestimation of work
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31 performance, threatening, talking behind one’s back or other pressurizing”.
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35 First, the respondents were asked whether they had been bullied in their current workplace,
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37 earlier in the same or in another workplace, never, or could not say. Those who reported they
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39 had never been bullied formed a reference category in the analyses (to whom the other
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41 respondents were compared). A second question asked about observing such behaviour at the
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43 respondent’s workplace using four response alternatives: not at all, sometimes, frequently, or
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45 could not say. Those who reported that they did not observe bullying at their workplace were
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47 used as a reference category.
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50 51 **Covariates**

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54 Age was included as five year age groups. Register data on previous psychotropic medication
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56 3 years before the baseline survey was also included as a covariate. Childhood bullying
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3 reported at baseline was asked by a question enquiring whether the participant had been
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5 bullied before turning 16 years. Data about occupational classes included manual workers,
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7 routine non-manual employees, semi-professionals, and professionals and managers. These
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9 data were derived from the employers' registers and completed from the questionnaires for
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11 those without consents to link questionnaire data with the registers. Body-mass index (BMI)
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13 was based on self-reported height and weight at baseline, and was included as a continuous
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15 variable.
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18 19 **Ethical approvals**

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22 Ethical approvals for the Helsinki Health Study have been obtained from the ethics
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24 committees at the Department of Public Health, University of Helsinki, and the City of
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26 Helsinki Health Authorities.
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29 30 **Statistical analyses**

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33 Descriptive statistics on the prevalence of bullying and psychotropic medication among
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35 women and men was calculated. A directed acyclic graph (DAG) shows the assumed causal
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37 associations between the key study variables (Figure 1). Cox regression models were fitted to
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39 examine the associations between workplace bullying and subsequent psychotropic
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41 medication. First, age was adjusted for in all the analyses (Model 1). Second, all previous
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43 psychotropic medication 3 years prior baseline survey was adjusted for in addition to age
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45 (Model 2). All further covariates were adjusted for after including age and psychotropic
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47 medication prior baseline. Model 3 was adjusted for childhood bullying. Occupational class
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49 was adjusted for in Model 4, and Model 5 was adjusted for BMI. Model 6 was full model
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51 mutually adjusted for all covariates. The results are presented as hazard ratios (HR) and their
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53 95% confidence intervals (95% CI). The analyses were conducted using SAS statistical
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55 program version 9.2 (SAS Institute Inc., Cary, NC, USA), and R.²⁷
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RESULTS

Prevalence of workplace bullying and sleep problems

Five % of women and men reported that they were bullied at baseline (Table 1). Additionally, 18% of women and 12% of men reported earlier bullying in the same or another workplace. Around half of women and men had at least sometimes observed bullying at their workplace, whereas eight % of women and seven % of men had frequently observed bullying. Many respondents also reported that they did not know if they had been bullied (10% of women and 11% of men) or if they had observed bullying (six % of women and five % of men) at their workplace.

Psychotropic medication was more prevalent among women than men: 23% of women and 17% of men had at least one purchase of prescribed reimbursed psychotropic medication over the follow-up, while 16% of women and 10% of men had psychotropic medication three years prior baseline.

Table 1. Distribution (%) of key study variables

	Women (n=4681)	Men (n=1315)
Workplace bullying	%	%
No	67.3	71.8
Yes, currently	4.7	5.3
Earlier, in this or another workplace	17.8	12.2
I do not know	10.3	10.7
Observing bullying at workplace		
No	36.3	42.5
Sometimes	50.5	44.9
Frequently	7.7	7.2
I do not know	5.5	5.4
Any psychotropic medication after baseline	23.3	16.5
Any prior psychotropic medication	15.7	10.4

Associations of workplace bullying with sleep problems

Workplace bullying was associated with subsequent psychotropic medication (Table 2). After adjusting for age, both current (HR 1.72, 95% CI 1.34-2.19) and earlier bullying (HR 1.56, 95% CI 1.35-1.80) were associated with psychotropic medication among women (Model 1). Adjustment for previous psychotropic medication (Model 2) somewhat attenuated the associations, whereas the effects of other covariates (Models 3-5) were negligible. Current and earlier bullying remained associated with subsequent psychotropic medication even after full adjustment (Model 6).

The associations among men were somewhat stronger than among women. After adjusting for age, both current (HR 2.75, 95% CI 1.75-4.33) and earlier bullying (HR 2.37, 95% CI 1.69-3.33) were associated with psychotropic medication among men (Model 1). As among women, the adjustment for previous psychotropic medication led to the strongest attenuation of the association (Model 2), whereas the effects of other covariates were negligible. Both current (HR 1.93, 95% CI 1.20-3.10) and earlier bullying (HR 1.71, 95% CI 1.21-2.44) remained associated with psychotropic medication after full adjustment among men (Model 6).

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Table 2. Workplace bullying at baseline and subsequent psychotropic medication (hazard ratios, HR, and their 95% confidence intervals, 95%, CI from Cox regression models)

Workplace bullying	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6	
Women (n=4681)	HR	95% CI	HR	95% CI	HR	95% CI	HR	95% CI	HR	95% CI	HR	95% CI
No	1.00		1.00		1.00		1.00		1.00		1.00	
Yes, currently	1.72	(1.34 -2.19)	1.51	(1.18 -1.93)	1.49	(1.16 -1.90)	1.50	(1.17 -1.92)	1.51	(1.18 -1.93)	1.48	(1.16 -1.89)
Earlier, in this or another workplace	1.56	(1.35 -1.80)	1.31	(1.13 -1.51)	1.29	(1.11 -1.49)	1.31	(1.13 -1.52)	1.30	(1.13 -1.51)	1.29	(1.11 -1.50)
I do not know	1.30	(1.07 -1.57)	1.23	(1.02 -1.49)	1.21	(1.00 -1.47)	1.23	(1.01 -1.49)	1.23	(1.02 -1.49)	1.21	(0.99 -1.46)
Women (n=4681)												
Men (n=1315)												
No	1.00		1.00		1.00		1.00		1.00		1.00	
Yes, currently	2.75	(1.75 -4.33)	2.15	(1.36 -3.41)	1.94	(1.20 -3.13)	2.21	(1.40 -3.49)	2.18	(1.38 -3.43)	1.93	(1.20 -3.10)
Earlier, in this or another workplace	2.37	(1.69 -3.33)	1.94	(1.38 -2.74)	1.85	(1.30 -2.62)	1.94	(1.38 -2.73)	1.82	(1.29 -2.58)	1.71	(1.21 -2.44)
I do not know	1.52	(1.00 -2.30)	1.26	(0.83 -1.92)	1.25	(0.82 -1.91)	1.29	(0.85 -1.97)	1.23	(0.81 -1.86)	1.23	(0.81 -1.87)

Model 1 Age adjusted for; Model 2 Age and previous psychotropic medication adjusted for; Model 3 Age, previous psychotropic medication, and childhood bullying adjusted for; Model 4 Age, previous psychotropic medication, and occupational class adjusted for; Model 5 Age, previous psychotropic medication, and body mass index adjusted for; Model 6 All variables in Models 1-5 adjusted for (full model)

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3 Also observing bullying at workplace was associated with psychotropic medication among
4 women and men (Table 3). After adjusting for age (Model 1), frequently observing bullying
5 was associated with psychotropic medication among women (HR 1.78, 95% CI 1.45-2.18).
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8 Previous psychotropic medication attenuated this association (Model 2), whereas the effects
9 of other covariates were negligible (Models 2-5). The association remained after full
10 adjustment (Model 6, HR 1.50, 95% CI 1.22-1.84).
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17 Among men, after adjusting for age (Model 1), frequently observing bullying was (strongly)
18 associated with psychotropic medication (HR 2.32, 95% CI 1.49-3.61). The association
19 attenuated but remained after adjustments for covariates (Models 2-5), and after full
20 adjustment (Model 6, HR 1.65, 95% CI 1.04-2.60). Also sometimes observing bullying was
21 associated with psychotropic medication among men (HR 1.38, 95% CI 1.02-1.86).
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Table 3. Observing bullying at workplace at baseline and subsequent psychotropic medication (hazard ratios, HR, and their 95% confidence intervals, 95%, CI from Cox regression models)

Observing bullying at workplace												
	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6	
	HR	95% CI	HR	95% CI	HR	95% CI	HR	95% CI	HR	95% CI	HR	95% CI
Women (n=4681)												
No	1.00		1.00		1.00		1.00		1.00		1.00	
Sometimes	1.07	(0.94 -1.22)	1.02	(0.90 -1.17)	1.01	(0.89 -1.16)	1.02	(0.89 -1.16)	1.02	(0.90 -1.17)	1.01	(0.88 -1.15)
Frequently	1.78	(1.45 -2.18)	1.53	(1.25 -1.88)	1.51	(1.23 -1.85)	1.52	(1.24 -1.86)	1.53	(1.24 -1.87)	1.50	(1.22 -1.84)
I do not know	1.02	(0.77 -1.35)	0.94	(0.71 -1.24)	0.93	(0.71 -1.23)	0.95	(0.72 -1.25)	0.94	(0.71 -1.24)	0.94	(0.71 -1.24)
Men (n=1315)												
No	1.00		1.00		1.00		1.00		1.00		1.00	
Sometimes	1.38	(1.02 -1.86)	1.27	(0.94 -1.71)	1.25	(0.92 -1.69)	1.25	(0.92 -1.69)	1.22	(0.90 -1.65)	1.18	(0.87 -1.59)
Frequently	2.32	(1.49 -3.61)	1.92	(1.23 -2.99)	1.67	(1.05 -2.67)	1.94	(1.24 -3.02)	1.89	(1.21 -2.94)	1.65	(1.04 -2.60)
I do not know	1.35	(0.73 -2.48)	1.16	(0.63 -2.15)	1.10	(0.60 -2.04)	1.16	(0.63 -2.13)	1.11	(0.60 -2.04)	1.03	(0.56 -1.91)

Model 1 Age adjusted for; Model 2 Age and previous psychotropic medication adjusted for; Model 3 Age, previous psychotropic medication, and childhood bullying adjusted for; Model 4 Age, previous psychotropic medication, and occupational class adjusted for; Model 5 Age, previous psychotropic medication, and body mass index adjusted for; Model 6 All variables in Models 1-5 adjusted for (full model)

DISCUSSION

Principal findings

A particular aim of this study was to examine the associations of workplace bullying with mental health problems using objective register data on psychotropic medication in a longitudinal study design. Firstly, overall, being bullied was associated with psychotropic medication among both women and men. This association remained after considering previous psychotropic medication and several covariates. Secondly, even earlier bullying was associated with subsequent psychotropic medication among both women and men. Thirdly, also observing bullying at workplace was associated with psychotropic medication, and the association remained after considering the covariates. These findings confirm those from previous cross-sectional studies and in particular corroborate associations found between workplace bullying and self-reported mental health.

Previous studies

Comparability to previous studies is limited, as most studies have relied on cross-sectional designs and self-reported medication. However, our results are in accordance with those from an earlier cross-sectional study, which reported an association between workplace bullying and self-reported psychotropic medication among French employees.⁷ Observing bullying was also associated with psychotropic medication in that earlier study.

Some other, mainly cross-sectional studies examining the associations between workplace bullying or conflicts at work with self-reported use of sleep-induced drugs, tranquilizers, antidepressants, and sedatives have also shown similar associations with ours suggesting adverse consequences of earlier and current bullying or conflicts at work for psychotropic medication.^{1, 8-10, 26, 28, 29} However, not all these studies have focused explicitly on

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3 workplace bullying, and the measurement of psychotropic medication has been limited and
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5 mainly based on single self-reported items. Thus, mental health outcomes have been varied
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7 and objective measurement such as register based psychotropic medication has been lacking.
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9 The findings of our prospective study using objective data on psychotropic medication avoid
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11 reporting bias for medication. Our findings confirm in a longitudinal design the previous
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13 cross-sectional and self-reported findings on the significance of workplace bullying to
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15 employee mental health problems.
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20 The included covariates had but minor contributions to the examined associations. For
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22 example, childhood bullying could have been expected to contribute to the association
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24 between current bullying and psychotropic medication, but its contributions were minor. Of
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26 those reporting childhood bullying, 11% reported that they were currently bullied as well. It
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28 has been shown also earlier that only some of those who have been bullied at school are
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30 bullied at workplace as well.²⁰ However, as the validity of retrospective reports on bullying is
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32 limited,³⁰ this information does not fully rule out even stronger effects of earlier bullying on
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34 the examined associations. To further confirm the possible effects we excluded those
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36 reporting childhood bullying from the analyses (n=459), but the associations remained, or
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38 slightly strengthened (data not shown). These sensitivity analyses suggest that the data are not
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40 selective to any larger extent and that the results do not reflect sensitivity to the exposure.
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47 Although obesity tends to be stigmatizing, bullied employees likely have only slightly higher
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49 body-mass index¹⁴ Obesity is also connected to mental health problems.³¹ Nevertheless, body-
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51 mass index had negligible effects on the examined associations in this study. It is possible
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53 that in younger or other type of employee cohorts than our middle aged public sector cohort,
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55 obesity might be a more sensitive issue. Alternatively, the results suggest that workplace
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3 bullying and its harmful consequences for mental health are unaccounted by relative weight,
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5 and are equally found across bullied employees independent of their body weight-mass index.
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10 Psychotropic medication before baseline was adjusted for in our analyses to control for the
11 contribution of workplace bullying to psychotropic medication independent of prior
12 medication, which strongly predicted subsequent medication (data not shown). Sensitivity
13 analyses were conducted excluding all those who had had any psychotropic medication before
14 the baseline but the results were similar to those after adjusting for prior medication. To avoid
15 any selection by covariates and redundant loss of data, we retained the full sample. To further
16 control for potential selection and confounding, and in particular the effects of earlier
17 psychotropic medication on workplace bullying at baseline and psychotropic medication at
18 follow-up, marginal structural equation models were fitted.^{32, 33} The inverse probability
19 weights to fit marginal structural models in a point treatment situation was used for
20 multinomial workplace bullying and observing bullying at workplace.³⁴ Weights were
21 calculated using sex, age, previous psychotropic medication, childhood bullying, and BMI as
22 predictors. The results remained unaffected or were even slightly strengthened in these
23 analyses, suggesting that selection and confounding are unlikely to cause major bias to the
24 findings of this study.
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46 **Strengths and weaknesses**

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48 Some further weaknesses of this study need to be acknowledged. First, our measures for
49 bullying were based on single questions and we lacked the duration and intensity of bullying.
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51 The associations might be stronger for more persistent and frequent bullying.⁷ However, in a
52 cross-sectional study, self-reported use of sedatives and hypnotics was not significantly
53 associated with the duration, history, or frequency of bullying.¹ Second, negative affectivity
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3 has been suggested as a mediator of the association between bullying and mental symptoms.³⁵
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5 We were unable to control for such reporting tendency, but its effects are likely minor in our
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7 study where the outcome was derived from objective register data. Third, bullying is a
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9 sensitive issue that may be underreported in surveys. To the extent that this holds for our
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11 study, the results are likely conservative. Underreporting or hiding might also explain why
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13 reporting 'could not say' to questions on bullying had some associations with psychotropic
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15 medication. Fourth, as the only middle-aged employees from the City of Helsinki, Finland,
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17 were included, the results may not be directly generalized to other age groups, cohorts, or
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19 sector of employment. However, there is no particular reason to assume that the associations
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21 of workplace bullying to psychotropic medication would be specific to the current setting. As
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23 earlier cross-sectional studies have already shown that workplace bullying is associated with
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25 self-reported psychotropic medication,^{1, 8-10, 26, 28, 29} this further suggests that the results
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27 probably could apply to other employed groups, too.
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35 A strength of this study was large and prospective cohort including register data linkage on
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37 psychotropic medication. As previous studies have mainly relied on self-reports of one or few
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39 medication groups, our study sheds light on the significance of workplace bullying to (all)
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41 objectively measured psychotropic medication and thereby medically confirmed mental
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43 health problems more generally. Moreover, we were able to control for various key
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45 covariates, and thus our results showed associations of bullying with psychotropic medication
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47 independent of age, prior medication, childhood exposures, occupational class, and body-
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49 mass index.
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Conclusions

Our study showed that workplace bullying is associated with subsequent psychotropic medication based on objective register data reflecting medically confirmed mental problems. These associations were found among both women and men. In addition to current workplace bullying, also earlier bullying and observing bullying was associated with psychotropic medication. Workplace bullying needs to be tackled proactively in an effective way to prevent its adverse consequences for mental health.

Competing interests

The authors have no conflicts of interest to declare except JH is currently or recently conducting research sponsored by Janssen-Cilag, Novartis, Orion Pharma, Abbott, Novo Nordisk Farma, Pfizer, Sanofi-Aventis, Astellas and Takeda.

Authors' contributions

Each author, TL, JH, TP, OR, and EL contributed to the planning of the study and analysis, commented on the manuscript text, as well as approved submission of the final version. TL conducted the analyses and drafted the first version of the manuscript. JH helped in the analyses.

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Figure 1. A directed acyclic graph (DAG) of the assumed causal associations between the study variables

For peer review only

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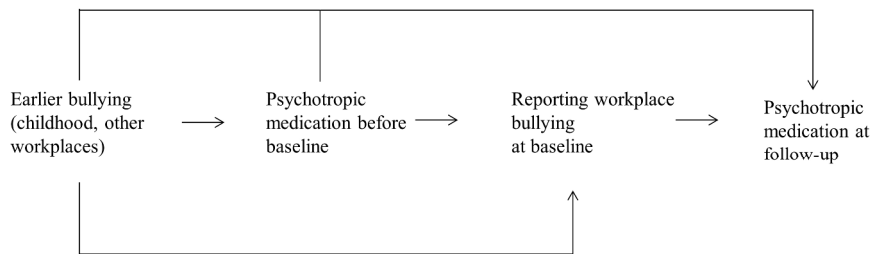
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STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of cohort studies

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(a) Indicate the study’s design with a commonly used term in the title or the abstract	1
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	2-3
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4-5
Objectives	3	State specific objectives, including any prespecified hypotheses	5
Methods			
Study design	4	Present key elements of study design early in the paper	6
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	6
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up	6
		(b) For matched studies, give matching criteria and number of exposed and unexposed	
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	6-8
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	6-8
Bias	9	Describe any efforts to address potential sources of bias	6-7
Study size	10	Explain how the study size was arrived at	6-7
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	6-8
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	8
		(b) Describe any methods used to examine subgroups and interactions	n/a
		(c) Explain how missing data were addressed	7-8
		(d) If applicable, explain how loss to follow-up was addressed	6-7
		(e) Describe any sensitivity analyses	15-16
Results			

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	6
		(b) Give reasons for non-participation at each stage	6
		(c) Consider use of a flow diagram	6
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	9
		(b) Indicate number of participants with missing data for each variable of interest	6
		(c) Summarise follow-up time (eg, average and total amount)	
Outcome data	15*	Report numbers of outcome events or summary measures over time	9
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	10-13
		(b) Report category boundaries when continuous variables were categorized	n/a
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	15-16
Discussion			
Key results	18	Summarise key results with reference to study objectives	14
Limitations			
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	15-16
Generalisability	21	Discuss the generalisability (external validity) of the study results	17
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	18

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at www.strobe-statement.org.



Workplace bullying and subsequent psychotropic medication: a longitudinal cohort study with register linkages

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3 **Workplace bullying and subsequent psychotropic medication: a longitudinal cohort**
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7 Running head: Workplace bullying and psychotropic medication
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ABSTRACT

Objectives: We aimed to examine longitudinally whether workplace bullying was associated with subsequent psychotropic medication among women and men.

Design: A prospective cohort study

Setting: Helsinki, Finland

Participants: Employees of the City of Helsinki, Finland (N=6606, 80% women) 40-60 years at baseline in 2000-2002, and a register-based follow-up on medication

Primary and secondary outcome measures: Workplace bullying comprised questions about current and earlier bullying as well as observing bullying. The Finnish Social Insurance Institution's register data on purchases of prescribed reimbursed psychotropic medication were linked with the survey data. All psychotropic medication (~~N06A, N06B, N06C~~) three years prior to and five years after the baseline survey was included. Covariates included age, prior psychotropic medication, childhood bullying, occupational class, and body-mass index. Cox proportional hazard models (hazard ratios, HR, 95% confidence intervals, CI) were fitted and days until the first purchase of prescribed psychotropic medication after baseline were used as the time axis.

Results: Workplace bullying was associated with subsequent psychotropic medication after adjusting for age and prior medication among women (HR 1.51, 95% CI 1.18-1.93) and men (HR 2.15, 95% CI 1.36-3.41). Also observing bullying was associated with subsequent psychotropic medication among women (HR 1.53, 95% CI 1.25-1.88) and men (HR 1.92, 95% CI 1.23-2.99). The associations only modestly attenuated after full adjustment.

Conclusion: Our findings highlight the significance of workplace bullying to subsequent psychotropic medication reflecting medically confirmed mental problems. Tackling workplace bullying likely helps prevent mental problems among employees.

Data sharing statement: There is no additional data available

Article summary

Article focus

- 1) Workplace bullying is a prevalent problem, which is associated with poorer mental health based on some previous studies using self-reported measures.
- 2) There are no previous studies on workplace bullying and psychotropic medication using longitudinal data and objectively measured, register-based outcome.
- 3) We hypothesized that workplace bullying is associated with the risk of psychotropic medication among both women and men, and that these associations are found both for victims of bullying and the bystanders. Moreover, we hypothesized that the associations remain even after considering key covariates

Key messages

- 1) This study showed that workplace bullying contributes to the risk of subsequent psychotropic medication among women and men who were victims or observers of bullying at their workplace. Also earlier exposures to bullying were associated with psychotropic medication over the five year follow-up
- 2) The associations remained after prior psychotropic medication, childhood bullying, occupational class and body mass index had been taken into account.
- 3) These findings further suggest that tackling workplace bullying helps prevent mental health problems among employees.

Strengths and limitations

- 1) A strength of this study was the use of register-linkages. Thus the data on medication were objective and covered all reimbursed psychotropic medication. Furthermore, we were able to consider prior psychotropic medication three years before baseline, as well as had a five year follow-up. The data were large and comprised both women and men.
- 2) A limitation of this study was that measures of bullying were based on single items and we were unable to examine duration and intensity of bullying.

INTRODUCTION

Workplace bullying is a prevalent problem in the workforce. In Finland, bullying affects roughly five to 10% of employees.^{1,2} However, the prevalence of bullying depends on the definition and varies between workplaces and cohorts.³ Albeit there are differences in the definitions and measures of workplace bullying, similar phenomena are likely captured. In general, workplace bullying is about situations at work, where the victims are in an unequal position with respect to their bully, and unable to defend themselves against the negative actions.^{4,5} Such workplace bullying also is systematic and typically persists over longer periods of time.

Workplace bullying occurs in many different contexts, and its forms can be either mental or even physical towards the victim.^{4,6} As a consequence, bullying causes psychosocial distress, but the victims of bullying also have a higher risk of both mental and physical health problems.^{1,2,4} However, few longitudinal studies have been conducted, and both bullying and its health-related consequences have been self-reported. In a previous cross-sectional study in France associations between workplace bullying and self-reported use of psychotropic medication such as sleep medication, tranquilizers, and medication for mental health problems were reported.⁷ Furthermore, a dose-response was suggested: the longer the exposure to bullying and the higher its frequency, the stronger the associations. Also in some other cross-sectional studies, similar associations between workplace bullying and self-reported psychotropic medication have been reported.^{1,8-10} Interpersonal conflicts at work have even been associated with higher risk of more severe mental disorders such as long term psychosis and psychiatric hospital treatment in a prospective Finnish study.¹¹ Our previous prospective studies have shown that workplace bullying at baseline is associated with subsequent self-reported common mental disorders¹² and sleep problems¹³ at follow-up.

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3 Earlier prospective findings suggest that victims of bullying also have a higher risk for
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5 subsequent depression,² mental distress,¹⁴ and also sickness absence.¹⁵ All these previous
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7 studies highlight the adverse consequences of bullying for employee health in general and
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9 mental health in particular, as well as productivity at workplaces.^{16,17}
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14 In addition to adverse consequences among the bullied employees, cross-sectional studies
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16 have suggested that even observers of bullying may be at risk of health problems.^{1, 7, 18} Our
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18 previous prospective study included observing bullying at workplace as an indicator of
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20 'workplace climate' alongside various psychosocial and other working conditions.¹⁹ However,
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22 the study did not focus on bullying, and the variable was treated as a dichotomous one.
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26 Observing bullying was associated particularly with antidepressant medication among men.
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28 Some previous studies also highlight the significance of earlier bullying to subsequent health,
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30 and ²⁰ even bullying in childhood may contribute to bullying in adulthood.²¹
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35 Our aim was to examine whether workplace bullying at baseline is associated with subsequent
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37 psychotropic medication reflecting medically confirmed mental problems over the follow-up.
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40 Covariates, such as prior medication, occupational class, body-mass index and childhood
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42 bullying were included for robust evidence about the contribution of workplace bullying to
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44 subsequent psychotropic medication.^{2, 7, 15, 21} As earlier studies have been mainly cross-
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46 sectional or based on self-reported mental health, our study with more objective register-
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48 based psychotropic medication as outcome allows confirming the previous findings relying on
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METHODS

Data

The baseline data were derived from the Helsinki Health Study cohort mail questionnaire surveys among 40 to 60 year old employees of the City of Helsinki, Finland, in 2000-2002 (n=8960, response rate 67%).²² According to our non-response and attrition analyses, the data are broadly representative of the target population,²²⁻²⁴ except men, younger participants, manual workers, and those with long sickness absence spells are slightly overrepresented among the non-respondents. A flow diagram of the study and further details of non-response and attrition are reported elsewhere.²² The City of Helsinki is the largest employer in Finland, and there are around 200 different non-manual and manual occupations.

Psychotropic medication

Psychotropic medication data were derived from the prescription register of the Social Insurance Institution, Finland. These data include all purchases of prescribed reimbursed psychotropic medication, psychotropic medication for short. The Social Insurance Institution's register data on medication are classified according to the World Health Organization Anatomical Therapeutic Chemical (ATC) classification.²⁵ For the present study, all psychotropic medication coded as N05 (psycholeptics) and N06 (psychoanaleptics) was included except medication for dementia (N06D) was excluded. Prior psychotropic medication three years before the baseline survey was adjusted for as a covariate, and the follow-up time after the baseline survey was five years or the time until the first purchase of psychotropic medication, or death (censored).

The psychotropic medication data were linked with the baseline survey data among those who had given an informed written consent for such linkages (n=6606, 74%). In Finland, each resident has a unique personal identification number which can be used to such register data

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3 linkages. After exclusion of participants with current psychotropic medication at baseline
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5 (n=319), the data about eligible participants for this study amounted to 6287. Due to item
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7 non-response to covariates and workplace bullying (approximately 0.5-1.5% per item), the
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9 final data used in the analyses comprised 4681 women and 1315 men.
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12 According to our earlier analyses non-consenters to data linkages were slightly younger, in
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14 lower socioeconomic positions, and with more medically certified sickness absence spells
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16 than non-consenters.^{22,26} Based on these analyses, the data are representative and consenters
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18 and non-consenters to data linkages are broadly similar.
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21 22 **Workplace bullying**

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25 We used two questions on workplace bullying in line with previous studies.^{2,27} The
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27 questionnaires included an instruction before the actual questions: “Mental violence or
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29 workplace bullying means isolation of a member of the organization, underestimation of work
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31 performance, threatening, talking behind one’s back or other pressurizing”.
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35 First, the respondents were asked whether they had been bullied in their current workplace,
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37 earlier in the same or in another workplace, never, or could not say. Those who reported they
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39 had never been bullied formed a reference category in the analyses (to whom the other
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41 respondents were compared). A second question asked about observing such behaviour at the
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43 respondent’s workplace using four response alternatives: not at all, sometimes, frequently, or
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45 could not say. Those who reported that they did not observe bullying at their workplace were
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47 used as a reference category.
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50 51 **Covariates**

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54 Age was included as five year age groups. Register data on previous psychotropic medication
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56 3 years before the baseline survey was also included as a covariate. Childhood bullying
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3 reported at baseline was asked by a question enquiring whether the participant had been
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5 bullied before turning 16 years. Data about occupational classes included manual workers,
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7 routine non-manual employees, semi-professionals, and professionals and managers. These
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9 data were derived from the employers' personnel registers and completed from the
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11 questionnaires for those without consents to link questionnaire data with the registers. Body-
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13 mass index (BMI) was based on self-reported height and weight at baseline, and was included
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15 as a continuous variable.
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18 19 **Ethical approvals**

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22 Ethical approvals for the Helsinki Health Study have been obtained from the ethics
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24 committees at the Department of Public Health, University of Helsinki, and the City of
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26 Helsinki Health Authorities.
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29 30 **Statistical analyses**

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33 Descriptive statistics on the prevalence of bullying and psychotropic medication among
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35 women and men was calculated. A directed acyclic graph (DAG) shows the assumed causal
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37 associations between the key study variables (Figure 1). Cox proportional hazard models were
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39 fitted to examine the associations between workplace bullying and subsequent psychotropic
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41 medication (days until the first purchase after baseline were used as a time axis). First, age
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43 was adjusted for in all the analyses (Model 1). Second, all previous psychotropic medication 3
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45 years prior baseline survey was adjusted for in addition to age (Model 2). All further
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47 covariates were added in Model 2, i.e., adjusted for after including age and psychotropic
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49 medication prior baseline. Model 3 was adjusted for childhood bullying. Occupational class
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51 was adjusted for in Model 4, and Model 5 was adjusted for BMI. Model 6 was full model
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53 mutually adjusted for all covariates. The results are presented as hazard ratios (HR) and their
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95% confidence intervals (95% CI). The analyses were conducted using SAS statistical program version 9.2 (SAS Institute Inc., Cary, NC, USA), and R.²⁸

RESULTS

Prevalence of workplace bullying and psychotropic medication

Five % of women and men reported that they were bullied at baseline (Table 1). Additionally, 18% of women and 12% of men reported earlier bullying in the same or another workplace. Around half of women and men had at least sometimes observed bullying at their workplace, whereas eight % of women and seven % of men had frequently observed bullying. Many respondents also reported that they did not know if they had been bullied (10% of women and 11% of men) or if they had observed bullying (six % of women and five % of men) at their workplace.

Psychotropic medication was more prevalent among women than men: 23% of women and 17% of men had at least one purchase of prescribed reimbursed psychotropic medication over the follow-up, while 16% of women and 10% of men had psychotropic medication three years prior baseline.

Table 1. Distribution (%) of key study variables

	Women (n=4681)	Men (n=1315)
Workplace bullying	%	%
No	67.3	71.8
Yes, currently	4.7	5.3
Earlier, in this or another workplace	17.8	12.2
I do not know	10.3	10.7
Observing bullying at workplace		
No	36.3	42.5
Sometimes	50.5	44.9
Frequently	7.7	7.2
I do not know	5.5	5.4
Any psychotropic medication after baseline	23.3	16.5
Any prior psychotropic medication	15.7	10.4

Associations of workplace bullying with psychotropic medication

Workplace bullying was associated with subsequent psychotropic medication (Table 2). After adjusting for age, both current (HR 1.72, 95% CI 1.34-2.19) and earlier bullying (HR 1.56, 95% CI 1.35-1.80) were associated with psychotropic medication among women (Model 1). Adjustment for previous psychotropic medication (Model 2) somewhat attenuated the associations, whereas the effects of other covariates (Models 3-5) were negligible. Thus the effect sizes remained similar to Model 2. Current and earlier bullying remained associated with subsequent psychotropic medication even after full adjustment (Model 6).

The associations among men were somewhat stronger than among women. After adjusting for age, both current (HR 2.75, 95% CI 1.75-4.33) and earlier bullying (HR 2.37, 95% CI 1.69-3.33) were associated with psychotropic medication among men (Model 1). As among women, the adjustment for previous psychotropic medication led to the strongest attenuation of the association (Model 2), whereas the effects of other covariates were negligible, and the hazard ratios remained relatively similar to Model 2. Both current (HR 1.93, 95% CI 1.20-3.10) and earlier bullying (HR 1.71, 95% CI 1.21-2.44) remained associated with psychotropic medication after full adjustment among men (Model 6).

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Table 2. Workplace bullying at baseline and subsequent psychotropic medication (hazard ratios, HR, and their 95% confidence intervals, 95%, CI from Cox regression models)

Workplace bullying	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6	
Women (n=4681)	HR	95% CI	HR	95% CI	HR	95% CI	HR	95% CI	HR	95% CI	HR	95% CI
No	1.00		1.00		1.00		1.00		1.00		1.00	
Yes, currently	1.72	(1.34 -2.19)	1.51	(1.18 -1.93)	1.49	(1.16 -1.90)	1.50	(1.17 -1.92)	1.51	(1.18 -1.93)	1.48	(1.16 -1.89)
Earlier, in this or another workplace	1.56	(1.35 -1.80)	1.31	(1.13 -1.51)	1.29	(1.11 -1.49)	1.31	(1.13 -1.52)	1.30	(1.13 -1.51)	1.29	(1.11 -1.50)
I do not know	1.30	(1.07 -1.57)	1.23	(1.02 -1.49)	1.21	(1.00 -1.47)	1.23	(1.01 -1.49)	1.23	(1.02 -1.49)	1.21	(0.99 -1.46)
Women (n=4681)												
Men (n=1315)												
No	1.00		1.00		1.00		1.00		1.00		1.00	
Yes, currently	2.75	(1.75 -4.33)	2.15	(1.36 -3.41)	1.94	(1.20 -3.13)	2.21	(1.40 -3.49)	2.18	(1.38 -3.43)	1.93	(1.20 -3.10)
Earlier, in this or another workplace	2.37	(1.69 -3.33)	1.94	(1.38 -2.74)	1.85	(1.30 -2.62)	1.94	(1.38 -2.73)	1.82	(1.29 -2.58)	1.71	(1.21 -2.44)
I do not know	1.52	(1.00 -2.30)	1.26	(0.83 -1.92)	1.25	(0.82 -1.91)	1.29	(0.85 -1.97)	1.23	(0.81 -1.86)	1.23	(0.81 -1.87)

Model 1 Age adjusted for; Model 2 Age and previous psychotropic medication adjusted for; Model 3 Age, previous psychotropic medication, and childhood bullying adjusted for; Model 4 Age, previous psychotropic medication, and occupational class adjusted for; Model 5 Age, previous psychotropic medication, and body mass index adjusted for; Model 6 All variables in Models 1-5 adjusted for (full model)

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3 Also observing bullying at workplace was associated with psychotropic medication among
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5 women and men (Table 3). After adjusting for age (Model 1), frequently observing bullying
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7 was associated with psychotropic medication among women (HR 1.78, 95% CI 1.45-2.18).
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9 Previous psychotropic medication attenuated this association (Model 2), whereas the effects
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11 of other covariates, added in the model including age and previous psychotropic medication,
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13 were negligible (Models 3-5). The association remained after full adjustment (Model 6, HR
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15 1.50, 95% CI 1.22-1.84).
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19 Among men, after adjusting for age (Model 1), frequently observing bullying was associated
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21 with psychotropic medication (HR 2.32, 95% CI 1.49-3.61). The association attenuated but
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23 remained after adjustments for covariates (Models 2-5), and after full adjustment (Model 6,
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25 HR 1.65, 95% CI 1.04-2.60). Also sometimes observing bullying was associated with
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27 psychotropic medication among men (HR 1.38, 95% CI 1.02-1.86).
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31 Further analyses examined separately antidepressant medication, as well as sedatives and
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33 anxiolytic medication (data not shown). As the largest part of all psychotropic medication was
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35 antidepressant medication the associations for any psychotropic medication broadly reflected
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37 those for antidepressants. However, when only antidepressant medication was examined, the
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39 associations were slightly stronger.
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Table 3. Observing bullying at workplace at baseline and subsequent psychotropic medication (hazard ratios, HR, and their 95% confidence intervals, 95%, CI from Cox regression models)

Observing bullying at workplace													
		Model 1		Model 2		Model 3		Model 4		Model 5		Model 6	
		HR	95% CI	HR	95% CI	HR	95% CI	HR	95% CI	HR	95% CI	HR	95% CI
Women (n=4681)													
	No	1.00		1.00		1.00		1.00		1.00		1.00	
	Sometimes	1.07	(0.94 -1.22)	1.02	(0.90 -1.17)	1.01	(0.89 -1.16)	1.02	(0.89 -1.16)	1.02	(0.90 -1.17)	1.01	(0.88 -1.15)
	Frequently	1.78	(1.45 -2.18)	1.53	(1.25 -1.88)	1.51	(1.23 -1.85)	1.52	(1.24 -1.86)	1.53	(1.24 -1.87)	1.50	(1.22 -1.84)
	I do not know	1.02	(0.77 -1.35)	0.94	(0.71 -1.24)	0.93	(0.71 -1.23)	0.95	(0.72 -1.25)	0.94	(0.71 -1.24)	0.94	(0.71 -1.24)
Men (n=1315)													
	No	1.00		1.00		1.00		1.00		1.00		1.00	
	Sometimes	1.38	(1.02 -1.86)	1.27	(0.94 -1.71)	1.25	(0.92 -1.69)	1.25	(0.92 -1.69)	1.22	(0.90 -1.65)	1.18	(0.87 -1.59)
	Frequently	2.32	(1.49 -3.61)	1.92	(1.23 -2.99)	1.67	(1.05 -2.67)	1.94	(1.24 -3.02)	1.89	(1.21 -2.94)	1.65	(1.04 -2.60)
	I do not know	1.35	(0.73 -2.48)	1.16	(0.63 -2.15)	1.10	(0.60 -2.04)	1.16	(0.63 -2.13)	1.11	(0.60 -2.04)	1.03	(0.56 -1.91)

Model 1 Age adjusted for; Model 2 Age and previous psychotropic medication adjusted for; Model 3 Age, previous psychotropic medication, and childhood bullying adjusted for; Model 4 Age, previous psychotropic medication, and occupational class adjusted for; Model 5 Age, previous psychotropic medication, and body mass index adjusted for; Model 6 All variables in Models 1-5 adjusted for (full model)

DISCUSSION

Principal findings

A particular aim of this study was to examine the associations of workplace bullying with mental health problems using objective register data on psychotropic medication in a longitudinal study design. Firstly, overall, being bullied was associated with psychotropic medication among both women and men. This association remained after considering previous psychotropic medication and several covariates. Secondly, even earlier bullying was associated with subsequent psychotropic medication among both women and men. Thirdly, also observing bullying at workplace was associated with psychotropic medication, and the association remained after considering the covariates. These findings confirm those from previous cross-sectional studies and in particular corroborate associations found between workplace bullying and self-reported mental health.

Previous studies

Comparability to previous studies is limited, as most studies have relied on cross-sectional designs and self-reported medication. However, our results are in accordance with those from an earlier cross-sectional study, which reported an association between workplace bullying and self-reported psychotropic medication among French employees.⁷ Observing bullying was also associated with psychotropic medication in that earlier study.

Some other, mainly cross-sectional studies examining the associations between workplace bullying or conflicts at work with self-reported use of sleep-induced drugs, tranquilizers, antidepressants, and sedatives have also shown similar associations with ours suggesting adverse consequences of earlier and current bullying or conflicts at work for psychotropic medication.^{1, 8-10, 27, 29, 30} However, not all these studies have focused explicitly on

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3 workplace bullying, and the measurement of psychotropic medication has been limited and
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5 mainly based on single self-reported items. Thus, mental health outcomes have been varied
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7 and objective measurement such as register based psychotropic medication has been lacking.
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9 The findings of our prospective study using objective data on psychotropic medication avoid
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11 reporting bias for medication. Our findings confirm in a longitudinal design the previous
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13 cross-sectional and self-reported findings on the significance of workplace bullying to
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15 employee mental health problems.
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20 The included covariates had but minor contributions to the examined associations. For
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22 example, childhood bullying could have been expected to contribute to the association
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24 between current bullying and psychotropic medication, but its contributions were minor. Of
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26 those reporting childhood bullying, 11% reported that they were currently bullied as well. It
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28 has been shown also earlier that only some of those who have been bullied at school are
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30 bullied at workplace as well.²¹ However, as the validity of retrospective reports on bullying is
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32 limited,³¹ this information does not fully rule out even stronger effects of earlier bullying on
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34 the examined associations. To further confirm the possible effects we excluded those
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36 reporting childhood bullying from the analyses (n=459), but the associations remained, or
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38 slightly strengthened (data not shown). These sensitivity analyses suggest that the data are not
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40 selective to any larger extent and that the results do not reflect sensitivity to the exposure.
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47 Although obesity tends to be stigmatizing, bullied employees likely have only slightly higher
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49 body-mass index.¹⁵ Obesity is also connected to mental health problems.³² Nevertheless,
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51 body-mass index had negligible effects on the examined associations in this study. It is
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53 possible that in younger or other type of employee cohorts than our middle aged public sector
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55 cohort, obesity might be a more sensitive issue. Alternatively, the results suggest that
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3 workplace bullying and its harmful consequences for mental health are unaccounted by
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5 relative weight, and are equally found across bullied employees independent of their body
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7 weight-mass index. Additionally, we conducted sensitivity analyses adjusting for various
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9 other potential confounders related to mental health such as alcohol and smoking but the
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11 results remained unaffected (data not shown). However, it cannot be ruled out that
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13 unmeasured covariates affected the findings. For example negative life events during the
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15 follow-up, independent of earlier bullying, might result to anxiety, depression, and other
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17 mental health problems leading to psychotropic medication.
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23 Psychotropic medication before baseline was adjusted for in our analyses to control for the
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25 contribution of workplace bullying to psychotropic medication independent of prior
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27 medication, which strongly predicted subsequent medication (data not shown). Sensitivity
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29 analyses were conducted excluding all those who had had any psychotropic medication before
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31 the baseline but the results were similar to those after adjusting for prior medication. To avoid
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33 any selection by covariates and redundant loss of data, we retained the full sample. To further
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35 control for potential selection and confounding, and in particular the effects of earlier
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37 psychotropic medication on workplace bullying at baseline and psychotropic medication at
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39 follow-up, marginal structural equation models were fitted.^{33,34} The inverse probability
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41 weights to fit marginal structural models in a point treatment situation was used for
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43 multinomial workplace bullying and observing bullying at workplace.³⁵ Weights were
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45 calculated using sex, age, previous psychotropic medication, childhood bullying, and BMI as
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47 predictors. The results remained unaffected or were even slightly strengthened in these
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49 analyses, suggesting that selection and confounding are unlikely to cause major bias to the
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51 findings of this study. Nonetheless, previous prospective studies have found bidirectional
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53 associations between bullying and mental health suggesting that reverse causation cannot be
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3 excluded^{2,14}. Thus while bullying might contribute to mental health problems, those suffering
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5 from mental problems might be more likely to be bullied, or perceive bullying.
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8 9 **Strengths and weaknesses**

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12 Some further weaknesses of this study need to be acknowledged. First, our measures for
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14 bullying were based on single questions. We lacked information about the specific time
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16 frame, duration, intensity and number of episodes of bullying. The associations might be
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18 stronger for more persistent, frequent and intense bullying.⁷ However, in a cross-sectional
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20 study, self-reported use of sedatives and hypnotics was not significantly associated with the
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22 duration, history, or frequency of bullying.¹ Bullying is also likely to be remembered and even
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24 single episodes could, therefore, have long lasting effects. Second, negative affectivity has
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26 been suggested as a mediator of the association between bullying and mental symptoms.³⁶ We
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28 were unable to control for such reporting tendency, but its effects are likely minor in our
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30 study where the outcome was derived from objective register data. Third, bullying is a
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32 sensitive issue that may be underreported in surveys. To the extent that this holds for our
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34 study, the results are likely conservative. Underreporting or hiding might also explain why
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36 reporting 'could not say' to questions on bullying had some associations with psychotropic
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38 medication. Fourth, as the only middle-aged employees from the City of Helsinki, Finland,
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40 were included, the results may not be directly generalized to other age groups, cohorts, or
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42 sector of employment. However, there is no particular reason to assume that the associations
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44 of workplace bullying to psychotropic medication would be specific to the current setting. As
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46 earlier cross-sectional studies have already shown that workplace bullying is associated with
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48 self-reported psychotropic medication,^{1, 8-10, 27, 29, 30} this further suggests that the results
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50 probably could apply to other employed groups, too. Finally, a long follow-up period might
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52 dilute the findings and unmeasured confounding, and changes over the follow-up might affect
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3 our findings. However, as we examined the time until the first purchase of psychotropic
4 medication after baseline, and the purchases of medication took place mostly before the end
5 of the five year follow-up, the third factors are unlikely to have affected our results to any
6 larger extent.
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10 A strength of this study was large and prospective cohort including register data linkage on
11 psychotropic medication. As previous studies have mainly been cross-sectional and relied on
12 self-reports of one or few medication groups, our study sheds light on the significance of
13 workplace bullying to objectively measured psychotropic medication and thereby medically
14 confirmed mental health problems more generally. Moreover, we were able to control for
15 various key covariates, and thus our results showed associations of bullying with psychotropic
16 medication independent of age, prior medication, childhood exposures, occupational class,
17 and body-mass index.
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33 **Conclusions**

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36 Our study showed that workplace bullying is associated with subsequent
37 psychotropic medication based on objective register data reflecting medically confirmed
38 mental problems. These associations were found among both women and men. In addition to
39 current workplace bullying, also earlier bullying and observing bullying was associated with
40 psychotropic medication. Workplace bullying needs to be tackled proactively in an effective
41 way to prevent its adverse consequences for mental health.
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Competing interests

The authors have no conflicts of interest to declare except JH is currently or recently conducting research sponsored by Janssen-Cilag, Novartis, Orion Pharma, Abbott, Novo Nordisk Farma, Pfizer, Sanofi-Aventis, Astellas and Takeda.

Authors' contributions

Each author, TL, JH, TP, OR, and EL contributed to the planning of the study and analysis, commented on the manuscript text, as well as approved submission of the final version. TL conducted the analyses and drafted the first version of the manuscript. JH helped in the analyses.

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3 Figure 1. A directed acyclic graph (DAG) of the assumed causal associations between the study variables
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3 **Workplace bullying and subsequent psychotropic medication: a longitudinal cohort**
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5 **study with register linkages**
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7 Running head: Workplace bullying and psychotropic medication
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ABSTRACT

Objectives: We aimed to examine longitudinally whether workplace bullying was associated with subsequent psychotropic medication among women and men.

Design: A prospective cohort study

Setting: Helsinki, Finland

Participants: Employees of the City of Helsinki, Finland (N=6606, 80% women) 40-60 years at baseline in 2000-2002, and a register-based follow-up on medication

Primary and secondary outcome measures: Workplace bullying comprised questions about current and earlier bullying as well as observing bullying. The Finnish Social Insurance Institution's register data on purchases of prescribed reimbursed psychotropic medication were linked with the survey data. All psychotropic medication (~~N06A, N06B, N06C~~) three years prior to and five years after the baseline survey was included. Covariates included age, prior psychotropic medication, childhood bullying, occupational class, and body-mass index.

Cox proportional hazard models (hazard ratios, HR, 95% confidence intervals, CI) were fitted and days until the first purchase of prescribed psychotropic medication after baseline were used as the time axis.

Results: Workplace bullying was associated with subsequent psychotropic medication after adjusting for age and prior medication among women (HR 1.51, 95% CI 1.18-1.93) and men (HR 2.15, 95% CI 1.36-3.41). Also observing bullying was associated with subsequent psychotropic medication among women (HR 1.53, 95% CI 1.25-1.88) and men (HR 1.92, 95% CI 1.23-2.99). The associations only modestly attenuated after full adjustment.

Conclusion: Our findings highlight the significance of workplace bullying to subsequent psychotropic medication reflecting medically confirmed mental problems. Tackling workplace bullying likely helps prevent mental problems among employees.

Data sharing statement: There is no additional data available

Article summary

Article focus

- 1) Workplace bullying is a prevalent problem, which is associated with poorer mental health based on some previous studies using self-reported measures.
- 2) There are no previous studies on workplace bullying and psychotropic medication using longitudinal data and objectively measured, register-based outcome.
- 3) We hypothesized that workplace bullying is associated with the risk of psychotropic medication among both women and men, and that these associations are found both for victims of bullying and the bystanders. Moreover, we hypothesized that the associations remain even after considering key covariates

Key messages

- 1) This study showed that workplace bullying contributes to the risk of subsequent psychotropic medication among women and men who were victims or observers of bullying at their workplace. Also earlier exposures to bullying were associated with psychotropic medication over the five year follow-up
- 2) The associations remained after prior psychotropic medication, childhood bullying, occupational class and body mass index had been taken into account.
- 3) These findings further suggest that tackling workplace bullying helps prevent mental health problems among employees.

Strengths and limitations

- 1) A strength of this study was the use of register-linkages. Thus the data on medication were objective and covered all reimbursed psychotropic medication. Furthermore, we were able to consider prior psychotropic medication three years before baseline, as well as had a five year follow-up. The data were large and comprised both women and men.
- 2) A limitation of this study was that measures of bullying were based on single items and we were unable to examine duration and intensity of bullying.

INTRODUCTION

Workplace bullying is a prevalent problem in the workforce. In Finland, bullying affects roughly five to 10% of employees.^{1,2} However, the prevalence of bullying depends on the definition and varies between workplaces and cohorts.³ Albeit there are differences in the definitions and measures of workplace bullying, similar phenomena are likely captured. In general, workplace bullying is about situations at work, where the victims are in an unequal position with respect to their bully, and unable to defend themselves against the negative actions.^{4,5} Such workplace bullying also is systematic and typically persists over longer periods of time.

Workplace bullying occurs in many different contexts, and its forms can be either mental or even physical towards the victim.^{4,6} As a consequence, bullying causes psychosocial distress, but the victims of bullying also have a higher risk of both mental and physical health problems.^{1,2,4} However, few longitudinal studies have been conducted, and both bullying and its health-related consequences have been self-reported. In a previous cross-sectional study in France associations between workplace bullying and self-reported use of psychotropic medication such as sleep medication, tranquilizers, and medication for mental health problems were reported.⁷ Furthermore, a dose-response was suggested: the longer the exposure to bullying and the higher its frequency, the stronger the associations. Also in some other cross-sectional studies, similar associations between workplace bullying and self-reported psychotropic medication have been reported.^{1,8-10} Interpersonal conflicts at work have even been associated with higher risk of more severe mental disorders such as long term psychosis and psychiatric hospital treatment in a prospective Finnish study.¹¹ Our previous prospective studies have shown that workplace bullying at baseline is associated with subsequent self-reported common mental disorders¹² and sleep problems¹³ at follow-up.

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3 Earlier prospective findings suggest that victims of bullying also have a higher risk for
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5 subsequent depression,² mental distress,¹⁴ and also sickness absence.¹⁵ All these previous
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7 studies highlight the adverse consequences of bullying for employee health in general and
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9 mental health in particular, as well as productivity at workplaces.^{16,17}
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14 In addition to adverse consequences among the bullied employees, cross-sectional studies
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16 have suggested that even observers of bullying may be at risk of health problems.^{1, 7, 18} Our
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18 previous prospective study included observing bullying at workplace as an indicator of
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20 'workplace climate' alongside various psychosocial and other working conditions.¹⁹ However,
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22 the study did not focus on bullying, and the variable was treated as a dichotomous one.
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24 Observing bullying was associated particularly with antidepressant medication among men.
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26 Some previous studies also highlight the significance of earlier bullying to subsequent health,
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28 and ²⁰ even bullying in childhood may contribute to bullying in adulthood.²¹
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35 Our aim was to examine whether workplace bullying at baseline is associated with subsequent
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37 psychotropic medication reflecting medically confirmed mental problems over the follow-up.
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39 Covariates, such as prior medication, occupational class, body-mass index and childhood
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41 bullying were included for robust evidence about the contribution of workplace bullying to
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43 subsequent psychotropic medication.^{2, 7, 15, 21} As earlier studies have been mainly cross-
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45 sectional or based on self-reported mental health, our study with more objective register-
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47 based psychotropic medication as outcome allows confirming the previous findings relying on
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49 self reports.
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METHODS

Data

The baseline data were derived from the Helsinki Health Study cohort mail questionnaire surveys among 40 to 60 year old employees of the City of Helsinki, Finland, in 2000-2002 (n=8960, response rate 67%).²² According to our non-response and attrition analyses, the data are broadly representative of the target population,²²⁻²⁴ except men, younger participants, manual workers, and those with long sickness absence spells are slightly overrepresented among the non-respondents. A flow diagram of the study and further details of non-response and attrition are reported elsewhere.²² The City of Helsinki is the largest employer in Finland, and there are around 200 different non-manual and manual occupations.

Psychotropic medication

Psychotropic medication data were derived from the prescription register of the Social Insurance Institution, Finland. These data include all purchases of prescribed reimbursed psychotropic medication, psychotropic medication for short. The Social Insurance Institution's register data on medication are classified according to the World Health Organization Anatomical Therapeutic Chemical (ATC) classification.²⁵ For the present study, all psychotropic medication coded as N05 (psycholeptics) and N06 (psychoanaleptics) was included except medication for dementia (N06D) was excluded. Prior psychotropic medication three years before the baseline survey was adjusted for as a covariate, and the follow-up time after the baseline survey was five years or **the time** until the first purchase of psychotropic medication, or death (censored).

The psychotropic medication data were linked with the baseline survey data among those who had given an informed written consent for such linkages (n=6606, 74%). In Finland, each resident has a unique personal identification number which can be used to such register data

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3 linkages. After exclusion of participants with current psychotropic medication at baseline
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5 (n=319), the data about eligible participants for this study amounted to 6287. Due to item
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7 non-response to covariates and workplace bullying (approximately 0.5-1.5% per item), the
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9 final data used in the analyses comprised 4681 women and 1315 men.
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12 According to our earlier analyses non-consenters to data linkages were slightly younger, in
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14 lower socioeconomic positions, and with more medically certified sickness absence spells
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16 than non-consenters.^{22,26} Based on these analyses, the data are representative and consenters
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18 and non-consenters to data linkages are broadly similar.
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21 22 **Workplace bullying**

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25 We used two questions on workplace bullying in line with previous studies.^{2,27} The
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27 questionnaires included an instruction before the actual questions: “Mental violence or
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29 workplace bullying means isolation of a member of the organization, underestimation of work
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31 performance, threatening, talking behind one’s back or other pressurizing”.
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35 First, the respondents were asked whether they had been bullied in their current workplace,
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37 earlier in the same or in another workplace, never, or could not say. Those who reported they
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39 had never been bullied formed a reference category in the analyses (to whom the other
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41 respondents were compared). A second question asked about observing such behaviour at the
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43 respondent’s workplace using four response alternatives: not at all, sometimes, frequently, or
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45 could not say. Those who reported that they did not observe bullying at their workplace were
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47 used as a reference category.
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50 51 **Covariates**

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54 Age was included as five year age groups. Register data on previous psychotropic medication
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56 3 years before the baseline survey was also included as a covariate. Childhood bullying
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3 reported at baseline was asked by a question enquiring whether the participant had been
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5 bullied before turning 16 years. Data about occupational classes included manual workers,
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7 routine non-manual employees, semi-professionals, and professionals and managers. These
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9 data were derived from the employers' **personnel** registers and completed from the
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11 questionnaires for those without consents to link questionnaire data with the registers. Body-
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13 mass index (BMI) was based on self-reported height and weight at baseline, and was included
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15 as a continuous variable.
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18 19 **Ethical approvals**

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22 Ethical approvals for the Helsinki Health Study have been obtained from the ethics
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24 committees at the Department of Public Health, University of Helsinki, and the City of
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26 Helsinki Health Authorities.
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29 30 **Statistical analyses**

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33 Descriptive statistics on the prevalence of bullying and psychotropic medication among
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35 women and men was calculated. A directed acyclic graph (DAG) shows the assumed causal
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37 associations between the key study variables (Figure 1). Cox **proportional hazard** models were
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39 fitted to examine the associations between workplace bullying and subsequent psychotropic
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41 medication (**days until the first purchase after baseline were used as a time axis**). First, age
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43 was adjusted for in all the analyses (Model 1). Second, all previous psychotropic medication 3
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45 years prior baseline survey was adjusted for in addition to age (Model 2). All further
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47 covariates were **added in Model 2, i.e.**, adjusted for after including age and psychotropic
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49 medication prior baseline. Model 3 was adjusted for childhood bullying. Occupational class
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51 was adjusted for in Model 4, and Model 5 was adjusted for BMI. Model 6 was full model
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53 mutually adjusted for all covariates. The results are presented as hazard ratios (HR) and their
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95% confidence intervals (95% CI). The analyses were conducted using SAS statistical program version 9.2 (SAS Institute Inc., Cary, NC, USA), and R.²⁸

RESULTS

Prevalence of workplace bullying and psychotropic medication

Five % of women and men reported that they were bullied at baseline (Table 1). Additionally, 18% of women and 12% of men reported earlier bullying in the same or another workplace. Around half of women and men had at least sometimes observed bullying at their workplace, whereas eight % of women and seven % of men had frequently observed bullying. Many respondents also reported that they did not know if they had been bullied (10% of women and 11% of men) or if they had observed bullying (six % of women and five % of men) at their workplace.

Psychotropic medication was more prevalent among women than men: 23% of women and 17% of men had at least one purchase of prescribed reimbursed psychotropic medication over the follow-up, while 16% of women and 10% of men had psychotropic medication three years prior baseline.

Table 1. Distribution (%) of key study variables

	Women (n=4681)	Men (n=1315)
Workplace bullying	%	%
No	67.3	71.8
Yes, currently	4.7	5.3
Earlier, in this or another workplace	17.8	12.2
I do not know	10.3	10.7
Observing bullying at workplace		
No	36.3	42.5
Sometimes	50.5	44.9
Frequently	7.7	7.2
I do not know	5.5	5.4
Any psychotropic medication after baseline	23.3	16.5
Any prior psychotropic medication	15.7	10.4

Associations of workplace bullying with **psychotropic medication**

Workplace bullying was associated with subsequent psychotropic medication (Table 2). After adjusting for age, both current (HR 1.72, 95% CI 1.34-2.19) and earlier bullying (HR 1.56, 95% CI 1.35-1.80) were associated with psychotropic medication among women (Model 1). Adjustment for previous psychotropic medication (Model 2) somewhat attenuated the associations, whereas the effects of other covariates (Models 3-5) were negligible. **Thus the effect sizes remained similar to Model 2.** Current and earlier bullying remained associated with subsequent psychotropic medication even after full adjustment (Model 6).

The associations among men were somewhat stronger than among women. After adjusting for age, both current (HR 2.75, 95% CI 1.75-4.33) and earlier bullying (HR 2.37, 95% CI 1.69-3.33) were associated with psychotropic medication among men (Model 1). As among women, the adjustment for previous psychotropic medication led to the strongest attenuation of the association (Model 2), whereas the effects of other covariates were negligible, **and the hazard ratios remained relatively similar to Model 2.** Both current (HR 1.93, 95% CI 1.20-3.10) and earlier bullying (HR 1.71, 95% CI 1.21-2.44) remained associated with psychotropic medication after full adjustment among men (Model 6).

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Table 2. Workplace bullying at baseline and subsequent psychotropic medication (hazard ratios, HR, and their 95% confidence intervals, 95%, CI from Cox regression models)

Workplace bullying	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6	
Women (n=4681)	HR	95% CI	HR	95% CI	HR	95% CI	HR	95% CI	HR	95% CI	HR	95% CI
No	1.00		1.00		1.00		1.00		1.00		1.00	
Yes, currently	1.72	(1.34 -2.19)	1.51	(1.18 -1.93)	1.49	(1.16 -1.90)	1.50	(1.17 -1.92)	1.51	(1.18 -1.93)	1.48	(1.16 -1.89)
Earlier, in this or another workplace	1.56	(1.35 -1.80)	1.31	(1.13 -1.51)	1.29	(1.11 -1.49)	1.31	(1.13 -1.52)	1.30	(1.13 -1.51)	1.29	(1.11 -1.50)
I do not know	1.30	(1.07 -1.57)	1.23	(1.02 -1.49)	1.21	(1.00 -1.47)	1.23	(1.01 -1.49)	1.23	(1.02 -1.49)	1.21	(0.99 -1.46)
Women (n=4681)												
Men (n=1315)												
No	1.00		1.00		1.00		1.00		1.00		1.00	
Yes, currently	2.75	(1.75 -4.33)	2.15	(1.36 -3.41)	1.94	(1.20 -3.13)	2.21	(1.40 -3.49)	2.18	(1.38 -3.43)	1.93	(1.20 -3.10)
Earlier, in this or another workplace	2.37	(1.69 -3.33)	1.94	(1.38 -2.74)	1.85	(1.30 -2.62)	1.94	(1.38 -2.73)	1.82	(1.29 -2.58)	1.71	(1.21 -2.44)
I do not know	1.52	(1.00 -2.30)	1.26	(0.83 -1.92)	1.25	(0.82 -1.91)	1.29	(0.85 -1.97)	1.23	(0.81 -1.86)	1.23	(0.81 -1.87)

Model 1 Age adjusted for; Model 2 Age and previous psychotropic medication adjusted for; Model 3 Age, previous psychotropic medication, and childhood bullying adjusted for; Model 4 Age, previous psychotropic medication, and occupational class adjusted for; Model 5 Age, previous psychotropic medication, and body mass index adjusted for; Model 6 All variables in Models 1-5 adjusted for (full model)

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3 Also observing bullying at workplace was associated with psychotropic medication among
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5 women and men (Table 3). After adjusting for age (Model 1), frequently observing bullying
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7 was associated with psychotropic medication among women (HR 1.78, 95% CI 1.45-2.18).
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9 Previous psychotropic medication attenuated this association (Model 2), whereas the effects
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11 of other covariates, added in the model including age and previous psychotropic medication,
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13 were negligible (Models 3-5). The association remained after full adjustment (Model 6, HR
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15 1.50, 95% CI 1.22-1.84).
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19 Among men, after adjusting for age (Model 1), frequently observing bullying was associated
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21 with psychotropic medication (HR 2.32, 95% CI 1.49-3.61). The association attenuated but
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23 remained after adjustments for covariates (Models 2-5), and after full adjustment (Model 6,
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25 HR 1.65, 95% CI 1.04-2.60). Also sometimes observing bullying was associated with
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27 psychotropic medication among men (HR 1.38, 95% CI 1.02-1.86).
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31 Further analyses examined separately antidepressant medication, as well as sedatives and
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33 anxiolytic medication (data not shown). As the largest part of all psychotropic medication was
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35 antidepressant medication the associations for any psychotropic medication broadly reflected
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37 those for antidepressants. However, when only antidepressant medication was examined, the
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39 associations were slightly stronger.
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Table 3. Observing bullying at workplace at baseline and subsequent psychotropic medication (hazard ratios, HR, and their 95% confidence intervals, 95%, CI from Cox regression models)

Observing bullying at workplace													
		Model 1		Model 2		Model 3		Model 4		Model 5		Model 6	
		HR	95% CI	HR	95% CI	HR	95% CI	HR	95% CI	HR	95% CI	HR	95% CI
Women (n=4681)													
	No	1.00		1.00		1.00		1.00		1.00		1.00	
	Sometimes	1.07	(0.94 -1.22)	1.02	(0.90 -1.17)	1.01	(0.89 -1.16)	1.02	(0.89 -1.16)	1.02	(0.90 -1.17)	1.01	(0.88 -1.15)
	Frequently	1.78	(1.45 -2.18)	1.53	(1.25 -1.88)	1.51	(1.23 -1.85)	1.52	(1.24 -1.86)	1.53	(1.24 -1.87)	1.50	(1.22 -1.84)
	I do not know	1.02	(0.77 -1.35)	0.94	(0.71 -1.24)	0.93	(0.71 -1.23)	0.95	(0.72 -1.25)	0.94	(0.71 -1.24)	0.94	(0.71 -1.24)
Men (n=1315)													
	No	1.00		1.00		1.00		1.00		1.00		1.00	
	Sometimes	1.38	(1.02 -1.86)	1.27	(0.94 -1.71)	1.25	(0.92 -1.69)	1.25	(0.92 -1.69)	1.22	(0.90 -1.65)	1.18	(0.87 -1.59)
	Frequently	2.32	(1.49 -3.61)	1.92	(1.23 -2.99)	1.67	(1.05 -2.67)	1.94	(1.24 -3.02)	1.89	(1.21 -2.94)	1.65	(1.04 -2.60)
	I do not know	1.35	(0.73 -2.48)	1.16	(0.63 -2.15)	1.10	(0.60 -2.04)	1.16	(0.63 -2.13)	1.11	(0.60 -2.04)	1.03	(0.56 -1.91)

Model 1 Age adjusted for; Model 2 Age and previous psychotropic medication adjusted for; Model 3 Age, previous psychotropic medication, and childhood bullying adjusted for; Model 4 Age, previous psychotropic medication, and occupational class adjusted for; Model 5 Age, previous psychotropic medication, and body mass index adjusted for; Model 6 All variables in Models 1-5 adjusted for (full model)

DISCUSSION

Principal findings

A particular aim of this study was to examine the associations of workplace bullying with mental health problems using objective register data on psychotropic medication in a longitudinal study design. Firstly, overall, being bullied was associated with psychotropic medication among both women and men. This association remained after considering previous psychotropic medication and several covariates. Secondly, even earlier bullying was associated with subsequent psychotropic medication among both women and men. Thirdly, also observing bullying at workplace was associated with psychotropic medication, and the association remained after considering the covariates. These findings confirm those from previous cross-sectional studies and in particular corroborate associations found between workplace bullying and self-reported mental health.

Previous studies

Comparability to previous studies is limited, as most studies have relied on cross-sectional designs and self-reported medication. However, our results are in accordance with those from an earlier cross-sectional study, which reported an association between workplace bullying and self-reported psychotropic medication among French employees.⁷ Observing bullying was also associated with psychotropic medication in that earlier study.

Some other, mainly cross-sectional studies examining the associations between workplace bullying or conflicts at work with self-reported use of sleep-induced drugs, tranquilizers, antidepressants, and sedatives have also shown similar associations with ours suggesting adverse consequences of earlier and current bullying or conflicts at work for psychotropic medication.^{1, 8-10, 27, 29, 30} However, not all these studies have focused explicitly on

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3 workplace bullying, and the measurement of psychotropic medication has been limited and
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5 mainly based on single self-reported items. Thus, mental health outcomes have been varied
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7 and objective measurement such as register based psychotropic medication has been lacking.
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9 The findings of our prospective study using objective data on psychotropic medication avoid
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11 reporting bias for medication. Our findings confirm in a longitudinal design the previous
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13 cross-sectional and self-reported findings on the significance of workplace bullying to
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15 employee mental health problems.
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20 The included covariates had but minor contributions to the examined associations. For
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22 example, childhood bullying could have been expected to contribute to the association
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24 between current bullying and psychotropic medication, but its contributions were minor. Of
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26 those reporting childhood bullying, 11% reported that they were currently bullied as well. It
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28 has been shown also earlier that only some of those who have been bullied at school are
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30 bullied at workplace as well.²¹ However, as the validity of retrospective reports on bullying is
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32 limited,³¹ this information does not fully rule out even stronger effects of earlier bullying on
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34 the examined associations. To further confirm the possible effects we excluded those
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36 reporting childhood bullying from the analyses (n=459), but the associations remained, or
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38 slightly strengthened (data not shown). These sensitivity analyses suggest that the data are not
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40 selective to any larger extent and that the results do not reflect sensitivity to the exposure.
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47 Although obesity tends to be stigmatizing, bullied employees likely have only slightly higher
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49 body-mass index.¹⁵ Obesity is also connected to mental health problems.³² Nevertheless,
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51 body-mass index had negligible effects on the examined associations in this study. It is
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53 possible that in younger or other type of employee cohorts than our middle aged public sector
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55 cohort, obesity might be a more sensitive issue. Alternatively, the results suggest that
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3 workplace bullying and its harmful consequences for mental health are unaccounted by
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5 relative weight, and are equally found across bullied employees independent of their body
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7 weight-mass index. Additionally, we conducted sensitivity analyses adjusting for various
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9 other potential confounders related to mental health such as alcohol and smoking but the
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11 results remained unaffected (data not shown). However, it cannot be ruled out that
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13 unmeasured covariates affected the findings. For example negative life events during the
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15 follow-up, independent of earlier bullying, might result to anxiety, depression, and other
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17 mental health problems leading to psychotropic medication.
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24 Psychotropic medication before baseline was adjusted for in our analyses to control for the
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26 contribution of workplace bullying to psychotropic medication independent of prior
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28 medication, which strongly predicted subsequent medication (data not shown). Sensitivity
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30 analyses were conducted excluding all those who had had any psychotropic medication before
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32 the baseline but the results were similar to those after adjusting for prior medication. To avoid
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34 any selection by covariates and redundant loss of data, we retained the full sample. To further
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36 control for potential selection and confounding, and in particular the effects of earlier
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38 psychotropic medication on workplace bullying at baseline and psychotropic medication at
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40 follow-up, marginal structural equation models were fitted.^{33,34} The inverse probability
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42 weights to fit marginal structural models in a point treatment situation was used for
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44 multinomial workplace bullying and observing bullying at workplace.³⁵ Weights were
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46 calculated using sex, age, previous psychotropic medication, childhood bullying, and BMI as
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48 predictors. The results remained unaffected or were even slightly strengthened in these
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50 analyses, suggesting that selection and confounding are unlikely to cause major bias to the
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52 findings of this study. Nonetheless, previous prospective studies have found bidirectional
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54 associations between bullying and mental health suggesting that reverse causation cannot be
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3 excluded^{2,14}. Thus while bullying might contribute to mental health problems, those suffering
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5 from mental problems might be more likely to be bullied, or perceive bullying.
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8 9 10 **Strengths and weaknesses**

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12 Some further weaknesses of this study need to be acknowledged. First, our measures for
13 bullying were based on single questions. We lacked information about the specific time
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15 frame, duration, intensity and number of episodes of bullying. The associations might be
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17 stronger for more persistent, frequent and intense bullying.⁷ However, in a cross-sectional
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19 study, self-reported use of sedatives and hypnotics was not significantly associated with the
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21 duration, history, or frequency of bullying.¹ Bullying is also likely to be remembered and even
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23 single episodes could, therefore, have long lasting effects. Second, negative affectivity has
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25 been suggested as a mediator of the association between bullying and mental symptoms.³⁶ We
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27 were unable to control for such reporting tendency, but its effects are likely minor in our
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29 study where the outcome was derived from objective register data. Third, bullying is a
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31 sensitive issue that may be underreported in surveys. To the extent that this holds for our
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33 study, the results are likely conservative. Underreporting or hiding might also explain why
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35 reporting 'could not say' to questions on bullying had some associations with psychotropic
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37 medication. Fourth, as the only middle-aged employees from the City of Helsinki, Finland,
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39 were included, the results may not be directly generalized to other age groups, cohorts, or
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41 sector of employment. However, there is no particular reason to assume that the associations
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43 of workplace bullying to psychotropic medication would be specific to the current setting. As
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45 earlier cross-sectional studies have already shown that workplace bullying is associated with
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47 self-reported psychotropic medication,^{1, 8-10, 27, 29, 30} this further suggests that the results
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49 probably could apply to other employed groups, too. Finally, a long follow-up period might
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51 dilute the findings and unmeasured confounding, and changes over the follow-up might affect
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3 our findings. However, as we examined the time until the first purchase of psychotropic
4 medication after baseline, and the purchases of medication took place mostly before the end
5 of the five year follow-up, the third factors are unlikely to have affected our results to any
6 larger extent.
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11 A strength of this study was large and prospective cohort including register data linkage on
12 psychotropic medication. As previous studies have mainly been cross-sectional and relied on
13 self-reports of one or few medication groups, our study sheds light on the significance of
14 workplace bullying to objectively measured psychotropic medication and thereby medically
15 confirmed mental health problems more generally. Moreover, we were able to control for
16 various key covariates, and thus our results showed associations of bullying with psychotropic
17 medication independent of age, prior medication, childhood exposures, occupational class,
18 and body-mass index.
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33 **Conclusions**

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36 Our study showed that workplace bullying is associated with subsequent
37 psychotropic medication based on objective register data reflecting medically confirmed
38 mental problems. These associations were found among both women and men. In addition to
39 current workplace bullying, also earlier bullying and observing bullying was associated with
40 psychotropic medication. Workplace bullying needs to be tackled proactively in an effective
41 way to prevent its adverse consequences for mental health.
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Competing interests

The authors have no conflicts of interest to declare except JH is currently or recently conducting research sponsored by Janssen-Cilag, Novartis, Orion Pharma, Abbott, Novo Nordisk Farma, Pfizer, Sanofi-Aventis, Astellas and Takeda.

Authors' contributions

Each author, TL, JH, TP, OR, and EL contributed to the planning of the study and analysis, commented on the manuscript text, as well as approved submission of the final version. TL conducted the analyses and drafted the first version of the manuscript. JH helped in the analyses.

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3 Figure 1. A directed acyclic graph (DAG) of the assumed causal associations between the study variables
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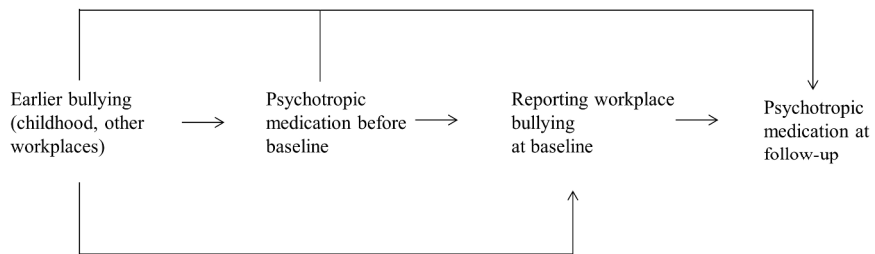
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STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cohort studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(a) Indicate the study's design with a commonly used term in the title or the abstract	1
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	2-3
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4-5
Objectives	3	State specific objectives, including any prespecified hypotheses	5
Methods			
Study design	4	Present key elements of study design early in the paper	6
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	6
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up	6
		(b) For matched studies, give matching criteria and number of exposed and unexposed	
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	6-8
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	6-8
Bias	9	Describe any efforts to address potential sources of bias	6-7
Study size	10	Explain how the study size was arrived at	6-7
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	6-8
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	8
		(b) Describe any methods used to examine subgroups and interactions	n/a
		(c) Explain how missing data were addressed	7-8
		(d) If applicable, explain how loss to follow-up was addressed	6-7
		(e) Describe any sensitivity analyses	15-16
Results			

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	6
		(b) Give reasons for non-participation at each stage	6
		(c) Consider use of a flow diagram	6
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	9
		(b) Indicate number of participants with missing data for each variable of interest	6
		(c) Summarise follow-up time (eg, average and total amount)	
Outcome data	15*	Report numbers of outcome events or summary measures over time	9
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	10-13
		(b) Report category boundaries when continuous variables were categorized	n/a
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	15-16
Discussion			
Key results	18	Summarise key results with reference to study objectives	14
Limitations			
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	15-16
Generalisability	21	Discuss the generalisability (external validity) of the study results	17
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	18

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at www.strobe-statement.org.