Nightmares: Risk Factors Among the Finnish General Adult Population

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Study Objectives: To identify risk factors for experiencing nightmares among the Finnish general adult population. The study aimed to both test whether previously reported correlates of frequent nightmares could be reproduced in a large population sample and to explore previously unreported associations.

Design: Two independent cross-sectional population surveys of the National FINRISK Study.

Setting: Age- and sex-stratified random samples of the Finnish population in 2007 and 2012.

Participants: A total of 13,922 participants (6,515 men and 7,407 women) aged 25–74 y.

Interventions: N/A.

Measurements and results: Nightmare frequency as well as several items related to socioeconomic status, sleep, mental well-being, life satisfaction, alcohol use, medication, and physical well-being were recorded with a questionnaire. In multinomial logistic regression analysis, a depression-related negative attitude toward the self (odds ratio [OR] 1.32 per 1-point increase), insomnia (OR 6.90), and exhaustion and fatigue (OR 6.86) were the strongest risk factors for experiencing frequent nightmares ($P < 0.001$ for all). Sex, age, a self-reported impaired ability to work, low life satisfaction, the use of antidepressants or hypnotics, and frequent heavy use of alcohol were also strongly associated with frequent nightmares ($P < 0.001$ for all).

Conclusions: Symptoms of depression and insomnia were the strongest predictors of frequent nightmares in this dataset. Additionally, a wide variety of factors related to psychological and physical well-being were associated with nightmare frequency with modest effect sizes. Hence, nightmare frequency appears to have a strong connection with sleep and mood problems, but is also associated with a variety of measures of psychological and physical well-being.

Keywords: adult, epidemiology, depression, dreaming, insomnia, nightmare, risk factor

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INTRODUCTION

Nightmares are vivid dreams containing intense negative emotions that can result in the dreamer awakening from sleep.[1,2] There is no universally accepted definition of a nightmare,[3–7] and studies on nightmares therefore tend to have disparate ways of defining the phenomenon under investigation. Regardless, population-level studies have mostly produced comparable results concerning the prevalence and correlates of nightmares, even when using different questions and definitions to measure them.

Among the general adult population, nightmares are not uncommon: 2–6% of adults report frequent nightmares (typically defined as one or more per week), and 35–45% report at least one nightmare per month.[8–13] Women have consistently been found to report more nightmares than men, with the sex difference being largest among young adults.[8,14,15] Most studies have also reported an age effect, i.e., that nightmares are most prevalent among children and adolescents,[16,17] whereas among adults they become more common with advancing age.[8,15] Nightmare prevalence is also elevated among populations with a high probability of having been exposed to traumatic events, such as war veterans.[8]

Several prior studies have shown that frequent nightmares are associated with a variety of mental disorders, including mood and anxiety disorders as well as psychotic symptoms.[9,10,18–21] Repeated posttraumatic nightmares are also one of the defining symptoms of posttraumatic stress disorder,[1,22] and frequent nightmares constitute an independent risk factor for attempted as well as completed suicide.[19,23–25]

Nightmares often co-occur with other sleep problems, especially insomnia[9,17,19,20] and related symptoms of daytime fatigue.[9,19] Their frequency is also affected by sleep duration independently of insomnia symptoms. In a study on nightmare prevalence in adolescents,[17] it was found that nightmares were more common among those who slept more than 9 h or less than 7 h per night compared with those who slept 7–9 h. In addition to sleep duration, nightmares are also associated with the evening chronotype, at least in women.[26,27]

Medication that affects the structure of rapid eye movement-nonrapid eye movement (REM-NREM) cycles may induce nightmares in some users.[28] Widely prescribed drugs of this kind include beta-blockers and some selective serotonin reuptake inhibitors. Ethanol also has REM sleep-suppressing properties, and alcohol use and especially withdrawal may

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Table 1—The number of participants in each survey.

	Survey 2007	Survey 2012	Total
Standard questionnaire	7,664	6,258	13,922
Female	4,106 (54%)	3,301 (52%)	7,407 (53%)
Male	3,558 (46%)	2,957 (48%)	6,515 (47%)
Additional questionnaire	3,838	4,729	8,567
Female	2,067 (54%)	2,585 (55%)	4,652 (54%)
Male	1,771 (46%)	2,144 (45%)	3,915 (46%)

All participants who completed the additional questionnaires also completed the standard questionnaire.

consequently cause nightmares in some individuals.[28,29] A connection between nightmare frequency and a low socioeconomic status has also been observed in some studies,[9,20] while being absent in others.[13]

Certain personality traits may be risk factors for nightmares, but large empirical studies on the topic are scarce. Hartmann has proposed that having a thin-boundary personality type that is characterized by a vivid imagination and openness to experiences makes a person more vulnerable to nightmares.[30] More recently, Nielsen and Levin have proposed a neurocognitive model of nightmare etiology,[14,31] in which they argue that a common denominator for many different correlates of nightmares is a "personality style characterized by intense reactive emotional distress".

The current study explored the risk factors for nightmares in a large representative population-based sample of Finnish adults. Our aim was to test whether the associations between nightmares and various risk factors identified by previous research could be replicated in a representative population-based sample as well as investigate several previously unexplored risk factors. Our comprehensive dataset enabled us not only to test these associations, but to compare the magnitude of effect sizes of different correlates to determine whether they are minor or major risk factors for frequent nightmares. This has not been possible in prior studies, in which fewer predictor variables have simultaneously been available.

METHODS

The FINRISK Study

The National FINRISK Study is a series of health surveys of the Finnish general adult population conducted every 5 y since 1972. The surveys include a questionnaire that is mailed to the participants and a health examination at the local primary healthcare center, where the completed questionnaire is returned and checked by a nurse. In the current study, data from the FINRISK surveys of 2007 and 2012 were used. These surveys were chosen because they included the most comprehensive array of questions about sleep and mental health, many of which were absent from older surveys. In addition, these surveys did not include veterans of World War II who were present in earlier surveys. The presence of war veterans is known to elevate nightmare prevalence at the population level.[8]

The survey participants were randomly drawn from population registers of the study regions according to standardized procedures. In 2007, 12,000 people were invited to participate, with the final response rate being 67%. In 2012, 10,000 people were invited and 65% of them participated. Because both samples were randomly drawn, 42 participants (0.3%) answered both surveys by chance. These participants did not receive any special treatment in the analysis. Additional information on the sampling and the FINRISK study can be found on the Epidemiological and Clinical Finnish Sample Collections website.[32] The FINRISK surveys of 2007 and 2012 received approval from the Coordinating Ethical Committee of Helsinki and Uusimaa Hospital District, and written informed consent was obtained from the participants.

Participants

Combined, the surveys of 2007 and 2012 included 13,922 participants, of whom 53% were female. The age range of participants was 25–74 y (standard deviation 14.05, mean 50.92, median 52). In both surveys, all the participants received a standard FINRISK questionnaire, and some participants also received additional questionnaires. In 2007, 67% of participants received an additional questionnaire containing variables of interest, and in 2012, those who participated in the physical examination were given an additional questionnaire to be completed at home. The return rate of this questionnaire was 86%. The exact number of participants completing each questionnaire is presented in Table 1.

The Questionnaire Items

The questionnaire item about nightmares in the FINRISK surveys is as follows: "*During the past 30 days, have you had nightmares*", with the response options "*often; sometimes; never*". No definition of a nightmare is provided to the participants.

We analyzed the association between the response to the nightmare question and 60 other items. A complete list of these items can be found in the electronic supplement. Some of the questions of interest were only present in the subsamples of the surveys, or only in one of the surveys, so N for single items varies from 3,838 to 13,922.

In addition to single items, the association of four instruments with nightmares was investigated. These included a Finnish translation of the 13-item Beck Depression Inventory (BDI-SF-13), a Finnish translation of the short Cynical Distrust Scale (CynDis), a part of the Job Content Questionnaire (JCQ), and a Finnish translation of the shortened Morningness-Eveningness Questionnaire (MEQ).

The BDI-13 used in the FINRISK surveys includes items 1, 2, 3, 4, 5, 7, 9, 12, 13, 14, 15, 17, and 18 of the original BDI-21. The BDI-13 has been found to be an effective screening tool for depression among adults.[33,34] For some analyses, the BDI scores were categorized to mild (5–7), moderate (8–15), and severe (over 16) depressive symptoms.[34] In our data, the BDI-13 was included in the additional questionnaires of both surveys. It yielded a Cronbach alpha of 0.86 and 0.87 in the 2007 and 2012 survey, respectively.

The CynDis scale is a shortened version of the Cook-Medley hostility scale[35] that has been found in factor analysis to have

high internal consistency. It includes eight items consisting of statements such as "Nobody really cares what happens to others" and "It is safer not to trust anybody", with response options on a four-point Likert scale. Higher scores on the scale mean that the person is more trusting. The CynDis was only included in the standard questionnaire of the FINRISK survey of 2007, and in that dataset it yielded a Cronbach alpha of 0.85.

The part of the JCQ used in the FINRISK surveys includes three questions about job demands (JCQ category 2) and three questions about job control (JCQ category 1b), which are the most important dimensions of work-related stress according to the Karasek demand/control model.[36,37] The JCQ was part of the standard questionnaire in 2007 and included in the additional questionnaire in 2012. In the survey of 2007, Cronbach alpha of the job control category was 0.79 and that of the job demand category 0.78, whereas in the 2012 survey the corresponding values were 0.82 and 0.78, respectively.

The MEQ[38] is a widely used questionnaire for self-determining the chronotype. The original MEQ was validated by measurements of circadian variation in the oral temperature. The FINRISK surveys include items 4, 5, 9, 15, 17, and 19 of the original MEQ. The MEQ was a part of the standard questionnaire in the 2007 survey and the additional questionnaire in the 2012 survey.

Statistical Methods

For the analysis of single associations we conducted Pearson chi-square (χ^2) tests for categorical and one-way analysis of variance (ANOVA) for continuous variables. It should be noted that most of the continuous variables tested were not normally distributed and were resistant to log transformation (BDI-13, CynDis, Life satisfaction), but because of the large sample size and the robustness of ANOVA parametric testing, the method was considered appropriate. Cramer V was used as a measure of the effect sizes for categorical variables and eta squared (η^2) for the continuous variables. The scale of these effect size measures is different: For Cramer V, 0.1 is considered a small but meaningful association, and for eta squared, 0.01 constitutes a meaningful level. To correct for the increased possibility of falsely positive results because of multiple hypothesis testing in the same data, we chose 0.001 as the level of statistical significance for the testing of single associations.

Confirmatory factor analysis with maximum likelihood extraction and varimax rotation was used to split the BDI-13 into components for some analyses, and multinomial logistic regression was used for multivariable modeling. The alpha level of 0.01 was used during the multivariate analysis. The analyses were performed with SPSS for Windows version 21 (Armonk, NY: IBM Corp).

RESULTS

Overall, 3.9% of the participants reported having had frequent nightmares during the previous 30 days, whereas 45.5% reported having had nightmares occasionally, and 50.6% reported no nightmares at all. There was no statistically significant difference between the surveys of 2007 and 2012 in nightmare prevalence ($\chi^2(2, n = 13{,}922) = 3.56$, $P = 0.167$), and the data from the surveys were therefore pooled in subsequent analyses.

Sociodemographic Factors

The sociodemographic factors most strongly associated with nightmare frequency were sex and employment status. Women had more nightmares than men: 4.8% of women and 2.9% of men reported frequent nightmares (χ^2, $P < 0.001$; Cramer V, 0.102). Nightmare prevalence increased statistically significantly with advancing age among men (χ^2, $P < 0.001$; Cramer V 0.076), but remained stable in women. More detailed analyses of the association between age, sex, and nightmares in these data are discussed in Sandman et al.[8] Frequent nightmares were more common among unemployed and retired participants (6.0–7.1%) than the employed and students (2.7–3.9%). The effect size of this association was larger among men than women (χ^2, $P < 0.001$; Cramer V, 0.101 for men and 0.065 for women).

A higher body mass index, lower education level, lower household income, and smaller household size were all associated with increase in nightmare frequency (χ^2, $P < 0.001$). Marital status was associated with nightmares among men, with divorced or widowed men reporting frequent nightmares more often (5.5%) than men who were single or in a relationship (2.6–2.8%). This association was not found among women. However, the effect sizes of all these associations were very small (Cramer V, 0.2–0.8). There was no significant association between nightmares and being pregnant (χ^2, $P = 0.210$). Full analyses can be found in Table S1 (supplemental material).

Sleep Related Factors

Insomnia was the single strongest correlate of nightmares (χ^2, $P < 0.001$; Cramer V, 0.240). Of participants who reported frequent insomnia, 17.1% also reported frequent nightmares, whereas only 1.3% of participants without insomnia symptoms reported frequent nightmares. Dissatisfaction with the amount of sleep (χ^2, $P < 0.001$; Cramer V 0.098), feeling exhausted (χ^2, $P < 0.001$; Cramer V, 0.208), and having frequent headaches (χ^2, $P < 0.001$; Cramer V, 0.172) were also strongly associated with nightmares.

Sleep duration had a clear U-shaped association with nightmare frequency, as can be seen from Figure 1, but the effect size of this association was small (χ^2, $P < 0.001$; Cramer V, 0.070). The evening chronotype was associated with nightmares in women: 7.5% of female evening types reported frequent nightmares compared with only 2.7% reported by female morning types (χ^2, $P < 0.001$; Cramer V 0.067) but the effect size of this association was small. There was no significant association between nightmares and chronotype among men. Finally, those participants who reported having moderate to serious problems with changes in mood and sleeping patterns because of seasonal variation (in light) reported significantly more nightmares than those who did not have such problems (χ^2, $P < 0.001$; Cramer V, 0.205). Full analyses can be found in Table S2 (supplemental material).

Psychological Well-Being

Depressive symptoms measured by the categorized BDI-13 (χ^2, $P < 0.001$; Cramer V, 0.211) and the self-report of having received a depression diagnosis from a doctor (χ^2, $P < 0.001$; Cramer V, 0.212) were strongly associated with frequent nightmares. Of the participants who had severe depressive

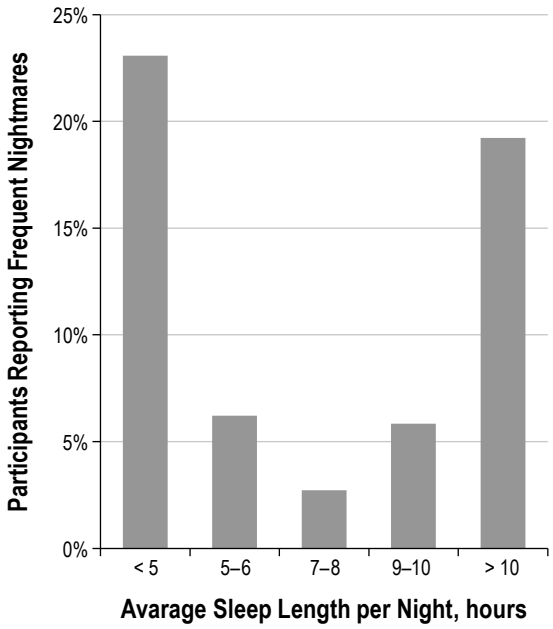

Figure 1—The association between sleep duration and nightmare frequency is U-shaped. N = 13,708.

symptoms (BDI score over 16), 28.4% reported frequent nightmares. Among those who had no depressive symptoms (BDI score < 5), the respective figure was 1.6%. A self-reported diagnosis of any other mental disorder (χ^2, P < 0.001; Cramer V, 0.093) had a weaker but still significant association with nightmare frequency, as did the self-reported working ability of the participant (χ^2, P < 0.001; Cramer V, 0.137). Exact figures can be found in Table S3 (supplemental material).

Continuous BDI scores were associated with nightmares with large effect size (F, P < 0.001; η^2, 0.090), with frequent nightmare sufferers having higher BDI scores. The association between cynical distrust scale and nightmares had small effect size (F, P < 0.001; η^2, 0.030) with frequent nightmare sufferers having lower scores that represent less trusting personality.

JCQ job control and job demand scores had significant associations with nightmare frequency, with a larger effect size among women (control: P < 0.001, η^2 0.011; demand: P < 0.001, η^2 0.010) than men (control: P < 0.001, η^2 0.006; demand: P < 0.001, η^2 0.008), but the effect sizes and *post hoc* tests imply that this association was weak. Full analyses of continuous variables can be found in Tables S9–S11 (supplemental material).

To further investigate the connection between the BDI score and nightmares, we performed explorative common factor analysis with maximum likelihood extraction and varimax rotation on the BDI and extracted three factors: a negative attitude toward self, lowered mood, and performance impairment.

Factor 1 consisted of questions 3, 5, 6, 7, and 10 of the BDI-13, which measure negative attitude toward self. It had an initial eigenvalue of 5.12, and after rotation explained 17.15% of the variance. Factor 2 included questions 1, 2, and 6, which measure lowered mood. Its eigenvalue was 1.14 and it explained 12.78% of the variance. Factor 3 included questions 8, 9, 11, 12, and 13, measuring daily performance impairment. It had an initial eigenvalue of 0.90 and explained 12.16% of the variance. The performance impairment factor includes questions concerning working ability and exhaustion that are also measured with other similar questions in the FINRISK questionnaire. The three-factor solution is theoretically justifiable and has previously been reported.[39] Factor loadings can be found in Table S13 (supplemental material).

A multinomial regression model only including the three BDI factors revealed that they all associate similarly with nightmares: For a one-point increase in factor scores, the OR of experiencing frequent nightmares increases by 1.22 for a negative attitude toward self, 1.25 for lowered mood, and 1.40 for performance impairment (P < 0.0001 for all).

Life Satisfaction

Quality of life was investigated in the questionnaire with a self-report scale from 1 to 10, with 1 being the worst possible and 10 the best possible quality. The mean quality of life score was 5.98 among those with frequent nightmares and 7.80 among those with no nightmares. The population mean of 7.51 was higher than the mean for frequent nightmare sufferers and lower than the mean for those without nightmares. The difference was significant, with a medium effect size (F, P < 0.001; η^2, 0.062). Full analyses can be found in Table S12 (supplemental material).

Satisfaction with different life domains was also associated with nightmares. Both dissatisfaction with the financial situation (χ^2, P < 0.001; Cramer V 0.100) and achievements in life (χ^2, P < 0.001; Cramer V, 0.121) were strongly associated with frequent nightmares. Dissatisfaction with family life was significantly associated with nightmares in both sexes, but the effect size of the association was larger among women. Among participants who were very unsatisfied with their family life, 31.5% of women (χ^2, P < 0.001; Cramer V, 0.119) and 7.0% of men (χ^2, P < 0.001; Cramer V, 0.090 reported frequent nightmares. For exact figures, see Table S4 (supplemental material).

Alcohol Consumption and Smoking

Question "Have you consumed alcohol during the past 12 mo" did not have statistically significant association to nightmares. The amount of alcohol consumed during the previous week had a statistically significant association, but the effect size was very small (χ^2, P < 0.001; Cramer V, 0.060 among men and χ^2, P < 0.001; Cramer V, 0.046 among women).

The frequency of being intoxicated during the previous 12 mo had a significant association with nightmares: those who reported having been intoxicated several times a week reported more nightmares than participants who reported being intoxicated less frequently. The effect size of this association was larger among men (χ^2, P < 0.001; Cramer V, 0.107) than among women (χ^2, P < 0.001; Cramer V, 0.090).

Among men, there was also a significant association between smoking and frequent nightmares, but the effect size was very small (χ^2, P < 0.001; Cramer V, 0.058). There was no statistically significant association between nightmares and smoking among women or the number of cigarettes smoked per day for either sex. Full analyses can be found in Table S5 (supplemental material).

Medication

The use of various medicines was significantly associated with frequent nightmares. Participants who had used painkillers during the previous month reported more nightmares than those who had not. The association was strongest for painkillers used for joint and muscle pain (χ^2, $P < 0.001$; Cramer V, 0.108) and weakest for those used to treat headaches (χ^2, $P < 0.001$; Cramer V, 0.072). The use of sedatives (χ^2, $P < 0.001$; Cramer V, 0.137), hypnotics (χ^2, $P < 0.001$; Cramer V, 0.151), and antidepressants (χ^2, $P < 0.001$; Cramer V, 0.151) was also strongly associated with having frequent nightmares.

The use of asthma medication, allergy medication, acetylsalicylic acid for heart attack prevention, anticoagulants, or antibiotics had no statistically significant association with nightmare frequency, or the association had a very small effect size. For full analyses, see Table S6 (supplemental material).

Physical Well-Being

There was a strong association between nightmare frequency and self-estimated physical health: frequent nightmares were reported by 28.9% of those who considered their health to be poor or very poor, but only 0.7% of those with very good health (χ^2, $P < 0.001$; Cramer V, 0.165). Moreover, compared with the population mean of 3.9%, the 0.7% reported by participants in very good health is considerably lower.

Of the diagnosed physical illnesses, hypertension (χ^2, $P < 0.001$; Cramer V, 0.113 for men and 0.078 for women) and angina pectoris (χ^2, $P < 0.001$; Cramer V, 0.105 for men and 0.063 for women) had a significant association with nightmares, with a larger effect size among men. Heart failure, asthma, back illness, diabetes, and other joint disease than rheumatoid arthritis had statistically significant connections with nightmares, but the effect sizes were very small. Cancer, cholecystitis, and rheumatoid arthritis were not significantly associated with nightmare frequency. Full analyses can be found in Table S7 (supplemental material).

Of the variables measuring physical condition and the amount of exercise, the self-estimated physical condition had a strong connection with nightmare frequency that was very similar to the association of self-estimated health: Participants who were in poor condition reported more frequent nightmares (19%), and participants in excellent condition reported less frequent nightmares (1.5%) than the population average (3.9%) (χ^2, $P < 0.001$; Cramer V, 0.121). The nature of work-related physical activity, the nature of leisure-time physical activity, the frequency of exercise, and the typical duration of exercise had a statistically significant association with nightmare frequency, but their effect sizes were very small. For full analyses, see Table S8 (supplemental material).

Multivariable Analysis

The multinomial logistic regression model of risk factors for nightmares is presented in Table 2. The model was constructed by starting with the 22 variables (see Table S14, supplemental material) that had the strongest association with nightmares in these data according to the effect size. To find the model best fitting these data, two methods were used: a model was first constructed by manually adding variables to the model based on their hypothesized importance and eliminating variables that became statistically nonsignificant during the process. Afterward, a second model was constructed by the automatic stepwise process in SPSS. Both methods produced the same final model that contained eight variables. To include BDI to the model, only data from additional questionaires of both surveys could be used resulting in n = 7,575.

Instead of using the entire BDI-13 in the modeling, we separately tested different BDI factors. This method was beneficial because it minimized the overlap between certain BDI questions and other variables entered into the model, e.g., questions about insomnia symptoms and working ability. Only a negative attitude toward self remained an independent risk factor in the regression model after adding other variables.

Independent risk factors for nightmares in the final model were sex, age, the BDI factor 'negative attitude toward self', insomnia, feeling exhausted, headaches, the ability to work, and the frequency of being intoxicated. In addition to these, all two-way interactions between the predictor variables in the regression model were tested. Only the interaction between frequent insomnia and the BDI factor 'negative attitude toward self' was statistically significant and was included in the model. Overall, the model was statistically significant ($\chi^2(32, n = 7,575) = 1,472.89$, $P < 0.0001$), had a Nagelkerke statistic of 0.217, and correctly classified 62.6% of the observations (with the chance level being 33.3%).

It should be noted that although the nature of the data would in principle allow the interpretation of ORs as a relative risk,[40] this was not possible because the direction of causality between nightmares and predictor variables was not clear. As such, the ORs should in this case be used as effect size estimates only.

To interpret the interaction, additional analysis was conducted with the entire BDI-13, insomnia, and nightmares (Table 3). Among participants with moderate to no depressive symptoms, insomnia and nightmares had a significant linear association: an increase in insomnia symptoms was associated with an increase in nightmare frequency. However, among participants with severe depressive symptoms, there was no statistically significant association between nightmares and insomnia. Among participants with severe depressive symptoms, frequent nightmares were common regardless of whether participants had insomnia symptoms.

DISCUSSION

The strongest risk factors for frequent nightmares were depression and insomnia. However, among participants with severe depressive symptoms the association between nightmares and insomnia was not significant. A possible explanation for this pattern might be that frequent insomnia (41.8%) and nightmares (28.4%) are so common among participants with severe depressive symptoms that their association to each other can no longer be observed. In the regression analysis, we aimed to separate the insomnia-related component of the BDI from other symptoms of depression. A negative attitude toward self was the only component of the BDI that was not measured by any other question in the FINRISK survey, and accordingly, it was the only component of the BDI that remained as an independent risk factor for nightmares in the regression model. As such, a negative attitude toward self appears to be a part of

Table 2—The multinomial logistic regression model.

	Frequent Nightmares			Occasional Nightmares		
Variable	**P**	**OR**	**95% CI**	**P**	**OR**	**95% CI**
Sex						
Female	0.002	1.63	1.20–2.23	< 0.001	1.40	1.26–1.56
Male		1.00			1.00	
Age (Increase in 10-y intervals)	< 0.001	1.33	1.17–1.50	< 0.001	1.10	1.06–1.15
BDI: Negative attitude toward self (1-point increase)	< 0.001	1.48	1.30–1.69	< 0.001	1.16	1.10–1.22
Insomnia						
Often	< 0.001	13.85	7.63–25.12	< 0.001	2.78	2.14–3.60
Sometimes	< 0.001	2.64	1.54–4.52	< 0.001	1.99	1.76–2.25
Never		1.00			1.00	
Exhaustion						
Often	< 0.001	6.35	3.44–11.71	< 0.001	1.93	1.60–2.32
Sometimes	0.001	2.58	1.45–4.61	< 0.001	1.77	1.56–2.00
Never		1.00			1.00	
Headache						
Often	< 0.001	4.10	2.64–6.28	< 0.001	1.81	1.48–2.22
Sometimes	0.007	1.64	1.15–2.33	< 0.001	1.67	1.50–1.86
Never		1.00			1.00	
Ability to work						
Unable	< 0.001	3.13	1.92–5.10	0.038	1.32	1.02–1.72
Partial	< 0.001	2.19	1.59–3.02	0.002	1.25	1.09–1.44
Full		1.00			1.00	
How often intoxicated?						
Once a week or more	< 0.001	2.52	1.51–4.23	< 0.001	1.81	1.50–2.23
1–3 times/mo	< 0.001	2.38	1.54–3.69	< 0.001	1.60	1.36–1.88
Seldom	0.087	1.35	0.96–1.90	0.009	1.17	1.04–1.33
Never		1.00			1.00	
Insomnia * BDI: Negativity						
Often * BDI:N	0.002			0.200		

Risk is presented as Exp(B) odds ratios. BDI, Beck Depression Inventory; CI, confidence interval; OR, odds ratio.

Table 3—Association between nightmares and insomnia at different levels of categorized Beck Depression Inventory-13.

	Nightmares often during the past 30 days	Cramer V	χ^2	n
No depressive symptoms		0.194	< 0.001	
Insomnia: often	8.9%			337
Insomnia: sometimes	1.8%			2,647
Insomnia: never	0.6%			3,203
Mild depressive symptoms		0.206	< 0.001	
Insomnia: often	20.0%			140
Insomnia: sometimes	4.0%			555
Insomnia: never	3.2%			346
Moderate depressive symptoms		0.159	< 0.001	
Insomnia: often	20.2%			243
Insomnia: sometimes	9.0%			500
Insomnia: never	5.5%			217
Severe depressive symptoms		0.136	0.226	
Insomnia: often	28.1%			64
Insomnia: sometimes	31.7%			63
Insomnia: never	19.2%			26

depression that sets it apart from mood and sleep problems as a risk factor for nightmares.

The use of antidepressants and hypnotics was also strongly associated with frequent nightmares, but according to the regression model, their association with nightmares did not appear to be independent of the problems they aim to treat. The association between depression, insomnia, and nightmares is in line with several prior observations,[9,10,18–20] although some studies have found that antidepressants and hypnotics had an independent effect on nightmares even when depression and insomnia symptoms were controlled for. [25,41]

Feeling exhausted and having frequent headaches were also strongly connected with nightmare frequency. They may represent the daytime consequences of insomnia, but the regression model implied that they were also independent risk factors for nightmares, an observation without a straightforward interpretation. The self-reported ability to work was a strong independent risk factor for frequent nightmares in our model. However, because there are a variety of reasons why people could lose their ability to work, including both psychological and physical problems, this association is quite unspecific. Female sex and advancing age were independent risk factors for nightmares as was expected in the light of prior studies, but unexpectedly, amount of alcohol consumed had a relatively weak association with nightmares. However, the frequency of intoxication appeared to be an independent risk factor for nightmares.

Several self-estimated quality-of-life measures were linearly associated with nightmares: low satisfaction was related to an increased and high satisfaction to a decreased risk of frequent nightmares. In regression analysis, these variables did not appear to be independent of depression, insomnia, or the self-reported ability to work.

Previously unreported associations with nightmares in these data included the use of painkillers, a cynical and distrusting personality, and seasonal variation in mood, sleep, and appetite. The use of painkillers may represent a connection between nightmares and chronic pain, as chronic pain is known to be associated with sleep disturbances.[42–44] The association with seasonal variation could be interpreted to imply that nightmares may be part of the symptomatology of seasonal affective disorder, as is the case with common depression.

Short and long sleep duration,[17] an evening chronotype among women,[26,27] and a low socioeconomic status[9,20] have been associated with frequent nightmares in prior studies. All these associations were replicated in these data. However, the effect sizes of these associations were very small compared with some of the other study variables, such as depression, insomnia, and life satisfaction. An association between an evening chronotype and nightmares was also reported by Merikanto et al.[27] in a study that used data partially overlapping with the current study, namely FINRISK 2007 with 6,858 participants. In the current study, the association was replicated with a larger dataset of FINRISK 2007 and 2012 with 11,531 participants.

Finally, there were some interesting negative results: Women who were pregnant did not report statistically significantly more nightmares than those who were not pregnant, despite there being a known link between sleep quality, dreaming, and pregnancy.[45,46] One possible explanation for the negative finding in our data could be that the dream disturbances related to pregnancy would only manifest themselves near the end of pregnancy.[47] In the FINRISK questionnaire, it was only inquired whether the participant was pregnant without specifying the stage of pregnancy and therefore it is possible that there were not many late-stage pregnancies included in the sample. Another slightly surprising negative result was that smoking was not associated with nightmares, as smoking is known to be connected with poorer sleep quality.[48]

Because of the nature of our data, the study had several limitations. Nightmares were not defined for the participants, and as such it was impossible to distinguish between nightmares, which cause awakening, from bad dreams, which do not. Thus, we do not know whether the criteria used by some researchers to distinguish between nightmares and bad dreams apply to the phenomenon studied here.[3,5,6] There is also a possibility that participants underestimated their nightmare frequency, as it has been shown that this often happens with retrospective questionnaires when compared with prospective dream logs.[5] It is also regrettable that to minimize the variation between survey questions, it was not possible to use the FINRISK surveys from 1972 to 2002, and it would also have been interesting to be able to measure the anxiety and posttraumatic stress disorder symptoms of the participants, but data did not include information on these symptoms.

Overall, these data revealed a few major risk factors for frequent nightmares and produced a large number of significant associations with smaller effect sizes. The common denominator for all these risk factors, possibly excluding frequent intoxication, appears to be lowered psychological or physical well-being. As such, there does not appear to be a single leading risk factor for having frequent nightmares, but rather, frequent nightmares are related to lowered mood, sleep quality, and well-being, which may be caused by various factors.

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Analyses of Categorical Variables (Tables S1–S8)

Table S1—Sociodemographic factors.

	Nightmares during the past 30 days				
	Occasionally	Often	Cramer V	χ^2	n
Sex			0.102	< 0.001	13,922
Female	49.3%	4.8%			7,407
Male	41.2%	2.9%			6,515
Age					13,922
Female			0.034	0.029	
25–34	49.6%	4.5%			1,338
35–44	47.4%	3.5%			1,428
45–54	49.3%	4.8%			1,557
55–64	51.6%	5.5%			1,576
65–74	48.5%	5.4%			1,508
Male			0.076	< 0.001	
25–34	38.9%	0.6%			988
35–44	37.2%	1.2%			1,208
45–54	41.7%	3.8%			1,320
55–64	42.7%	4.0%			1,461
65–74	44.1%	4.1%			1,538
Total			0.046	< 0.001	
25–34	45.1%	2.8%			2,326
35–44	42.7%	2.4%			2,636
45–54	45.8%	4.3%			2,877
55–64	47.3%	4.8%			3,037
65–74	46.3%	4.7%			3,046
Body mass index[a]					9,769
Female			0.044	< 0.001	
Normal weight	48.8%	3.4%			2,104
Overweight	47.7%	5.2%			1,700
Obese	50.3%	6.2%			1,461
Male			0.074	< 0.001	
Normal weight	39.0%	2.0%			1,062
Overweight	39.8%	1.9%			2,197
Obese	44.4%	5.1%			1,245
Total			0.053	< 0.001	
Normal weight	45.5%	2.9%			3,166
Overweight	43.2%	3.4%			3,897
Obese	47.6%	5.7%			2,706

[a]Body mass index of 24 or less is considered normal weight, 25–29 overweight, and 30 or more obese. The number of underweight participants in the sample is so few (0.5%) that they are included in the normal weight category. [b]Includes 346 housewives.

Table S1 continues on the following page

Table S1 (*continued*)—Sociodemographic factors.

	Nightmares during the past 30 days				
	Occasionally	**Often**	**Cramer V**	**χ^2**	**n**
Education					13,755
Female			0.051	< 0.001	
Low	51.8%	5.6%			2,365
Middle	49.7%	5.2%			2,486
High	46.5%	3.4%			2,468
Male			0.046	< 0.001	
Low	45.0%	3.1%			2,092
Middle	40.5%	3.1%			2,194
High	38.1%	2.4%			2,150
Total			0.047	< 0.001	
Low	48.6%	4.4%			4,457
Middle	45.4%	4.2%			4,680
High	42.6%	2.9%			4,618
Household income					13,354
Female			0.072	< 0.001	
Very low	51.3%	8.8%			326
Less than average	52.3%	5.5%			3,453
Average or more	47.0%	3.5%			3,240
Male			0.081	< 0.001	
Very low	45.3%	6.7%			506
Less than average	45.9%	3.6%			1,940
Average or more	38.5%	2.0%			3,889
Total			0.078	< 0.001	
Very low	48.6%	7.9%			1,140
Less than average	49.4%	4.7%			4,357
Average or more	42.8%	2.7%			7,857
Marital status					13,900
Female			0.048	0.271	
In relationship	48.9%	4.6%			5,144
Single	51.8%	5.2%			984
Divorced or widowed	49.1%	5.2%			1,265
Male			0.019	< 0.001	
In relationship	40.1%	2.6%			4,854
Single	44.1%	2.8%			1,018
Divorced or widowed	45.2%	5.5%			635
Total			0.032	< 0.001	
In relationship	44.6%	3.6%			9,998
Single	47.9%	4.0%			2,002
Divorced or widowed	47.8%	5.3%			1,900

[a]Body mass index of 24 or less is considered normal weight, 25–29 overweight, and 30 or more obese. The number of underweight participants in the sample is so few (0.5%) that they are included in the normal weight category. [b]Includes 346 housewives.

Table S1 continues on the following page

Table S1 (*continued*)—Sociodemographic factors.

	Nightmares during the past 30 days				
	Occasionally	Often	Cramer V	χ^2	n
Employment					13,815
Female			0.065	< 0.001	
Employed[b]	47.9%	3.7%			4,708
Student	52.4%	5.1%			353
Retired	51.0%	6.8%			1,947
Unemployed	55.9%	7.6%			354
Male			0.101	< 0.001	
Employed	38.5%	1.6%			3,957
Student	43.1%	1.6%			188
Retired	45.8%	5.3%			1,939
Unemployed	46.1%	6.5%			369
Total			0.077	< 0.001	
Employed[b]	43.6%	2.7%			8,665
Student	49.2%	3.9%			541
Retired	48.4%	6.0%			3,886
Unemployed	50.9%	7.1%			723
Pregnancy					7,250
Female			0.021	0.210	
Not pregnant	49.7%	4.7%			7,098
pregnant	44.1%	3.3%			152
Household size					13,893
Female			0.060	< 0.001	
1	51.1%	5.8%			1,721
2	51.2%	5.4%			3,157
3	47.2%	2.9%			1,058
4	46.0%	3.1%			923
≥ 5	42.8%	3.9%			533
Male			0.072	< 0.001	
1	45.4%	4.2%			1,444
2	41.6%	3.6%			2,921
3	38.1%	1.6%			886
4	39.4%	0.8%			776
≥ 5	34.8%	1.3%			474
Total			0.063	< 0.001	
1	48.5%	5.1%			3,165
2	46.6%	4.5%			6,078
3	43.1%	2.3%			1,944
4	43.0%	2.1%			1,699
≥ 5	39.0%	2.7%			1,007

[a]Body mass index of 24 or less is considered normal weight, 25–29 overweight, and 30 or more obese. The number of underweight participants in the sample is so few (0.5%) that they are included in the normal weight category. [b]Includes 346 housewives.

Table S2—Sleep related factors.

	Nightmares during the past 30 days				
	Occasionally	Often	Cramer V	χ^2	n
Insomnia during the past 30 days					13,838
Female			0.232	< 0.001	
Often	56.8%	15.7%			509
Sometimes	51.2%	2.8%			2,687
Not at all	30.4%	0.9%			3,282
Male			0.240	< 0.001	
Often	58.1%	18.0%			812
Sometimes	57.4%	4.0%			3,510
Not at all	37.4%	1.8%			3,038
Total			0.240	< 0.001	
Often	57.6%	17.1%			1,321
Sometimes	54.7%	3.5%			6,197
Not at all	33.8%	1.3%			6,320
Do you get enough sleep?[a]					12,904
Female			0.088	< 0.001	
Almost always	44.6%	3.3%			2,606
Often	51.1%	3.8%			3,163
Rarely	51.5%	9.0%			1,103
Male			0.107	< 0.001	
Almost always	35.7%	2.0%			2,563
Often	42.6%	2.1%			2,658
Rarely	47.8%	7.5%			811
Total			0.098	< 0.001	
Almost always	40.2%	2.7%			5,169
Often	47.2%	3.0%			5,821
Rarely	49.9%	8.4%			1,914
Feels exhausted during the past 30 days					13,816
Female			0.197	< 0.001	
Often	57.6%	13.4%			1,335
Sometimes	51.6%	3.2%			4,539
Not at all	34.8%	0.9%			1,471
Male			0.209	< 0.001	
Often	53.7%	11.3%			745
Sometimes	45.7%	2.2%			4,031
Not at all	24.4%	0.6%			1,695
Total			0.208	< 0.001	
Often	56.2%	12.6%			2,080
Sometimes	48.8%	2.7%			8,570
Not at all	29.2%	0.8%			3,166

[a]The 939 participants answering "Do not know" are treated as missing values. [b]Question only present in the extended questionnaire of 2012.

Table S2 continues on the following page

Table S2 (*continued*)—Sleep related factors.

	Nightmares during the past 30 days				
	Occasionally	**Often**	**Cramer V**	**χ^2**	**n**
Headache during the past 30 days					13,844
Female			0.167	< 0.001	
Often	56.5%	13.5%			873
Sometimes	53.6%	3.9%			4,350
Not at all	37.6%	2.4%			2,144
Male			0.153	< 0.001	
Often	46.7%	12.4%			323
Sometimes	48.8%	3.0%			2,906
Not at all	33.7%	1.6%			3,248
Total			0.172	< 0.001	
Often	53.8%	13.2%			1,196
Sometimes	51.7%	3.6%			7,256
Not at all	35.3%	1.9%			5,392
Problem with seasonal variation in mood, sleep and appetite[b]					4,675
Female			0.204	< 0.001	
No problems	48.1%	3.6%			2,278
Moderate to severe problem	59.9%	15.2%			282
Male			0.181	< 0.001	
No problems	38.5%	1.8%			1,996
Moderate to severe problem	55.5%	11.8%			119
Total			0.205	< 0.001	
No problems	43.6%	2.8%			4,274
Moderate to severe problem	58.6%	14.2%			401
Chronotype					11,531
Female			0.072	< 0.001	
Morning	46.7%	2.7%			2,747
Intermediate	51.0%	4.8%			2,683
Evening	52.3%	7.5%			857
Male			0.034	0.014	
Morning	39.4%	2.3%			2,573
Intermediate	42.0%	2.7%			2,112
Evening	44.7%	3.8%			559
Total			0.059	< 0.001	
Morning	43.2%	2.5%			5,320
Intermediate	47.0%	3.9%			4,795
Evening	49.3%	6.0%			1,416
Average sleep length per night					13,708
Female			0.067	< 0.001	
≤ 6 h	49.4%	8.2%			1,020
7–8 h	49.1%	3.5%			5,260
≥ 9 h	50.3%	7.2%			1,011
Male			0.080	< 0.001	
≤ 6 h	43.4%	6.1%			1,204
7–8 h	40.5%	1.8%			4,581
≥ 9 h	41.6%	4.7%			632
Total			0.070	< 0.001	
≤ 6 h	46.2%	7.1%			2,224
7–8 h	45.1%	2.7%			9,841
≥ 9 h	47.0%	6.3%			1,643

[a]The 939 participants answering "Do not know" are treated as missing values. [b]Question only present in the extended questionnaire of 2012.

Table S3—Psychological well-being.

	Nightmares during the past 30 days				
	Occasionally	Often	Cramer V	χ^2	n
BDI-13 categorized[a]					8,375
Female			0.206	< 0.001	
No depression symptoms	46.0%	2.0%			3,218
Mild depression symptoms	55.4%	6.9%			639
Moderate depression symptoms	61.1%	12.4%			606
Severe depression symptoms	50.0%	29.0%			100
Male			0.210	< 0.001	
No depression symptoms	36.6%	1.2%			2,993
Mild depression symptoms	48.9%	4.7%			405
Moderate depression symptoms	58.5%	8.9%			359
Severe depression symptoms	56.4%	27.3%			55
Total			0.211	< 0.001	
No depression symptoms	41.5%	1.6%			6,211
Mild depression symptoms	52.9%	6.0%			1,044
Moderate depression symptoms	60.1%	11.1%			965
Severe depression symptoms	52.3%	28.4%			155
Depression diagnosis[b]					13,786
Female			0.209	< 0.001	
No	48.7%	3.5%			6,699
Yes	56.0%	17.8%			647
Male			0.206	< 0.001	
No	40.3%	2.2%			6,063
Yes	54.1%	15.4%			377
Total			0.212	< 0.001	
No	44.7%	2.8%			6,697
Yes	55.3%	16.9%			285
Other mental disorder diagnosis[a]					13,781
Female			0.083	< 0.001	
No	49.2%	4.4%			7,137
Yes	56.4%	13.7%			204
Male			0.107	< 0.001	
No	41.0%	2.7%			6,315
Yes	47.2%	15.2%			125
Total			0.093	< 0.001	
No	45.3%	3.6%			6,868
Yes	52.9%	14.3%			108
Ability to work					11,700
Female			0.141	< 0.001	
Full working ability	47.8%	2.7%			4,919
Partial working ability	54.7%	10.2%			1,211
Unable to work	52.7%	15.6%			262
Male			0.139	< 0.001	
Full working ability	38.4%	1.4%			4,002
Partial working ability	48.5%	6.0%			1,007
Unable to work	45.8%	11.4%			299
Total			0.137	< 0.001	
Full working ability	43.6%	2.1%			8,921
Partial working ability	51.9%	8.3%			2,218
Unable to work	49.0%	13.4%			561

[a]5–7 points = mild depression symptoms, 8–15 points = moderate, > 16 = severe. [b]Self-report of a diagnosis made by a physician during the past 12 mo.
BDI, Beck Depression Inventory.

Table S4—Life satisfaction.

	Nightmares during the past 30 days				
	Occasionally	**Often**	**Cramer V**	**χ^2**	**n**
Satisfaction to financial situation					13,857
Female			0.102	< 0.001	7,342
Very satisfied	39.8%	3.9%			373
Satisfied	47.1%	3.1%			1,332
Somewhat satisfied	51.5%	4.7%			1,270
Unsatisfied	54.1%	7.8%			328
Very unsatisfied	55.8%	13.8%			82
Male			0.102	< 0.001	
Very satisfied	36.2%	1.7%			473
Satisfied	37.2%	1.8%			2,349
Somewhat satisfied	43.4%	3.0%			2,733
Unsatisfied	48.7%	4.4%			702
Very unsatisfied	44.2%	11.6%			233
Total			0.100	< 0.001	
Very satisfied	38.3%	3.0%			1,136
Satisfied	42.5%	2.5%			5,027
Somewhat satisfied	47.5%	3.9%			5,629
Unsatisfied	51.7%	6.3%			1,563
Very unsatisfied	50.4%	12.7%			502
Satisfaction to achievements in life					13,802
Female			0.125	< 0.001	
Very satisfied	41.8%	2.9%			1,047
Satisfied	46.9%	3.3%			3,424
Somewhat satisfied	54.4%	6.2%			2,479
Unsatisfied	60.5%	10.1%			347
Very unsatisfied	51.1%	28.9%			45
Male			0.130	< 0.001	
Very satisfied	31.6%	2.3%			703
Satisfied	36.8%	1.6%			2,866
Somewhat satisfied	46.5%	3.9%			2,413
Unsatisfied	55.5%	5.4%			425
Very unsatisfied	41.5%	18.9%			53
Total			0.121	< 0.001	
Very satisfied	37.7%	2.6%			1,750
Satisfied	42.3%	2.5%			6,290
Somewhat satisfied	50.5%	5.1%			4,892
Unsatisfied	57.8%	7.5%			772
Very unsatisfied	45.9%	23.5%			98

Table S4 continues on the following page

Table S4 (*continued*)—Life satisfaction.

	Nightmares during the past 30 days				
	Occasionally	**Often**	**Cramer V**	χ^2	**n**
Satisfaction to family life					13,777
Female			0.119	< 0.001	
Very satisfied	42.9%	3.1%			1,849
Satisfied	49.5%	3.8%			3,087
Somewhat satisfied	54.6%	6.0%			1,546
Unsatisfied	57.4%	8.6%			303
Very unsatisfied	53.7%	31.5%			54
No family	49.6%	7.0%			486
Male			0.090	< 0.001	
Very satisfied	34.8%	2.1%			1,607
Satisfied	40.3%	2.2%			2,689
Somewhat satisfied	48.7%	4.0%			1,259
Unsatisfied	47.0%	5.1%			234
Very unsatisfied	55.8%	7.0%			43
No family	42.7%	4.8%			620
Total			0.103	< 0.001	
Very satisfied	39.2%	2.6%			3,456
Satisfied	45.2%	3.1%			5,776
Somewhat satisfied	51.9%	5.1%			2,805
Unsatisfied	52.9%	7.1%			537
Very unsatisfied	54.6%	20.6%			97
No family	45.8%	5.8%			1,106

Table S5—Alcohol consumption and smoking.

	Nightmares during the past 30 days				
	Occasionally	Often	Cramer V	χ^2	n
Alcohol during the past 12 mo					12,744
Female			0.037	0.010	
Yes	50.0%	4.4%			6,184
No	49.1%	7.5%			456
Male			0.046	0.001	
Yes	40.7%	2.8%			5,733
No	45.3%	5.4%			371
Total			0.041	< 0.001	
Yes	45.6%	3.6%			11,917
No	47.4%	6.5%			827
No. of alcohol portions during past week[a]					
Female			0.046	< 0.001	7,342
0–2	48.2%	4.4%			4,574
3–16	51.0%	4.7%			2,599
> 16	53.8%	11.8%			169
Male			0.060	< 0.001	6,444
0–2	39.8%	3.2%			2,539
3–24	41.0%	2.3%			3,513
> 24	50.5%	6.6%			392
How often intoxicated during past 12 mo					11,341
Female			0.090	< 0.001	
Several times a week	45.1%	23.5%			51
Weekly	54.6%	7.7%			196
Several times a month	60.8%	6.2%			339
Monthly	55.2%	6.3%			397
Less than monthly	49.8%	3.9%			2,941
Not once	46.9%	3.9%			2,076
Male			0.107	< 0.001	
Several times a week	55.1%	9.2%			185
Weekly	52.7%	3.4%			581
Several times a month	44.6%	2.6%			778
Monthly	42.3%	1.6%			612
Less than monthly	38.3%	2.3%			2,268
Not once	34.0%	3.6%			917
Total			0.069	< 0.001	
Several times a week	53.0%	12.3%			236
Weekly	53.2%	4.5%			777
Several times a month	49.5%	3.7%			1,117
Monthly	47.4%	3.5%			1,009
Less than monthly	44.8%	3.2%			5,209
Not once	42.9%	3.8%			2,993

[a]One portion = 12 g of 100% alcohol. In Finland over 16 portions for women and over 24 for men per week is considered excessive. The limit is a national recommendation given by the National Institute of Health and Welfare based on consensus of the local experts of the field.

Table S5 continues on the following page

Table S5 (*continued*)—Alcohol consumption and smoking.

	Nightmares during the past 30 days				
	Occasionally	**Often**	**Cramer V**	**χ^2**	**n**
Smoking					13,820
Female			0.038	0.002	
Never smoked	47.8%	4.4%			4,643
Quit over 6 mo ago	51.9%	4.9%			1,291
Quit less than 6 mo ago	48.3%	4.9%			143
Smoker	52.2%	5.8%			1,289
Male			0.058	< 0.001	
Never smoked	38.5%	2.0%			2,865
Quit over 6 mo ago	43.0%	3.2%			1,843
Quit less than 6 mo ago	41.7%	2.3%			175
Smoker	44.1%	4.3%			1,571
Total			0.034	< 0.001	
Never smoked	44.2%	3.5%			7,508
Quitted over 6 mo ago	46.7%	3.9%			3,134
Quitted less than 6 mo ago	44.7%	3.5%			318
Smoker	47.8%	5.0%			2,860
Cigarettes per day					
Female			0.049	0.003	
0	48.9%	4.2%			3,328
1–10	52.7%	4.5%			446
11–20	51.3%	7.2%			277
≥ 21	50.0%	15.0%			40
Male			0.041	0.061	
0	41.4%	3.1%			2,651
1–10	46.5%	3.9%			258
11–20	41.8%	3.4%			474
≥ 21	51.3%	5.3%			152
Total			0.035	0.006	
0	45.6%	3.7%			5,979
1–10	50.4%	4.3%			704
11–20	45.3%	4.8%			751
≥ 21	51.0%	7.3%			192

[a]One portion = 12 g of 100% alcohol. In Finland over 16 portions for women and over 24 for men per week is considered excessive. The limit is a national recommendation given by the National Institute of Health and Welfare based on consensus of the local experts of the field.

Table S6—Medication.

	Nightmares during the past 30 days				
	Occasionally	Often	Cramer V	χ^2	n
Painkillers for headache					13,427
Female			0.068	< 0.001	
During past mo	52.4%	5.4%			4,183
Over 1 mo ago	45.4%	3.7%			2,598
Never	41.5%	2.9%			381
Male			0.052	< 0.001	
During past mo	44.3%	3.5%			2,451
Over 1 mo ago	40.0%	2.0%			2,894
Never	36.5%	3.0%			920
Total			0.072	< 0.001	
During past mo	49.4%	4.7%			6,634
Over 1 mo ago	42.6%	2.8%			5,492
Never	38.0%	3.0%			1,301
Painkillers for joint and muscle pain					13,382
Female			0.107	< 0.001	
During past mo	54.0%	7.2%			2,666
Over 1 mo ago	49.4%	3.3%			2,961
Never	40.7%	2.7%			1,498
Male			0.097	< 0.001	
During past mo	47.0%	5.1%			1,833
Over 1 mo ago	41.3%	2.0%			2,788
Never	34.8%	1.5%			1,636
Total			0.108	< 0.001	
During past mo	51.1%	6.3%			4,499
Over 1 mo ago	45.5%	2.7%			5,749
Never	37.6%	2.1%			3,134
Painkillers for other pain					12,959
Female			0.082	< 0.001	
During past mo	53.9%	7.2%			1,816
Over 1 mo ago	49.0%	3.6%			3,536
Never	43.6%	3.4%			1,519
Male			0.100	< 0.001	
During past mo	49.1%	6.2%			1,016
Over 1 mo ago	41.3%	1.8%			3,326
Never	35.6%	2.3%			1,746
Total			0.096	< 0.001	
During past mo	52.2%	6.8%			2,832
Over 1 mo ago	45.3%	2.8%			6,862
Never	39.4%	2.8%			3,265

Table S6 continues on the following page

Table S6 (*continued*)—Medication.

	Nightmares during the past 30 days				
	Occasionally	**Often**	**Cramer V**	**χ^2**	**n**
Sedatives					13,163
Female			0.130	< 0.001	
During past mo	53.2%	17.1%			346
Over 1 mo ago	56.0%	9.1%			795
Never	47.8%	3.3%			5,861
Male			0.141	< 0.001	
During past mo	55.3%	13.9%			237
Over 1 mo ago	53.6%	7.1%			481
Never	39.5%	1.9%			5,443
Total			0.137	< 0.001	
During past mo	54.0%	15.8%			583
Over 1 mo ago	55.1%	8.3%			1,276
Never	43.8%	2.6%			11,304
Hypnotics					13,262
Female			0.141	< 0.001	
During past mo	56.2%	12.7%			822
Over 1 mo ago	56.1%	7.1%			1,228
Never	46.3%	2.8%			5,008
Male			0.155	< 0.001	
During past mo	57.8%	10.6%			490
Over 1 mo ago	51.6%	4.5%			827
Never	37.8%	1.7%			4,887
Total			0.151	< 0.001	
During past mo	56.8%	11.9%			1,312
Over 1 mo ago	54.3%	6.0%			2,055
Never	42.1%	2.2%			9,895
Antidepressants					13,202
Female			0.144	< 0.001	
During past mo	53.3%	16.6%			578
Over a mo ago	58.8%	7.1%			690
Never	47.4%	3.2%			5,776
Male			0.149	< 0.001	
During past mo	57.4%	14.4%			270
Over 1 mo ago	56.9%	5.4%			392
Never	39.1%	1.9%			5,496
Total			0.151	< 0.001	
During past mo	54.6%	15.9%			848
Over 1 mo ago	58.1%	6.5%			1,082
Never	43.4%	2.6%			11,272

Table S6 continues on the following page

Table S6 (*continued*)—Medication.

	Nightmares during the past 30 days				
	Occasionally	Often	Cramer V	χ^2	n
Asthma medication					13,184
Female			0.052	< 0.001	
During past mo	54.4%	8.0%			246
Over 1 mo ago	52.5%	4.4%			276
Never	48.1%	4.3%			2,726
Male			0.040	0.001	
During past mo	46.5%	5.3%			400
Over 1 mo ago	43.9%	2.0%			351
Never	40.6%	2.6%			5,422
Total			0.052	< 0.001	
During past mo	51.4%	6.9%			1,054
Over 1 mo ago	49.4%	3.5%			991
Never	44.4%	3.4%			11,139
Allergy medication					13,129
Female			0.040	< 0.001	
During past mo	55.4%	5.9%			507
Over 1 mo ago	51.3%	4.6%			1,778
Never	47.4%	4.5%			4,698
Male			0.028	0.043	
During past mo	45.1%	5.1%			253
Over 1 mo ago	42.0%	2.2%			1,124
Never	40.7%	2.7%			4,769
Total			0.039	< 0.001	
During past mo	52.0%	5.7%			760
Over 1 mo ago	47.7%	3.7%			2,902
Never	44.0%	3.6%			9,467
Acetylsalicylic acid for heart attack prevention					13,296
Female			0.051	< 0.001	
During past mo	53.8%	6.8%			294
Over 1 mo ago	53.7%	7.6%			127
Never	48.4%	4.1%			2,849
Male			0.090	< 0.001	
During past mo	45.6%	6.6%			979
Over 1 mo ago	52.1%	3.2%			313
Never	39.7%	2.0%			4,931
Total			0.062	< 0.001	
During past mo	49.1%	6.7%			1,725
Over 1 mo ago	52.9%	5.5%			641
Never	44.5%	3.2%			10,930

Table S6 continues on the following page

Table S6 (*continued*)—Medication.

	Nightmares during the past 30 days				
	Occasionally	**Often**	**Cramer V**	χ^2	**n**
Anticoagulants					12,956
Female			0.018	0.338	
During past mo	49.4%	5.6%			73
Over 1 mo ago	50.3%	6.7%			129
Never	49.1%	4.4%			2,991
Male			0.042	< 0.001	
During past mo	46.9%	5.6%			288
Over 1 mo ago	42.6%	4.6%			284
Never	40.8%	2.4%			5,485
Total			0.024	0.004	
During past mo	47.8%	5.6%			450
Over 1 mo ago	46.6%	5.7%			584
Never	45.3%	3.5%			11,922
Antibiotics					12,624
Female			0.035	0.002	
During past mo	51.0%	5.3%			582
Over 1 mo ago	49.7%	4.5%			5,429
Never	42.8%	3.9%			712
Male			0.039	0.001	
During past mo	39.1%	5.3%			358
Over 1 mo ago	41.9%	2.4%			4,550
Never	37.3%	2.7%			993
Total			0.039	< 0.001	
During past mo	46.5%	5.3%			940
Over 1 mo ago	46.2%	3.6%			9,979
Never	39.6%	3.2%			1,705

Table S7—Physical well-being.

	Nightmares during the past 30 days				
	Occasionally	Often	Cramer V	χ^2	n
Hypertension[a]					13,788
Female			0.078	< 0.001	
No	48.7%	3.9%			5,651
Yes	51.2%	7.4%			1,693
Male			0.113	< 0.001	
No	39.6%	2.0%			4,717
Yes	45.3%	5.5%			1,727
Total			0.089	< 0.001	
No	44.5%	3.0%			10,368
Yes	48.2%	6.4%			3,420
Hearth failure[a]					13,790
Female			0.040	< 0.001	
No	49.2%	4.7%			7,218
Yes	57.6%	9.1%			132
Male			0.063	< 0.001	
No	40.8%	2.7%			6,189
Yes	48.2%	7.2%			251
Total			0.044	< 0.001	
No	45.3%	3.8%			13,407
Yes	51.4%	7.8%			383
Angina pectoris[a]					13,792
Female			0.063	< 0.001	
No	49.0%	4.6%			7,174
Yes	62.9%	9.7%			175
Male			0.105	< 0.001	
No	40.7%	2.6%			6,186
Yes	50.6%	10.5%			257
Total			0.076	< 0.001	
No	45.1%	3.7%			13,360
Yes	55.6%	10.2%			432
Cancer[a]					13,797
Female			0.035	0.010	
No	49.5%	4.6%			7,211
Yes	40.6%	9.4%			138
Male			0.044	0.002	
No	41.1%	2.8%			6,310
Yes	39.9%	8.0%			138
Total			0.037	< 0.001	
No	45.6%	3.8%			13,521
Yes	40.2%	8.7%			276

[a]Self-report of a diagnosis made by a physician during the past 12 mo.

Table S7 continues on the following page

Table S7 (*continued*)—Physical well-being.

	Nightmares during the past 30 days				
	Occasionally	Often	Cramer V	χ^2	n
Asthma[a]					13,782
Female			0.057	< 0.001	
No	48.8%	4.5%			6,797
Yes	55.2%	7.5%			547
Male			0.046	0.001	
No	40.7%	2.8%			6,107
Yes	47.4%	5.1%			331
Total			0.057	< 0.001	
No	45.0%	3.7%			12,904
Yes	52.3%	6.6%			878
Cholecystitis[a]					
Female			0.018	0.315	
No	49.3%	4.7%			7,245
Yes	50.0%	7.7%			104
Male			0.027	0.092	
No	41.0%	2.9%			6,400
Yes	51.1%	6.7%			45
Total			0.023	0.022	
No	45.4%	3.8%			13,645
Yes	50.3%	7.4%			149
Rheumatoid arthritis[a]					
Female			0.029	0.044	
No	49.3%	4.6%			7,182
Yes	50.6%	8.5%			164
Male			0.012	0.621	
No	41.1%	2.9%			6,357
Yes	40.0%	4.7%			85
Total					
No	45.4%	3.8%	0.025	0.013	13,539
Yes	47.0%	7.2%			249
Other joint disease[a]					
Female			0.059	< 0.001	
No	48.8%	4.3%			6,354
Yes	52.4%	7.3%			975
Male			0.091	< 0.001	
No	40.3%	2.5%			5,773
Yes	48.3%	6.4%			661
Total			0.076	< 0.001	
No	44.8%	3.5%			12,127
Yes	50.7%	6.9%			1,636

[a]Self-report of a diagnosis made by a physician during the past 12 mo.

Table S7 continues on the following page

Table S7 (*continued*)—Physical well-being.

	Nightmares during the past 30 days				
	Occasionally	Often	Cramer V	χ^2	n
Back illness[a]					13,770
Female			0.087	< 0.001	
No	48.1%	4.2%			2,909
Yes	55.4%	7.3%			462
Male			0.089	< 0.001	
No	40.1%	2.4%			5,279
Yes	45.5%	5.5%			1,154
Total			0.085	< 0.001	
No	44.4%	3.4%			11,378
Yes	50.6%	6.4%			2,392
Diabetes[a]					
Female			0.056	< 0.001	
No	49.3%	4.5%			6,998
Yes	50.4%	9.8%			347
Male			0.066	< 0.001	
No	40.9%	2.7%			5,983
Yes	43.8%	6.7%			464
Total			0.056	< 0.001	
No	45.4%	3.6%			12,981
Yes	46.6%	8.0%			811
Self-estimated health					13,870
Female			0.169	< 0.001	
Very good	40.6%	0.8%			1,096
Good	48.4%	3.1%			3,460
Mediocre	53.6%	6.2%			2,291
Poor	56.8%	15.2%			493
Very poor	28.6%	42.9%			35
Male			0.177	< 0.001	
Very good	29.7%	0.6%			870
Good	38.4%	1.1%			2,833
Mediocre	47.1%	3.7%			2,203
Poor	50.4%	11.8%			534
Very poor	45.5%	20.0%			55
Total			0.165	< 0.001	
Very good	35.8%	0.7%			1,966
Good	43.9%	2.2%			6,293
Mediocre	50.4%	5.0%			4,494
Poor	53.5%	13.4%			1,027
Very poor	38.9%	28.9%			90

[a]Self-report of a diagnosis made by a physician during the past 12 mo.

Table S8—Physical exercise.

	Nightmares during the past 30 days				
	Occasionally	Often	Cramer V	χ^2	n
Self-estimated physical condition					12,393
Female			0.116	< 0.001	
Excellent	40.2%	2.4%			413
Good	48.2%	2.9%			2,849
Satisfactory	51.3%	4.6%			2,575
Poor	53.0%	10.6%			758
Very poor	47.5%	19.8%			101
Male			0.127	< 0.001	
Excellent	33.7%	0.6%			463
Good	38.2%	1.5%			2,314
Satisfactory	44.3%	3.1%			2,240
Poor	46.8%	7.8%			613
Very poor	46.3%	17.9%			67
Total			0.121	< 0.001	
Excellent	36.8%	1.5%			876
Good	43.7%	2.3%			5,163
Satisfactory	48.0%	3.9%			4,815
Poor	50.3%	9.3%			1,371
Very poor	47.0%	19.0%			168
Nature of work related physical activity					13,671
Female			0.033	0.016	
Sedentary job	49.6%	5.2%			4,173
Standing work	47.7%	3.4%			1,874
Light physical work	50.6%	4.7%			1,123
Heavy physical work	49.5%	6.5%			93
Male			0.057	< 0.001	
Sedentary job	42.1%	3.7%			3,441
Standing work	36.8%	1.2%			1,201
Light physical work	42.0%	2.1%			1,218
Heavy physical work	42.3%	3.5%			548
Total			0.038	< 0.001	
Sedentary job	46.2%	4.6%			7,614
Standing work	43.4%	2.5%			3,075
Light physical work	46.1%	3.3%			2,341
Heavy physical work	43.4%	3.9%			641
Nature of leisure physical activity					13,824
Female			0.058	< 0.001	
No physical activity	49.5%	7.8%			1,560
Light physical activity	49.7%	4.0%			3,859
Physical exercise	48.6%	3.2%			1,857
Competitive sports	49.2%	4.8%			63
Male			0.066	< 0.001	
No physical activity	44.2%	5.2%			1,337
Light physical activity	42.1%	2.7%			3,253
Physical exercise	37.4%	1.9%			1,716
Competitive sports	35.8%	1.7%			179
Total			0.062	< 0.001	
No physical activity	47.0%	6.6%			2,897
Light physical activity	46.2%	3.4%			7,112
Physical exercise	43.2%	2.6%			3,573
Competitive sports	39.3%	2.5%			242

Table S8 continues on the following page

Table S8 (*continued*)—Physical exercise.

	Nightmares during the past 30 days				
	Occasionally	**Often**	**Cramer V**	**χ^2**	**n**
How often do you do at least 20 min of exercise					12,309
Female			0.066	< 0.001	
Cannot because of illness	47.6%	13.9%			208
Less than once a week	48.7%	5.7%			936
Weekly	50.5%				897
2 times per week	49.6%	4.8%			1,286
3 times per week	49.5%	4.0%			1,467
4 times per week	48.7%	2.6%			889
5 or more	49.5%	4.4%			965
Male			0.074	< 0.001	
Cannot because of illness	40.9%	9.6%			230
Less than once a week	42.1%	4.1%			1,051
Weekly	41.4%	2.1%			780
2 times per week	39.9%	1.8%			1,014
3 times per week	44.1%	2.9%			1,089
4 times per week	38.2%	1.7%			717
5 or more	39.4%	3.1%			780
Total			0.064	< 0.001	
Cannot because of illness	44.1%	11.6%			438
Less than once a week	45.2%	4.8%			1,987
Weekly	46.3%	3.0%			1,677
2 times per week	45.3%	3.5%			2,300
3 times per week	47.2%	3.6%			2,556
4 times per week	44.0%	2.2%			1,606
5 or more	45.0%	3.8%			1,745
How long do you usually exercise at one time?					12,009
Female			0.066	< 0.001	
No exercise	47.5%	8.5%			282
< 15 min	48.2%	13.7%			139
15–29 min	49.5%	6.2%			1,085
30–59 min	49.5%	3.6%			3,184
≥ 60 min	49.4%	3.5%			1,812
Male			0.070	< 0.001	
No exercise	39.6%	6.9%			379
< 15 min	41.0%	7.4%			217
15–29 min	44.5%	2.5%			957
30–59 min	40.3%	2.7%			2,104
≥ 60 min	40.3%	1.7%			1,850
Total					
No exercise	43.0%	7.6%	0.061	< 0.001	661
< 15 min	43.8%	9.8%			356
15–29 min	47.2%	4.5%			2,042
30–59 min	45.8%	3.3%			5,288
≥ 60 min	44.8%	2.6%			3,662

Analyses of Continuous Variables (Tables S9–S12)

Full analyses of continuous variables with ANOVA can be found in these tables.

Table S9—Beck Depression Inventory-13.

	Nightmares during the past 30 days					
	Never	Occasionally	Often	η^2	F	n
BDI-13 score						
Female	[2.55, 2.91]	[3.99, 4.33]	[7.76, 8.89]	0.083	P < 0.0001	4,563
Male	[2.01, 2.32]	[3.55, 3.91]	[7.43, 8.83]	0.091	P < 0.0001	3,812
Total	[2.33, 2.56]	[3.86, 4.11]	[7.84, 8.70]	0.090	P < 0.0001	8,375

Tamhane *post hoc*, significant difference between all groups (P < 0.0001). BDI, Beck Depression Inventory.

Table S10—Job content questionnaire.

	Nightmares during the past 30 days					
	Never	Occasionally	Often	η^2	F	n
JCQ job control[a]						
Female	[11.64, 11.85]	[11.13, 11.33]	[10.29, 11.00]	0.011	P < 0.0001	6,350
Male	[12.41, 12.60]	[11.99, 12.20]	[11.35, 12.20]	0.006	P < 0.0001	5,455
JCQ job demand[b]						
Female	[8.22, 8.44]	[8.68, 8.90]	[9.30, 10.03]	0.010	P < 0.0001	6,356
Male	[8.09, 8.29]	[8.47, 8.71]	[8.91, 9.84]	0.008	P < 0.0001	5,455

[a]Tamhane *post hoc* test reveals that among females there is a significant difference between all other groups other than "often" and "occasionally". Among males the only significant difference is between groups "occasionally" and "never". [b]Tamhane *post hoc* test shows that all groups differ significantly from each other among females. Among males there is no significant difference between "often" and "occasionally" groups.

Table S11—Cynical distrust scale.

	Nightmares during the past 30 days					
	Never	Occasionally	Often	η^2	F	n
Cynical distrust score						
Female	[22.95, 23.34]	[21.83, 22.21]	[18.96, 20.22]	0.036	P < 0.0001	3,854
Male	[21.69, 22.08]	[20.59, 21.03]	[17.21, 18.89]	0.032	P < 0.0001	3,399
Total	[22.36, 22.64]	[21.35, 21.64]	[18.52, 19.54]	0.030	P < 0.0001	7,253

Tamhane *post hoc*, significant difference between all groups (P < 0.0001).

Table S12—Quality of life.

	Nightmares during the past 30 days					
	Never	Occasionally	Often	η^2	F	n
Quality of life 1–10						
Female	[7.83, 7.94]	[7.34, 7.50]	[6.04, 6.39]	0.063	P < 0.0001	5,755
Male	[7.67, 7.78]	[7.17, 7.30]	[5.49, 5.99]	0.059	P < 0.0001	5,144
Total	[7.76, 7.83]	[7.31, 7.38]	[5.86, 6.11]	0.062	P < 0.0001	13,622

Tamhane *post hoc*, significant difference between all groups (P < 0.0001).

Table S13—Factor solution for the variance analyses.

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0.928
Bartlett's Test of Sphericity	Approx. chi-square	33787.976
	df	78
	P	< 0.0001

	Factor Loadings in Rotated Factor Matrix		
BDI-13 Question	**Negative Attitude Towards Self**	**Lowered Mood**	**Performance Impairment**
1: Sadness	0.348	0.628[b]	0.266
2: Hopelessness	0.307	0.588[b]	0.205
3: Sense of failure	0.548[a]	0.348	0.162
4: Dissatisfaction	0.352	0.513[b]	0.343
5: Worthlessness	0.647[a]	0.212	0.189
6: Disappointment	0.723[a]	0.288	0.155
7: Self harm	0.377[a]	0.322	0.175
8: Lose of interest	0.269	0.324	0.350[c]
9: Ability to decide	0.378	0.292	0.415[c]
10: Appearance	0.482[a]	0.171	0.298
11: Working ability	0.176	0.172	0.633[c]
12: Tiredness	0.140	0.141	0.628[c]
13: Appetite	0.089	0.192	0.234[c]

[a]Question included in factor: Negative Attitude Towards Self. [b]Question included in factor: Lowered Mood. [c]Question included in factor: Performance Impairment. Extraction method: maximum likelihood. Rotation method: varimax with Kaiser normalization. df, degrees of freedom; BDI, Beck Depression Inventory.

Table S14—Variables considered for multinomial regression analyses.

BDI factor: Negative attitude toward self[a]
BDI factor: Negative mood
BDI factor: Performance impairment
Sex[a]
Age[a]
Insomnia during the previous 30 days?[a]
Feeling exhausted during the previous 30 days?[a]
Headache during the previous 30 days?[a]
Self-estimated working ability[a]
How often intoxicated?[a]
Self-estimated health
Self-estimated physical condition
Self-estimated quality of life
Satisfaction with financial situation
Satisfaction with achievements in life
Satisfaction with family life
Other mental disorder diagnosis
Use of sedatives
Use of hypnotics
Use of antidepressants
Chronotype
Average sleep duration per night

[a]Independent risk factors in the final regression model. BDI, Beck Depression Index.