

# The role of psychosocial risk factors in the burden of headache

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**Purpose:** Psychosocial risk factors are common in headache patients and affect the impact of headache in multiple ways. The aim of our study was to assess how psychosocial risk factors correlate with the headache impact test-6 (HIT-6). To our knowledge this is the first study to evaluate the impact of several psychosocial factors on the HIT-6 score.

**Patients and methods:** Our study population consisted of 469 Finnish female employees reporting headache during the past year. Psychosocial risk factors were assessed using validated, self-administered questionnaires: the generalized anxiety disorder 7-item scale (GAD-7) for anxiety, the major depression inventory (MDI) for depressive symptoms, the ENRICH short social support instrument (ESSI) for social isolation, the cynical distrust scale for hostility and the Bergen burnout indicator (BBI-15) for work stress.

**Results:** Exploratory factor analysis of the HIT-6 scores revealed two factors, one describing psychological and quality of life aspects affected by headache and the other describing severity of pain and functional decline. Internal consistency of the HIT-6 was 0.87 (95% CI: 0.85–0.89). Correlations between the total HIT-6 score and all measured psychosocial risk factors except for hostility were weak, but statistically significant.

**Conclusion:** The HIT-6 questionnaire has good construct validity and it describes reliably and independently the impact of headache without interference of psychosocial factors in general working-aged female population.

**Keywords:** headache, psychosocial, factor analysis, female employee

## Introduction

Psychiatric comorbidities are more frequent in persons suffering from headache compared to headache-free persons and in large population-based studies depression and anxiety associated both with migraine and with other headaches.<sup>1,2</sup> Also stress and hostility are more common in a headache population.<sup>3–5</sup> The relationship of depression and anxiety with headache is thought to be bidirectional especially in migraine patients, ie depression increases headache symptoms and headache, if frequent, causes depression.<sup>6</sup> Because psychiatric symptoms are common in headache patients, it is important to take also the mental factors into account when assessing the burden of headache and the treatment of headache patients. The headache population in general and occupational practice is more likely to be mildly affected compared to patients attending specialist clinics. Even though the former group of patients might express mental symptoms, such as anxiety, when seeking medical help for pain, it is important to direct the clinical investigation and treatment towards the headache. In headache, as in other pain syndromes, one of the main targets is to prevent the condition from becoming chronic.

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The headache impact test-6 (HIT-6) is a brief and widely used questionnaire to assess headache severity and headache-related disability.<sup>7-9</sup> It is a validated, self-administered six-item questionnaire, consisting of items for pain intensity, social functioning, role functioning, vitality, cognitive functioning, and psychological distress.<sup>7</sup> The HIT-6 is suitable for daily practice to screen headache patients needing special attention regarding treatment.<sup>10</sup> It can also be used in clinical research to measure long-term treatment response.<sup>11,12</sup>

The HIT-6 has been translated into more than 20 languages, including Finnish.<sup>13,14</sup> However, item scale correlation of the HIT-6 item three in the Finnish translation was weak due to identified translation problems.<sup>15</sup> The HIT-6 has been validated in different headache populations using other headache and quality of life questionnaires.<sup>10,16,17</sup> The HIT-6 has also been used as a reference in validation of anxiety questionnaires.<sup>18</sup> Furthermore, correlation of the HIT-6 score with the severity of depression and correlation of depression with psychosocial parameters in headache patients have been reported.<sup>9,19</sup>

To our knowledge, this is the first study to assess the relation of individual HIT-6 items with psychosocial factors, anxiety, depression, stress, social isolation and hostility in a female working-aged population. The aim of the present study is to assess how in a female population psychosocial risk factors correlate with HIT-6, as well as to evaluate the usefulness of the HIT-6 questionnaire in occupational health care.

## Material and methods

### Study population

The subjects for this study were enrolled from the PORTAAT (Pori to Aid Against Threats) study population comprising employees of the city of Pori (83,500 inhabitants) in southwestern Finland during 2014–2015.<sup>20</sup> The study population included workers from ten work units selected by the chief of the welfare unit of Pori. Invitation and study information letters were sent to the employees as an email attachment by the managers of the work units. Librarians, museum employees, ground-keepers, computer workers, social workers, nurses, physicians, administrative officials, and general office staff were invited to an enrollment appointment with the study nurse. Altogether 836 employees (732 females, 104 males) consented to participate in the PORTAAT study. For this subanalysis, we included a total of 469 females, who had

complete data concerning psychosocial risk factors and who answered “yes” to the question “Have you had headache during the past year?” which is the anchor question for the HIT-6 questionnaire. The exact headache diagnosis of the women was not known.

### Demographic and lifestyle data

Demographic and lifestyle data were collected using self-administered questionnaires. Their comprehensiveness was tested in a group of volunteers. Questions assessed marital status (“cohabiting or not”), smoking (“current smoker, non-smoking”, defined as having never smoked or having quit smoking >12 months ago), years of education, quality of sleep (“good” or “not good”) and alcohol consumption (the 3-item alcohol use disorders identification test, AUDIT-C).<sup>21</sup> Financial satisfaction was assessed with the question “Do you have to save on expenditures?” (“yes” or “no”). Leisure-time physical activity (LTPA) was classified as follows: high: LTPA for  $\geq 30$  minutes at a time, four or more times a week; moderate: LTPA for  $\geq 30$  minutes at a time, two to three times a week; low: LTPA for  $\geq 30$  minutes at a time for a maximum of once a week. Quality of life was assessed using the EuroQol questionnaire (EQ-5D), which comprises five dimensions of health: mobility, self-care, usual activities, pain/discomfort and anxiety/depression.<sup>22</sup> The level of the problem on each dimension can be reported as “no”, “moderate” or “extreme” problems. These health states may be converted into a single summary index by applying the choice-based method of the time trade-off using the UK's general population.<sup>23</sup> The number of days on sick leave due to any sort of pain was measured by asking “How many days of work have you missed (sick leave) because of pain during the past 12 months?”.

Trained study nurses measured height, weight and blood pressure of each subject. Body mass index (BMI) was calculated as weight (kg) divided by height squared ( $m^2$ ).

### The HIT-6 questionnaire

The HIT-6 is a six-item, self-administered questionnaire including three questions assessing headache during the past 4 weeks and three questions about headaches with no time limit.<sup>7</sup> The construct validity of the HIT-6 questionnaire is good and it has been found to have good internal consistency (Cronbach's  $\alpha = 0.90$ ) and test-retest reliability (Cronbach's  $\alpha = 0.78$ ).<sup>7</sup> HIT-6 questions concern the following items: (1) frequency of severe pain; (2) ability to do usual daily activities; (3) need to lie down; (4)

tiredness; (5) irritation; and (6) ability to concentrate.<sup>8</sup> The HIT-6 is scored by giving a value for each question (never=6, rarely=8, sometimes=10, very often=11 and always=13). The total score is the sum of the scores on all six questions. On the basis of the total score, the HIT-6 categorizes patients into four levels of headache impact: little or no impact (<50), some impact (50–55), substantial impact (56–59) and very severe impact (≥60).

The study subjects filled in the new Finnish version of the HIT-6 questionnaire, which was produced by the forward-backward translation process.<sup>13</sup> A new Finnish translation was done, because of problems in the earlier Finnish version of HIT-6.<sup>15</sup> Translation from English to Finnish was first performed by five native speakers of Finnish fluent in English. A native English speaker fluent in Finnish and previously unfamiliar with the HIT-6 translated this Finnish translation back to English. This translation was compared to the original English HIT-6 for conceptual equivalence. The new Finnish translation was performed without the approval of OptumInsight Life Sciences (QualityMetrics), however, a retroactive license has since been issued.

## Questionnaires for psychosocial risk factors

Psychosocial risk factors, anxiety, depression, social isolation, hostility and work stress were assessed using standardized self-administered questionnaires. Because the PORTAAT study analyses mainly cardiovascular risk factors, the psychosocial risk factors for the present study were selected according to the European 2012 guidelines on cardiovascular disease prevention in clinical practice.<sup>24</sup>

### Anxiety

Anxiety was assessed by the generalized anxiety disorder 7-item scale (GAD-7). The total score ranges from 0 to 21; 0–4= no or little anxiety, 5–9= some anxiety, 10–15= substantial anxiety and 16–21= severe anxiety; score of 10 or more has 89% sensitivity and 82% specificity for generalized anxiety.<sup>25</sup>

### Depression

Depression was assessed using the major depression inventory (MDI).<sup>26</sup> The MDI is a self-rated questionnaire consisting of 10 items. It measures depressive symptoms during the past 2 weeks on a 6-point Likert-type scale from 0= never to 5= all the time. The total score ranges from 0 to 50, a high score indicating a high number of

depressive symptoms, and the optimal cut-off score of 26 indicating major (moderate to severe) depression.

### Social isolation

Social isolation was studied using the ENRICH short social support instrument (ESSI).<sup>27</sup> The ESSI is composed of six items estimating the amount of received social support with a 5-point Likert-type scale from 0=never to 4=always. The total score range is 0 to 24, a lower score indicating higher level of social isolation. This is the first study to use this questionnaire in a headache population.

### Hostility

Hostility was measured using the cynical distrust self-administered questionnaire (cynical distrust scale) consisting of eight items rated on a 5-point Likert scale from completely disagree to completely agree.<sup>28</sup> The total score range is 8 to 32, a lower score indicating a higher level of hostility. This is the first study to use this questionnaire in a headache population.

### Work stress

Work stress was evaluated by the Finnish Bergen Burnout Indicator (BBI-15).<sup>29</sup> The BBI-15 measures occupational burnout using 15 questions. The answers are given using Likert-type scales from 1 to 6 (1= completely disagree to 6= completely agree), that are summed up to score from 15 to 90, a high score indicating a high level of work stress. This is the first study to use this questionnaire in a headache population.

## Statistical analysis

The characteristics of the study population are presented as means with SD or as medians with IQR or as counts with percentages. Internal consistency was estimated by calculating Cronbach's alpha internal consistency with bias corrected bootstrap and 95%CI. An exploratory factor analysis with the iterated principal-factor method for factoring and promax-rotated factor loadings on polychoric correlation matrix was performed to identify related items in the HIT-6 questionnaire. Promax rotation is an alternative nonorthogonal rotation method. The strategies used to extract the number of factors were: the Kaiser criteria, which determine that components with eigenvalues lower than one should be excluded and the screen test of Cattell criteria. Item analysis of the HIT-6 scales was performed by analyzing item discriminating power (corrected item correlation) and item difficulty (item mean) depicted by the exploratory data analysis. Corrected item correlation

was estimated using polyserial correlations. Adjusted correlation (partial) coefficients of HIT-6 and psychosocial factors were calculated by the Pearson method, using Sidak adjusted probabilities. Correlation coefficients less than 0.20 were considered very weak, between 0.20 and 0.39 weak, between 0.40 and 0.59 moderate, between 0.60 and 0.79 strong, and above 0.79 very strong.<sup>30</sup> Multivariate regression analyses were used to identify the psychosocial factors of the HIT-6 using standardized regression coefficients beta ( $\beta$ ). The  $\beta$  value is a measure of how strongly each predictor variable influences the criterion (dependent) variable. The  $\beta$  is measured in units of standard deviation. Cohen's standard for  $\beta$  values above 0.10, 0.30 and 0.50 represent small, moderate and large relationships, respectively. The floor and ceiling values representing the percentages of the females, who obtained the lowest or highest scores, were calculated for each HIT-6 item separately. The floor and ceiling effects are considered to be present if more than 15% of the respondents achieve the lowest or highest possible scores.<sup>31</sup> Statistical significance was set a priori at  $P < 0.05$ . All statistical analyses were carried out with Stata, version 15.0 (StataCorp, College Station, TX, USA).

## Results

We evaluated 469 female employees, who had suffered from headache during the past year. The baseline characteristics of the subjects are shown in Table 1. Figure 1 shows the distribution of the HIT-6 scores in the study population. The mean (SD) of the HIT-6 score was 48 (8), range 36–68.

All study subjects responded to all six HIT-6 items. Table 2 shows the mean scores (SD) of the items and the floor and ceiling effects. The floor effect was clearest in the questions concerning the impact of headache on the quality of life (items 4 to 6).

Exploratory factor analysis of the HIT-6 scores revealed two factors; factor 1 (items 4 to 6) describes quality of life and psychological aspects affected by headache, and factor 2 (items 1 to 3) severity of headache and functional decline (Table 3). These factors explained 95% of the total variance. Significant positive correlation between factor 1 and factor 2 was detected ( $r = 0.58$ , 95% CI: 0.51–0.64).

Item analysis of the HIT-6 showed that all items had a good overall item correlation (Figure 2). Items 1 and 3 (severity of headache and functional decline) showed the highest mean values. Internal consistency of the HIT-6 was (Cronbach's  $\alpha$  coefficient) 0.87 (95%CI: 0.85–0.89).

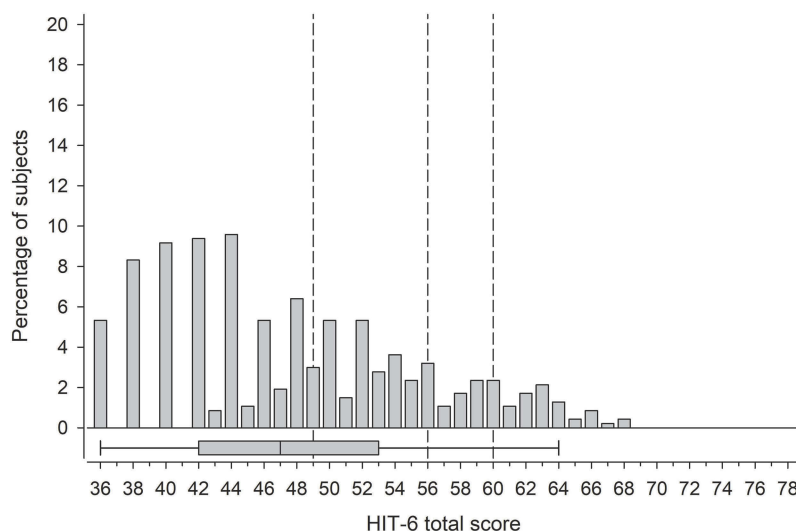
**Table 1** Characteristics of the 469 study subjects

Variable	Measures
Age, years, mean (SD)	48 (10)
BMI, kg/m <sup>2</sup> , mean (SD)	26.8 (5.0)
Smoking, N (%)	42 (9)
Living with spouse, N (%)	435 (93)
Satisfied with financial situation, N (%)	331 (71)
Education years, mean (SD)	14.0 (2.7)
Sick leave days due to pain during the last 12 months, median (IQR)	2 (0, 8)
Leisure-time physical activity, N (%)	
Low	98 (21)
Moderate	204 (43)
High	167 (36)
Quality of life (EQ-5D), mean (SD)	0.86 (0.14)
Good sleep quality, N (%)	354 (75)
Alcohol consumption (AUDIT-C score), mean (SD)	2.7 (1.6)
Psychosocial risk factors, mean (SD)	
Anxiety (GAD-7)	3.1 (3.4)
Depressive symptoms (MDI)	5.4 (5.6)
Social isolation (ESSI)	21 (3)
Hostility (CDS)	22 (6)
Work stress (BBI-15)	32 (11)
Blood pressure, mmHg, mean (SD)	
Systolic	131 (7)
Diastolic	84 (10)

**Abbreviations:** BMI, body mass index; EQ-5D, EuroQol questionnaire; AUDIT-C alcohol use disorders identification test; GAD-7, generalized anxiety disorder 7-item scale; MDI, major depression inventory; ESSI, the ENRICH short social support instrument; CDS, cynical distrust scale; BBI-15, Bergen burnout indicator.

Correlations between the HIT-6 factor 1, HIT-6 factor 2 and psychosocial factors adjusted for age and education years are shown in Table 4. Adjustment for age and education was made because both variables affect the incidence of headache.<sup>32,33</sup>

A statistically significant positive correlation was found between the HIT-6 total score and depression, anxiety and stress and a statistically significant negative correlation between HIT-6 total score and social isolation. The HIT-6 factor 1 (quality of life and psychological aspects affected by headache) had a statistically significant positive correlation with depression and anxiety and a negative correlation with social isolation. In turn, the HIT-6 factor 2 (pain severity and intensity) had statistically significant positive correlation with anxiety, depression and stress. There were no statistically significant relationships between the total HIT-6 score and psychosocial factors (Figure 3).



**Figure 1** Histogram of the HIT-6 total scores in the study population. Box-and-whiskers plot shows median and IQR, and whiskers indicate 5th and 95th percentiles. Dotted lines show the HIT-6 categories (headache impact): little or no impact (score <50), some impact (50–55), substantial impact (56–59) and severe impact (≥60).

**Abbreviation:** HIT-6, headache impact test-6.

**Table 2** Mean scores (SD) of the HIT-6 items in study population and floor and ceiling effects

HIT-6 Item	Mean (SD)	Floor <sup>a</sup> %	Ceiling <sup>b</sup> %
1	8.7 (1.7)	16.8	0.6
2	8.0 (1.6)	30.5	0.2
3	9.0 (1.9)	17.3	5.3
4	7.4 (1.6)	50.1	0.2
5	7.3 (1.6)	54.5	0.4
6	7.5 (1.6)	46.7	0.6
Total HIT-6	48 (8)	5.3	0.0

**Notes:** <sup>a</sup>Best possible value of the item. <sup>b</sup>Worst possible value of the item. The floor and ceiling values representing the percentages of females, who obtained the lowest or highest scores, were calculated for each HIT-6 item separately.

**Abbreviation:** HIT-6, headache impact test-6.

**Table 3** Exploratory factor analysis with promax-rotated factor loadings of the HIT-6 items. Coefficients with values <0.40 not shown

HIT-6 item	Factor 1	Factor 2
Item 1		0.63
Item 2		0.86
Item 3		0.76
Item 4	0.77	
Item 5	0.88	
Item 6	0.85	

**Abbreviation:** HIT-6, headache impact test-6.

## Discussion

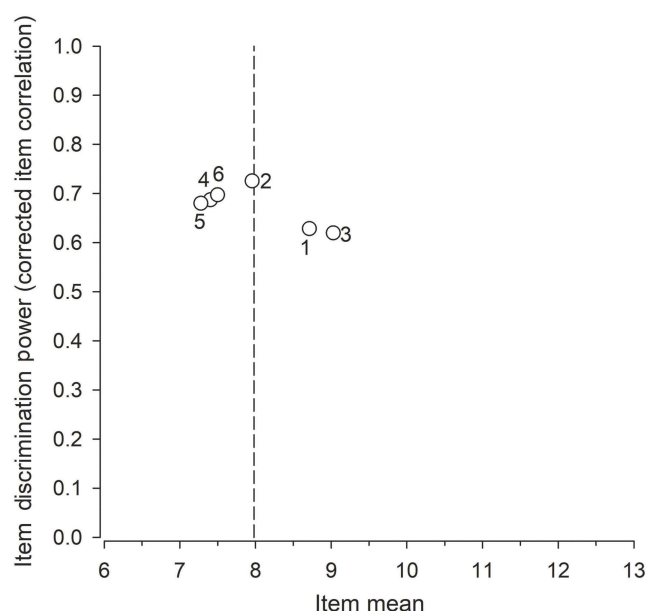
Our study showed that apart from hostility, the correlations of the HIT-6 total score with all measured psychosocial

risk factors were weak, although statistically significant. This implies that in occupational health care the HIT-6 specifically describes the impact of headache without being confounded by psychosocial factors in a female population. Our study also indicated that the HIT-6 questionnaire can be divided into two factors: factor 1 describing the psychological stress and impaired quality of life and factor 2 expressing the intensity of and the physical deterioration caused by headache. The HIT-6 item discriminatory power was good and the factorial nature of the questionnaire became evident in the item analysis.

In the present study a floor effect was observed for both factors 1 and 2. It was strong for factor 1 describing psychological effects and impaired quality of life. This was expected, because our study population consisted of females with preserved work ability and without prominent problems or functional decline caused by headache. In contrast, factor 2 showed less floor effect and, therefore, a larger variety of pain intensity and impairment of functionality.

According to earlier studies the HIT-6 is feasible in general practice.<sup>10</sup> Our study supports earlier HIT-6 validation studies showing that the new Finnish version of HIT-6 reliably measures the burden of headache. On the basis of earlier studies we know that anxiety, depression and stress are common in headache patients and that they increase the impact of headache and impair daily functioning.<sup>34</sup> There are only a few studies correlating the HIT-6 with psychological risk factors but no previous studies have assessed the relation of individual HIT-6 items with psychosocial factors.<sup>9,16,19,35</sup> These studies





**Figure 2** Item analysis for the HIT-6 items. The line denotes total mean of all items. Numbers indicate corresponding items in the HIT-6.  
**Abbreviation:** HIT-6, headache impact test-6.

**Table 4** Correlations between the HIT-6 and psychosocial factors (adjusted by age and education years)

	HIT-6 factor		HIT-6
	1	2	Total
Depression (MDI)	0.19*** (0.09 to 0.29)	0.13* (0.03 to 0.23)	0.18*** (0.08 to 0.28)
Anxiety (GAD-7)	0.19*** (0.09 to 0.27)	0.13* (0.03 to 0.22)	0.17** (0.06 to 0.26)
Social isolation (ESSI)	-0.15** (-0.23 to -0.06)	-0.10 (-0.19 to -0.02)	-0.14* (-0.23 to -0.05)
Hostility (CDS)	-0.10 (-0.19 to -0.02)	-0.09 (-0.18 to -0.01)	-0.10 (-0.20 to -0.02)
Stress (BBI-15)	0.10 (0.01 to 0.19)	0.17*** (0.08 to 0.26)	0.15** (0.06 to 0.24)

**Notes:** \* $P < 0.05$ , \*\* $P < 0.01$ , \*\*\* $P < 0.001$ ; Sidak-adjusted (multiplicity adjustment) probabilities. 95%CI obtained by bias-corrected bootstrapping (5,000 replications) for multiplicity adjustment.

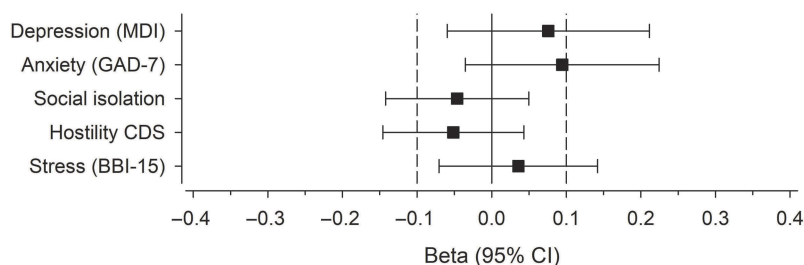
**Abbreviations:** HIT-6, headache impact test-6; GAD-7, generalized anxiety disorder 7-item scale; MDI, major depression inventory; ESSI, ENRICH short social support instrument; CDS, cynical distrust scale; BBI-15, Bergen burnout indicator.

show that patients with higher HIT-6 scores have higher depression scores. Breslau et al reported that the correlation between headache and depression is bidirectional;

patients with more headaches are prone to depression and depressed patients are prone to have more headaches.<sup>6</sup> The evidence of a relationship between depression and other headaches has also been documented.<sup>19</sup> Our study shows that in a female occupational population the HIT-6 (ie impact of headache) correlates only weakly, but statistically significantly, with the psychosocial factors. This denotes that the HIT-6 focuses on the burden caused by headache per se, which is important in selecting appropriate treatment options.

In the present study, hostility was the only psychosocial factor lacking correlation with the HIT-6 items. The significance of this observation remains obscure and is complicated by the fact that hostility has been primarily defined for research purposes and not routinely used in clinical evaluation.

The strength of our study is that the study population was well characterized and consisted of a relatively large cohort of female employees. The questionnaires used to measure psychosocial risk factors are valid and reliable. The new translation of the Finnish HIT-6 questionnaire was produced and validated according to recommendations.<sup>13</sup> Although there was some variability in occupational tasks, our study population consisted of employees having a relatively homogeneous cultural background. Only female employees were included in this substudy, because the total number of males in the PORTAAT study was low from the beginning and only a



**Figure 3** Multivariate relationships between the total HIT-6 score and psychosocial factors ( $\beta$ -values with 95% confidence intervals). Dotted line shows small (beta 0.10) magnitude of effect size.

**Abbreviations:** GAD-7, generalized anxiety disorder 7-item scale; MDI, major depression inventory; ESSI, ENRICH short social support instrument; CDS, cynical distrust scale; BBI-15, Bergen burnout indicator; HIT-6, headache impact test-6.

few men had headache. Exclusive enrollment of female participants also contributed to the homogeneity of the study population and the reliability of the results. This is important because psychosocial risk factors and headache characteristics are different in women and men.<sup>36</sup>

A limitation of the study was that we did not know the exact diagnoses of headache in our study population. However, this should not significantly affect our conclusions, since the HIT-6 has been validated in many different headache populations. Because of the inclusion criteria, females with few headaches in the past year and probably only few females with chronic headache were included in the study. This might skew the results and underestimate the impact of psychiatric symptoms. Future studies are needed to estimate the interrelationship of HIT-6 items and psychosocial risk factors in specific headache populations, eg episodic migraineurs and chronic headache patients.

There was no substantial psychological burden or impairment in quality of life in our study population consisting of females with preserved work ability. This raises the question of whether the correlation between HIT-6 and psychosocial risk factors would be different in a disabled population, eg those with chronic tension type headache or chronic migraine. Further studies are warranted to define how psychosocial factors affect the HIT-6 scores in females with disabling headache.

## Conclusion

Our study shows that the HIT-6 has good construct validity in a female occupational population, and that its items can be divided into two factors, which describe separate categories of headache impact: the pain itself and its psychological impact. In our study population the correlations between the HIT-6 total score and all psychosocial risk factors measured (except for hostility) were weak, but statistically significant. This indicates that, in female employees, the HIT-6

questionnaire measures specifically the impact of headache without distortion by psychosocial factors. In general and occupational practice a high HIT-6 score indicates the need to actively treat the headache, based on correct headache diagnosis and etiologic targeting of the therapy.

## Ethical approval and consent to participate

The study protocol and consent forms were reviewed and approved by the Ethics Committee of the Hospital District of Southwestern Finland. All participants provided written informed consent for the project and subsequent medical research.

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## Author contributions

All authors participated in planning the study. Kirsi Malmberg-Ceder and Päivi E Korhonen collected the data. Hannu Kautiainen carried out the statistical analyses. All authors contributed toward data analysis, drafting and critically revising the paper, gave final approval of the version to be published, and agree to be accountable for all aspects of the work.

## Disclosure

Maija Haanpää reports personal fees from Abbvie, Astellas, and Pfizer, outside the submitted work. The

other authors report no conflicts of interest in this work.

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