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Nightmares: Prevalence among the Finnish General Adult Population and War Veterans during 1972-2007

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Study Objectives: To investigate the prevalence of nightmares among the Finnish general adult population during 1972-2007 and the association between nightmare prevalence and symptoms of insomnia, depression, and anxiety in World War II veterans.

Design: Eight independent cross-sectional population surveys of the National FINRISK Study conducted in Finland in 1972, 1977, 1982, 1987, 1992, 1997, 2002, and 2007.

Setting: Epidemiologic.

Participants: A total of 69,813 people (33,811 men and 36,002 women) age 25-74 years.

Interventions: N/A.

Measurements and Results: The investigation of nightmare prevalence and insomnia, depression, and anxiety symptoms was based on questionnaires completed by the participants. Among the whole sample, 3.5% of the men and 4.8% of the women reported frequent nightmares ($P < 0.0001$ for sex difference), but the prevalence was affected by the age of participants and the year of the survey. Nightmare prevalence increased with age, particularly among the men. The number of people reporting occasional nightmares increased roughly by 20% for both sexes from 1972 to 2007 ($P < 0.0001$). Participants with war experiences reported more frequent nightmares and symptoms of insomnia, depression, and anxiety than participants without such experiences ($P < 0.0001$).

Conclusions: Prevalence of nightmares was affected by the sex and age of the participants, and occasional nightmares have become more common in Finland. Exposure to war elevates nightmare prevalence as well as insomnia, depression, and anxiety symptoms even decades after the war; large numbers of war veterans can affect nightmare prevalence on population level.

Keywords: Adult, epidemiology, general population, nightmare, sex differences, veterans

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INTRODUCTION

A nightmare is typically defined as a vivid and frightening dream that awakens the dreamer,[1-3] but the definition of a nightmare, and especially the importance of the awakening criterion in defining nightmares, is still a topic of debate.[4-7] As a result, the definition of nightmare used varies from study to study; in many studies no definition is provided. Nevertheless, these studies produce comparable prevalence estimates, suggesting that the concept of nightmares is well understood among the general population independent of its scientific definition.

Nightmares can be divided into idiopathic and posttraumatic types. Occasional idiopathic nightmares are usually completely benign but frequent nightmares may cause considerable distress and can be associated with other sleep problems and various mental health problems.[8-10] Those experiencing frequent nightmares also have a significantly higher risk for committing suicide.[11,12] Posttraumatic nightmares differ from idiopathic ones because they are triggered by a real traumatic event and contain elements of the original experience. They can also recur with similar content for years[13,14] and are one of the core symptoms of posttraumatic stress disorder.[2,3]

Several theories attempt to explain the etiology of nightmares[9] and an integrative neurocognitive model has been proposed,[9,15] but the understanding of nightmare etiology is still incomplete. Thus, further basic empirical research on nightmare prevalence and correlates in different populations is warranted.

Prevalence estimates of frequent nightmares vary between studies due to differences in methods and study populations. Among the general adult population, only a few large studies have been conducted (Table 1). In general, approximately 2-5% of the general adult population experience frequent nightmares; among adults, women report frequent nightmares more often than men.[12,16-20]

The sex difference is consistently found in studies of adult nightmare prevalence. There are several hypotheses why nightmares are more common among women. Schredl and Reinhard[21] have proposed that the difference might be explained by women having higher dream recall frequency in general as well as higher prevalence of posttraumatic stress disorder, depression, and insomnia, which are associated with nightmares.[13,22,23] Levin and Nielsen[9] have also suggested that sex difference in nightmares may reflect differences in emotional processing and emotional coping style.[15]

The prevalence of nightmares in children, adolescents, and clinical samples (e.g., individuals with chronic insomnia) is

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Table 1—Studies addressing the prevalence of nightmares among the general adult population

Study	n	Sample	Mean age	Question	Prevalence
Bjorvatn et al. 2010	1,000	Random sample of Norwegian general adult population	47 (SD 17.7, 18-96)	Have you experienced nightmares in your sleep?	2.8% at least once a week
Schredl 2010	2,019	Random sample of German general population older than 14 years	46 (SD 16.9, 14-92)	How often have you experienced strongly negatively toned dreams with fear or panic resulting in immediate awakening?	2.4% at least once a week, 4.7% at least once every 2 week
Li et al. 2010	8,558	Random sample of Chinese families with children (data from parents)	41 (SD 5.5, 20-78)	During the past 12 months, how often have you had nightmares?	5.1% at least once a week
Tanskanen et al. 2001	36,211	Series of population surveys in Finland	Among frequent nightmare sufferers 46 (SD 10.8, 25-64)	How often have you had nightmares during the past month?	1.8-6.0% often during the past month
Hublin et al. 1999	3,547	Birth cohort of Finnish twins	44 (SD 7.8, 33-60)	How often do you have nightmares?	At least once a week, males 2.5%, females 3.2%
Janson et al. 1995	2,202	Random samples in three different European countries	33 (SD 7, 20-44)	How often do you have nightmares?	0.9-6.8% at least once a week

SD, standard deviation.

generally found to be higher than among typical adults, although the results vary with differences in methods.[10,24,25] Excluding childhood and adolescence, people also tend to report more nightmares as they age,[21] although this trend is not apparent in all studies.

The purpose of the current study was to investigate the prevalence of nightmares in the Finnish general adult population. Previously Tanskanen et al.[12] have reported the prevalence of nightmares from 1972 to 1992 (n = 36,211) (Table 1) in a sample partially overlapping with the sample of the current study. However, their study focused on the association between frequent nightmares and suicide, whereas the current study focuses on nightmare prevalence in more detail. We were specifically interested in how sex and age are associated with nightmare prevalence and whether the prevalence has changed from 1972 to 2007. In addition, our sample included participants who were confirmed war veterans as well as participants who had lived during World War II, but whose war experiences cannot be verified from the data. Previous studies have shown that war veterans can experience posttraumatic nightmares more than 40 years after the traumatic experience,[26,27] and that war-related dream themes are more common among people who lived during World War II, even 60 years after the war has ended.[28] Therefore, we also investigated the prevalence of nightmares and its correlation with symptoms of insomnia, depression, and anxiety among people who were confirmed war veterans as well as the age group that was at least 18 years old during the war and might have served in the military but whose war experiences cannot be verified from the data available.

We expected that nightmares would be more frequent in women than men and further hypothesized that confirmed war veterans would report frequent nightmares more often than men who did not serve on the front lines due to the posttraumatic nightmares evoked by the war experiences. We also hypothesized that prevalence of nightmares would be higher among participants who were adults during the war, but whose actual war experiences cannot be confirmed compared with the general population who were too young to have served on the front lines during the war or were born after the war had ended. To our knowledge, our study is the first to investigate changes in nightmare prevalence over several decades, and to control for the effect of war exposure on the prevalence of nightmares among the general population.

METHODS

The FINRISK Surveys

Our dataset consisted of eight independent cross-sectional population surveys of the National FINRISK Study (1972, 1977, 1982, 1987, 1992, 1997, 2002, and 2007). An additional subsample of 1,420 participants age 25-64 years from North Karelia in 1977 is also included in our analysis.

FINRISK is a series of large cross-sectional health surveys conducted every 5 years since 1972 and it includes an extensive health and lifestyle questionnaire and a physical examination conducted on a random population sample of Finnish adults. Originally, the primary purpose of the studies was to assess the risk factors of cardiovascular diseases in eastern Finland, but from 1982 onward regions in southern Finland and from 1992 onward regions in northern Finland were added to sampling sites. Every FINRISK survey is conducted on a random sample drawn from the population register of the study regions according to the standardized sampling methods.[29] Because the sampling is random, the same participant might by chance be selected to answer more than one survey. In the whole sample, 3,443 participants are known to have answered at least two surveys but for the most part the surveys contain different participants each year. More details about the methods and the sampling of FINRISK are provided by Vartiainen et al.[30] and the FINRISK website.[31] Each FINRISK study has received the approval of the relevant ethical committee and informed consent was received from all participants (verbal 1972-1992 and

Table 2—Groups within the FINRISK data

	Whole sample			War generation			Confirmed war veterans		
Year	Age range (years)	Men	Women	Age range (years)	Men	Women	Age range (years)	Men	Women
1972	25-59	5,719	5,863	46-59	2,081	2,281	46-59	1,724	85
1977	25-64	5,826	6,153	51-64	1,776	2,193	51-64	1,467	78
1982	25-64	4,480	4,536	56-64	930	1,057	N/A	0	0
1987	25-64	2,794	2,968	61-64	242	230	N/A	0	0
1992	25-64	2,841	3,197	N/A	0	0	N/A	0	0
1997	25-74	4,186	4,149	71-74	271	154	N/A	0	0
2002	25-74	4,407	5,030	N/A	0	0	N/A	0	0
2007	25-74	3,558	4,106	N/A	0	0	N/A	0	0
Total		33,811	36,002		5,300	5,915		3,191	163

The confirmed war veterans are included in the war generation and both are included in the whole sample.

written since 1997). Data are handled in such a way as to guarantee the anonymity of the participants.

The question about nightmares in FINRISK is as follows: "*During the past 30 days, have you had nightmares*" with answer options: "*often; sometimes; never*". No definition of a nightmare is provided for the participants. In addition to nightmares, we also investigated self-reported insomnia, depression, and anxiety symptoms of participants involved in World War II. Questions addressing these issues were phrased as follows: "*During the past 30 days, how often have you been A) bothered by insomnia B) felt depressed* and *C) felt anxious and nervous*" with answer options: "*often; sometimes; never.*" Questions about insomnia and nightmares are present in and phrased the same way in all of the FINRISK surveys, whereas questions about self-reported anxiety and depression are present in and phrased the same way in surveys from 1972 to 2002 but omitted from the survey of 2007.

Participants

Of the 71,921 participants of all eight FINRISK surveys, 69,813 participants (36,002 women, 33,811 men) had answered the question about nightmares and henceforth we refer to these participants as the whole sample. The mean age of the whole sample was 45.9 years (standard deviation [SD] 12.27, median 46, range 25-74).

From the whole sample, we defined two subpopulations: confirmed war veterans and the war generation (Table 2). Identification of war veterans was based on the following questions present only in FINRISK samples of 1972 and 1977: "*Did you serve on the front during the last wars?*" and "*Were you wounded during the war*", with answer options: "*no,*" "*yes, slightly (no permanent injury)*" and "*yes, I am a war invalid.*" The last wars of Finland refer to periods of 1939-1940 and 1941-1944 during the Second World War.

Based on these questions in surveys of 1972 and 1977, 3,191 men (mean age 54.8 years, SD 4.6, median 55, range 46-64) are known to have served on the front lines, and we call this group confirmed war veterans. Of the veterans, 1,306 were wounded during the war and 402 are war invalids. Although there were 163 women who answered that they had served on the front lines, this group was too small to conduct any meaningful analyses on and they were excluded from the veteran group.

The second identified subpopulation is called the war generation, which consists of participants born before 1927. These people were at least age 18 years in 1944 when World War II ended in Finland. From the data available, we cannot determine which of these people have actually participated in war-related activities, but based on the data from 1972 and 1977 we calculated the ratio of men who served on the front lines during the war, and we estimate that approximately two-thirds of the men of the war generation are actual war veterans. In addition to actual war veterans, the war generation includes women and men who did not serve on the front lines, but their lives were most likely also affected by the war to varying degrees, as the conflict in Finland at the time was very serious and affected the entire society.

The war generation consists of 11,215 participants (5,300 men and 5,915 women) in the FINRISK samples of 1972, 1977, 1982, 1987, and 1997. The mean age of the war generation in 1972 was 52.1 years (SD 4.1, median 52, range 46-59), in 1997 it was 72.5 years (SD 1.1, median 72, range 71-74) and over all study years it was 56.5 years (SD 5.9, median 57, range 46-74). The confirmed war veterans are included in the war generation.

Our data include 28,359 participants (14,188 women and 14,171 men) born during 1927 to 1944 and therefore were age 0-17 years during the war. These people are present in every survey. They differ from the war generation in that none of these people should have served on the front lines during the war, but the war may or may not have had an effect on their lives, and thus may have affected their nightmare frequency. We do not treat these participants as a special group for analysis because they (with the war generation) actually outnumber the participants born after the war and therefore they actually represent the Finnish general population during the study years. Thus, by the term general adult population in the current study we are referring to participants born between 1927 and 1982, some of whom may have had war-related experiences in their childhood or adolescence, but none of whom have served on the front lines. This reflects most of the current population of Finland. The general adult population includes 58,598 participants (28,511 men and 30,087 women) with a mean age of 43.6 years (SD 12.0, median 42, range 25-74).

Statistical Methods

For the analysis of associations between nightmares, insomnia, sex, and war experiences, we used the Pearson chi-square

test. To test for trends of nightmare prevalence in relation to age and historical time, the Mantel-Haenszel χ^2 (*MH* χ^2) test for linear trend from SAS software was used. Cramer V was used to give nonparametric effect size estimates, and Spearman nonparametric correlation and multinomial logistic regression were used for additional analysis. Results of regression analysis are given as Exp(B) odds ratios. Because our sample size was large, we decided to use an alpha level of 0.01. Analyses were performed with SAS Institute Inc. SAS 9.2 and IBM SPSS 20.0.

RESULTS

Prevalence of Nightmares

In the whole sample with all years combined (n = 69,813), 3.5% of men and 4.8% of women reported frequent nightmares, and 36.2% of men and 43.5% of women reported having occasional nightmares during the past 30 days. The overall difference between sexes was significant ($\chi^2(2, n = 69,813) = 531.86$, $P < 0.0001$) with a small effect size (Cramer V = 0.09).

Because of the known link between war experiences and the prevalence of nightmares, we anticipate that the whole sample may not represent well the current general population of Finland, as it contains the war generation and as many as two-thirds of the men of the war generation may have been involved in service on the front lines during the war. The current general population of Finland may be better represented by participants who were not been adults during the war or were born after the war. With the war generation omitted (n = 58,598), 2.9% of men and 4.4% of women reported frequent nightmares and 36.2% of men and 45.1% of women reported occasional nightmares. The sex difference was even more significant ($\chi^2(2, n = 58,598) = 667.88$, $P < 0.0001$, Cramer V = 0.11).

The Effect of Age and Sex on the Prevalence of Nightmares

In the whole sample, there was an increasing trend in the prevalence of frequent nightmares of men with advancing age (*MH* $\chi^2(1, n = 33,811) = 216.53$, $P < 0.0001$, Cramer V = 0.08). There was also a significant but weak increasing trend with age in women (*MH* $\chi^2(1, n = 36,002) = 39.15$, $P < 0.0001$, Cramer V = 0.04). Occasional nightmares also became more common among both sexes as they aged (for men *MH* $\chi^2(1, N = 33,811) = 116.79$, $P < 0.0001$, Cramer V = 0.06), for women *MH* $\chi^2(1, n = 36,002) = 42.98$, $P < 0.0001$, Cramer V = 0.05).

Age-related change in nightmare prevalence with the war generation excluded can be seen in Figure 1. Without the war generation, the trends are slightly less significant but otherwise similar compared with the whole sample. In the general population, the prevalence of frequent nightmares of men increased with age (*MH* $\chi^2(1, n = 28,511) = 111.63$, $P < 0.0001$, Cramer V = 0.07) and a slight increasing trend can also be observed in women (*MH* $\chi^2(1, n = 30,087) = 13.3924$, $P = 0.0003$, Cramer V = 0.03) (Figure 1A). Occasional nightmares also increased with age in men (*MH* $\chi^2(1, n = 28,511) = 139.03$, $P < 0.0001$, Cramer V = 0.07), but there was no significant change for women (*MH* $\chi^2(1, n = 30,087) = 0.69$, $P = 0.4049$) (Figure 1B).

Both in the whole sample and in the general population at approximately 55 years of age, the prevalence of frequent nightmares of men reached the levels observed in women and at approximately 65 years of age, the sex difference in the prevalence of occasional nightmares was no longer evident. Exact prevalence figures for nightmares in different age groups can be found in the supplemental material.

Nightmare Prevalence From 1972 to 2007

There was a change in nightmare prevalence from 1972 to 2007 in Finland. This trend was significantly affected by inclusion or omission of the war generation as illustrated in Figure 2.

Among the whole sample, there was a weak but significant decreasing trend for the prevalence of frequent nightmares for both sexes from 1972 to 2007 (for men *MH* $\chi^2(1, n = 33,811) = 19.66$, $P < 0.0001$, Cramer V = 0.03), for women *MH* $\chi^2(1, n = 36,002) = 51.61$, $P < 0.0001$, Cramer V = 0.05). The decreasing trend of frequent nightmares is due to the large number of frequent nightmares reported by the war generation in the samples from 1972 to 1982. When the war generation was excluded, in the general population there was no significant trend in the prevalence of frequent nightmares for men but there was a slight decreasing trend for women (men *MH* $\chi^2(1, n = 28,511) = 4.50$, $P = 0.0338$, women *MH* $\chi^2(1, n = 30,087) = 14.26$, $P = 0.0002$, Cramer V = 0.03).

In the whole sample, for occasional nightmares, there was a significant increasing trend from 1972 to 2007 with peaks at 1997 and 2007 for both sexes (men *MH* $\chi^2(1, n = 33,811) = 111.89$, $P < 0.0001$, Cramer V = 0.07) and women *MH* $\chi^2(1, n = 36,002) = 179.54$, $P < 0.0001$, Cramer V = 0.08). These trends remained significant for both sexes in the general population (men *MH* $\chi^2(1, n = 28,511) = 137.14$, $P < 0.0001$, Cramer V = 0.08, women *MH* $\chi^2(1, n = 30,087) = 71.05$, $P < 0.0001$, Cramer V = 0.06). The exact prevalence figures of nightmares in the different study years can be found in the supplemental material.

Multivariable Analysis of Nightmare Prevalence

To control for the possible confounding effect of the study year to the association between nightmares and age, we constructed a multinomial logistic regression model with sex, age, study year, and belonging to the war generation as predictors for nightmare frequency. Age was used as a continuous variable, but entered into the model categorized into 5-year intervals to better correspond to our previous analysis. All predictors were significant, with female sex and belonging to the war generation being the most significant risk factors for nightmares. Age was a significant predictor for frequent nightmares, but less so for occasional nightmares. The regression model also cannot capture the sex difference in the age distribution of nightmares as seen in Figure 1. Effect of study year is minor, which is in part explained by "belonging to the war generation" carrying the same kind of information. These results are presented in Table 3.

Nightmares and Symptoms of Insomnia, Depression, and Anxiety Among the War Veterans and the War Generation

In the samples of 1972 and 1977, nightmares and insomnia symptoms were reported significantly more often by war veterans than by those men of the 1972 and 1977 samples who had not served on the front lines (for nightmares $\chi^2(2, n = 11,403) = 165.71$, $P < 0.0001$, Cramer V = 0.12, for insomnia $\chi^2(2, n = 11,425) = 216.78$, $P < 0.0001$, Cramer V = 0.14).

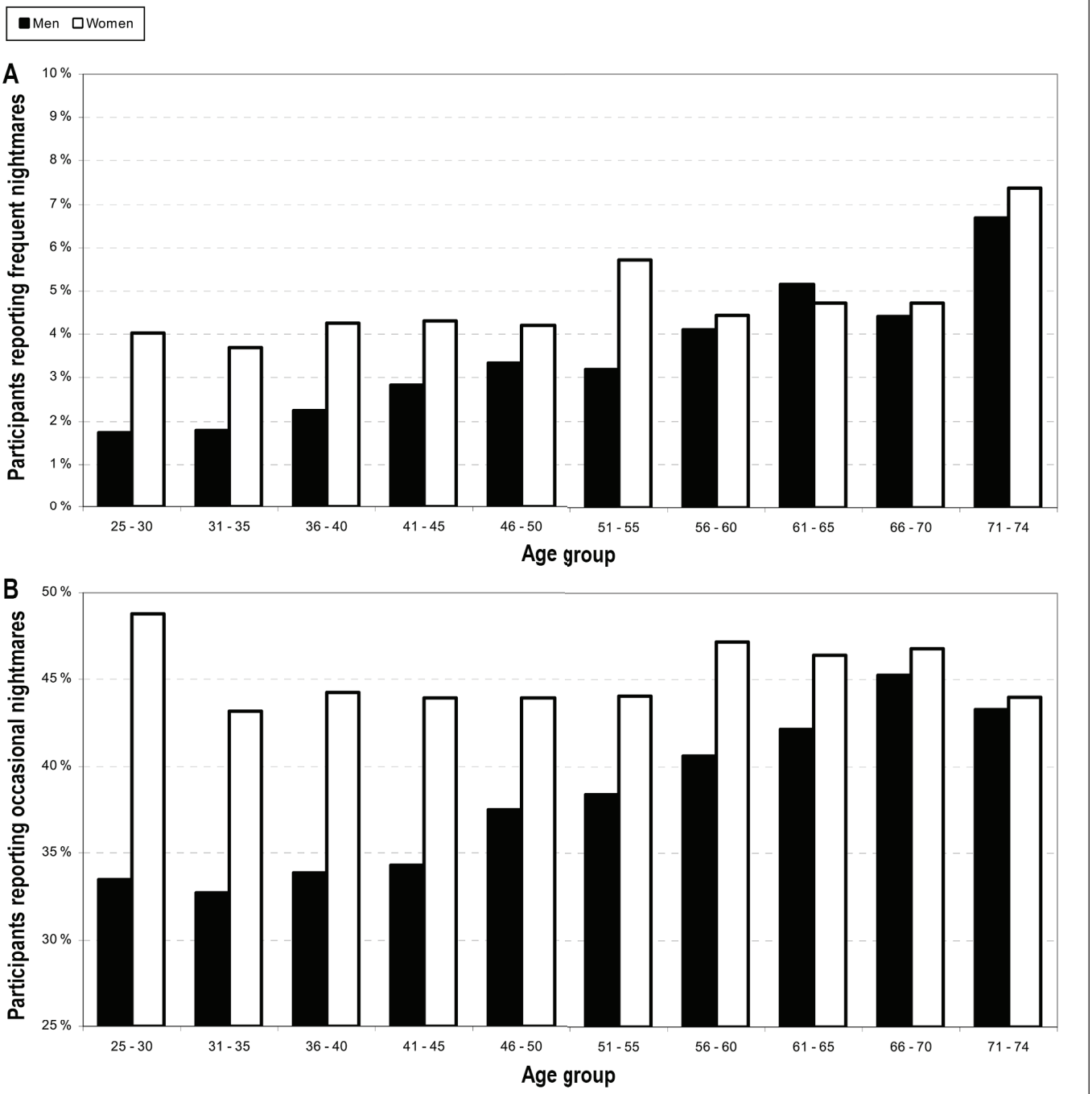

Figure 1—(A) Prevalence of frequent nightmares in different age groups in the general population (war generation excluded) over all study years (n = 58,598). **(B)** Prevalence of occasional nightmares in different age groups in the general population (war generation excluded) over all study years (n = 58,598). Note that the y-axis starts at 25% to make the graph more readable.

Self-reported depression and anxiety symptoms were also significantly more common among war veterans, but the association was somewhat weaker than with insomnia and nightmares (for depression $\chi^2(2, n = 11,371) = 130.97$, $P < 0.0001$, Cramer V = 0.11, for anxiety $\chi^2(2, n = 11,465) = 51.78$, $P < 0.0001$, Cramer V = 0.07).

Among those who had served on the front lines, war invalids reported frequent nightmares slightly more often than those who were not wounded or had sustained nonpermanent injury ($\chi^2(4, n = 3,131) = 14.41$, $P = 0.006$, Cramer V = 0.05). In men with service on the front lines, the prevalence of insomnia, depression, or anxiety symptoms was not statistically significantly different among those who were wounded and those who were not. The prevalence figures can be seen in Table 4.

The prevalence of nightmares and insomnia as well as symptoms of depression and anxiety among the war generation compared with that of participants in the same surveys who were not adults during the war is presented in Table 5. The prevalence of nightmares and insomnia among the war generation is significantly elevated. For nightmares $\chi^2(2, n = 23,005) = 237.24$, $P < 0.0001$, Cramer V = 0.10 for men and $\chi^2(2, n = 23,669) = 149.31$, $P < 0.0001$, Cramer V = 0.08 for

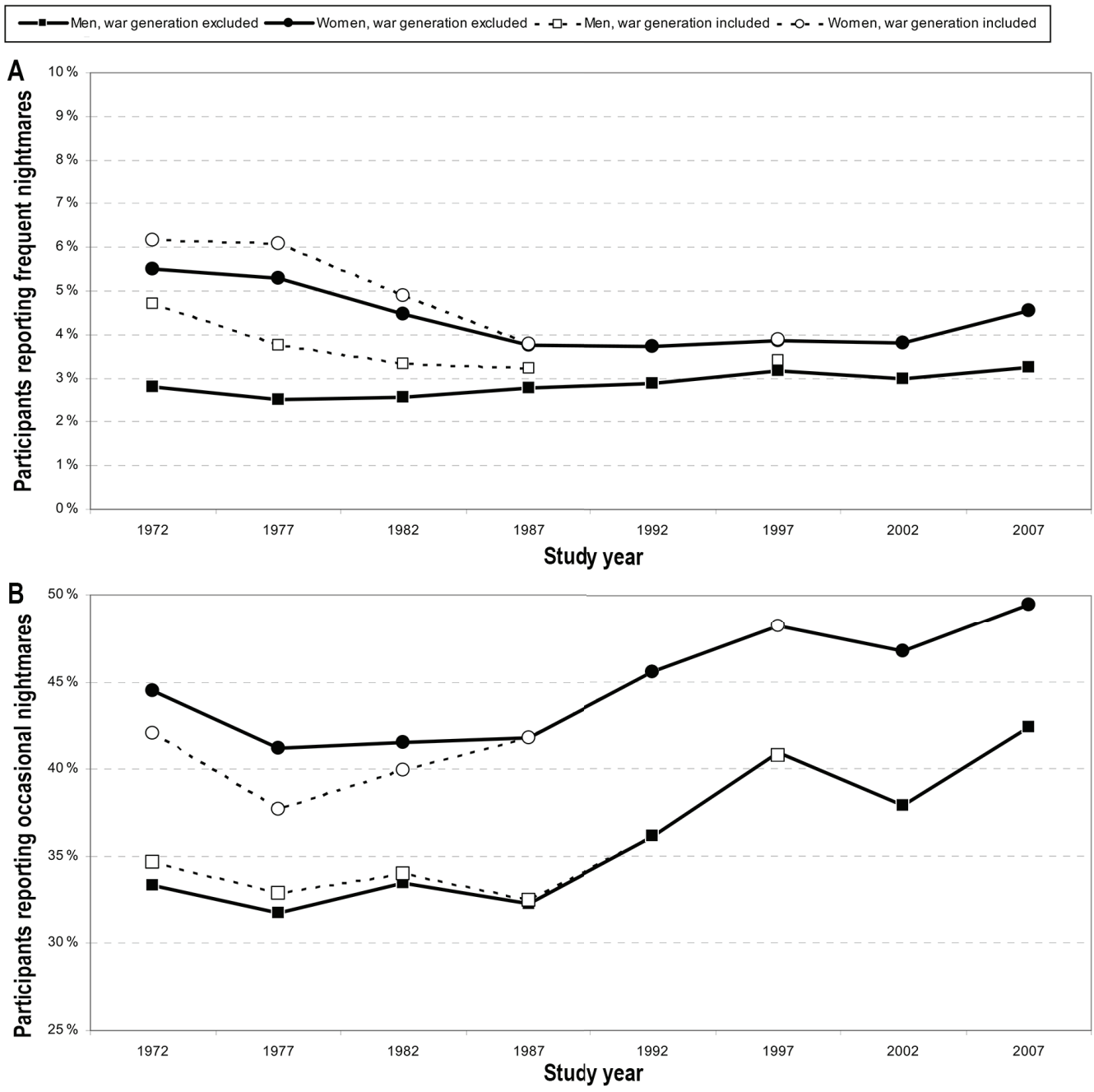

Figure 2—(A) Prevalence of frequent nightmares in the different study years. Solid lines represent the general population (war generation excluded) (n = 58,598) whereas dotted lines represent the whole sample (n = 69,813). **(B)** Prevalence of occasional nightmares in the different study years. Solid lines represent the general population (war generation excluded) (n = 58,598) and dotted lines represent the whole sample (n = 69,813).Note that the y-axis starts at 25% to make the graph more readable.

women and for insomnia ($\chi^2(2, n = 23,089) = 316.54, P < 0.0001$, Cramer V = 0.12 for men and $\chi^2(2, n = 23,853) = 650.17$, $P < 0.0001$, Cramer V = 0.17 for women). The absolute prevalence of nightmares is also higher in men than in women among the war generation. The war generation also reported significantly more symptoms related to depression and anxiety but the associations are weaker than those in nightmares and insomnia (for depression $\chi^2(2, n = 18,808) = 139.84$, $P < 0.0001$, Cramer V = 0.09 for men and $\chi^2(2, n = 19,639) = 68.04.31$, $P < 0.0001$, Cramer V = 0.06 for women and for anxiety ($\chi^2(2, n = 19,810) = 65.57.54$, $P < 0.0001$, Cramer V = 0.06 for men and $\chi^2(2, n = 19,810) = 76.64$, $P < 0.0001$, Cramer V = 0.06 for women).

Nightmares correlate moderately with the symptoms of insomnia ($\rho(61,671) = 0.32$, $P < 0.0001$), depression ($\rho(43,882) = 0.37$, $P < 0.0001$) and anxiety ($\rho(44,092) = 0.31$, $P < 0.0001$) in the whole sample. These correlations are marginally stronger among the war generation and war veterans compared with the general population and among men compared with women, but the differences are not significant. We also investigated whether insomnia, depression, and anxiety symptoms were more prevalent among war veterans and the

Table 3—Multinomial logistic regression analysis of the relations between sex, age, study year, and war experiences

	Occasional nightmares			Frequent nightmares		
Variable	**Sig.**	**OR**	**OR 95% CI**	**Sig.**	**OR**	**OR 95% CI**
Sex						
Female	< 0.0001	1.401	1.359-1.445	< 0.0001	1.588	1.471-1.714
Male		1			1	
Population						
War generation	< 0.0001	0.920	0.870-0.971	0.002	1.207	1.069-1.363
General		1			1	
Age (5-year interval)	0.001	1.013	1.005-1.021	< 0.0001	1.128	1.105-1.151
Study year	< 0.0001	1.009	1.007-1.010	< 0.0001	0.989	0.984-0.993

Reference category is: "*no nightmares during the past 30-days.*" n = 69,813. CI, confidence interval; OR, odds ratio; Sig, significance.

Table 4—Nightmares and symptoms of insomnia, anxiety, and depression of men in 1972 and 1977

	n	Nightmares often (%)	Insomnia often (%)	Depressed often (%)	Anxious often (%)
Did not serve on the front lines	8,212	2.9	5.2	3.9	7.8
Served on the front lines, was not wounded	1,848	7.0	9.6	7.6	11.3
Wounded on the front lines, non-permanent injury	881	7.0	12.3	8.8	13.4
Wounded on the front lines, war invalid	402	10.9	13.4	10.2	12.7

war generation with frequent nightmares than among the general population with frequent nightmares but found no significant differences.

Controlling for the Age Effect on Nightmares of the War Generation

As we have shown previously in this article, frequent nightmares become more common with age. Thus, as the war generation is systematically older than the participants who answered the same surveys but were not adults during the war, the previously reported higher nightmare prevalence may be due to age bias. In an attempt to control for age bias, we also compared the prevalence of nightmares and insomnia symptoms among the war generation to that of the age group that was of a comparable age in the surveys of 2002 and 2007. These participants had not been exposed to World War II in any form and only a small percentage may have had any war- related experiences (such as peacekeeping missions). These age-matched participants were, however, born later and thus lived in a different era; this is a confounding factor that cannot be controlled.

In 2002-2007, the prevalence of frequent nightmares among the age group of 46-74 years was 4.2% among men and 4.8% among women, whereas the prevalence of frequent insomnia was 9.7% and 13.6%, respectively. The difference between the nightmare prevalence of the war generation and the age-matched control group was significant ($\chi^2(2, n = 10,127) = 63.45$, $P < 0.0001$, Cramer V = 0.08 for men and $\chi^2(2, n = 11,071) = 179.68$, $P < 0.0001$, Cramer V = 0.13 for women). The difference in prevalence of insomnia was also significant, although this difference was mostly due to people reporting occasional insomnia (data in the supplemental material) than those with frequent insomnia ($\chi^2(2, n = 10,172) = 25.97$, $P < 0.0001$, Cramer V = 0.05 for men and $\chi^2(2, n = 11,221) = 87.55$, $P < 0.0001$, Cramer V = 0.09 for women).

Table 5—Nightmares and symptoms of insomnia, depression, and anxiety among the war generation and the general population in the combined sample of participants of the years 1972, 1977, 1982, 1987, and 1997

	General population		War generation	
	Men	**Women**	**Men**	**Women**
n	17,705	17,754	5,300	5,915
Nightmares often (%)	2.8	4.6	7.2	7.0
Insomnia often (%)	5.4	6.1	10.9	13.9
Depressed often (%)	3.7	6.5	7.1	9.6
Anxious often (%)	7.3	9.8	11.0	12.0

DISCUSSION

As expected, in our sample of Finnish adults, women report frequent and occasional nightmares more often than men and the nightmare prevalence of war veterans and the war generation is elevated compared with that of participants without war experiences. The prevalence of frequent nightmares in our whole sample is comparable to the prevalence estimates of previous population-based studies.[12,16-20]

The sex difference in nightmare prevalence is affected by the participant's age. Although young women reported nightmares significantly more often than young men, this difference narrows with advancing age and disappears at approximately age 60 years for both frequent and occasional nightmares. It is also worth noting that, although both sexes report nightmares most often in the age group of 71-74 years, women also experience a peak of frequent nightmares in the age group 51-55 years, which coincides with the average age of menopause. It

is known, that women have a higher dream recall frequency in general[32] and this may explain part of the sex difference, but it does not explain why men report more nightmares as they age.

A recent meta-analysis by Schredl and Reinhard[21] shows that previous studies with various methods have found age- and sex-related patterns in nightmare prevalence similar to those of our study. We speculate that a possible explanation for this pattern might be that the tendency to experience nightmares is affected by levels of sex steroid hormones, especially androgens. Androgen levels in men peak at young adulthood and then decreases with advancing age while nightmares are least prevalent at young adulthood and increase with age. [33] The levels and variation of androgens in women overall is much less than in men.[34] There is also converging evidence that androgens affect fear- and stress-related behavior[35-40] as well as many sleep characteristics.[41,42] It would seem plausible to seek to test whether high levels of androgens are a protective factor against nightmares and part of the explanation for the sex difference in nightmare prevalence.

In our data, the prevalence of occasional nightmares has increased and the prevalence of frequent nightmares has decreased slightly during the past 35 years. However, with the war generation excluded, the significant change in the prevalence of frequent nightmares disappears. Thus, the reduction in the prevalence of frequent nightmares in the whole sample is related to a decrease in the amount of participants with war experiences. In addition, the number of people reporting occasional nightmares has increased during 1972 to 2007. There is a steep increase in occasional nightmares during 1987 to 1997, which coincides with a great economic recession that took place in Finland in the 1990s. In an earlier study[43] no evidence of significant changes in parasomnias during 1983 to 1987 and 1992 to 1995 was found. According to our, data, however, the prevalence of occasional nightmares reached its peak later, in 1997, implying a delayed response to the recession.

Overall, it appears that occasional sleep problems, including nightmares, have increased in Finland during the past 3 decades. There has been a minor decrease in the average sleep length, increase in occasional insomnia symptoms, and a large increase in the use of hypnotic agents during 1972 to 2005 in Finland,[44] and there are similar findings from England.[45]

The prevalence of nightmares and insomnia symptoms are significantly higher among the confirmed war veterans and war invalids in the surveys of 1972 and 1977 than among those men who did not serve on the front lines. Notably, this difference remains visible in our data despite the fact that the data were collected 28 years or more after World War II. Furthermore, among the war generation that includes unconfirmed war veterans, men who did not serve on the front lines, and women, the prevalence of nightmares and insomnia symptoms is still high several decades after the war. Part of this increase is probably attributable to age effects rather than war experiences. We do not have an optimal control group for controlling the age effect as our data do not include peers of the war generation without any war experiences. Therefore, the only age-matched control participants of the war generation could be obtained from the surveys of different decades. As such, the difference in nightmare frequency between the war generation and their age-matched postwar control counterparts cannot be interpreted to be caused by the war exposure alone. It is possible that there are some uncontrolled trends in society that also influenced the difference in nightmare prevalence and this possibility should be kept in mind when interpreting the results of this particular comparison.

Because the FINRISK data do not include information on possible posttraumatic stress disorder diagnosis or dream content, it is impossible to estimate the prevalence of idiopathic nightmares compared with posttraumatic ones in our sample. However, previous studies have shown that posttraumatic nightmares can persist decades after the trauma,[26,27] so it is reasonable to assume that the difference we observed between the war veterans and the general population stems from a difference in posttraumatic nightmares.

Confirmed war veterans and also the war generation report more feelings of depression and anxiety than the general population. Unfortunately, the questions available in the early FINRISK surveys about these symptoms are quite vague and it is unclear how well they represent depression and anxiety disorders in a modern sense. Although each of these symptoms is more prevalent among the war veterans and war generation compared with those of participants who were not involved in the war to the same extent, their correlation with each other is not stronger among these groups than among the general population. It should also be noted that nightmares are the only variable that distinguishes in a statistically significant way war veterans who returned home safely from those who were wounded, suggesting that nightmares might be a more sensitive measure of traumatic experiences than self-reports of insomnia, depression, and anxiety symptoms.

The current study only investigated the insomnia symptoms of participants with war experiences because the prevalence and trends of insomnia among the Finnish general adult population in this and some additional samples have been previously studied in detail by Kronholm et al.[44] and Ohayon and Partinen.[46]

The study by Tanskanen and colleagues[12] reported the association between nightmares and suicide and prevalence of nightmares in a subset of the same data (FINRISK 1972-1992) used in our study. An increase in nightmares increased the risk for suicide in a graded manner when several lifestyle and health factors were controlled for. Our study demonstrates that from 1972 to 1987, war experiences significantly affected nightmare prevalence, so it would be interesting to replicate the study by Tanskanen and colleagues[12] while controlling for war experiences.

The nature of the data places some limitations on our study. Because we are working with retrospective dream recall, the participants probably underestimate their dream frequency, and especially nightmare frequency, compared with a dream log study.[4] With the questions available, it is also impossible to assess the participants' normal dream recall frequency or their attitude about dreams, two aspects that have not been controlled in any population-based study of nightmare frequency but have been shown to affect retrospective dream recall estimates.[47]

In our study, no definition of nightmare was given to the participants so the responses reflected both nightmares and bad dreams. Neither was it possible to distinguish between nightmare distress and nightmare frequency, which have been proposed to be partly independent dimensions in a nightmare

disorder.[9] However, population-based studies using loose definitions of a nightmare produce comparable prevalence estimates and also link frequent nightmares to increased psychopathology and suicide risk, so the information produced by these studies has clinical significance.

The strengths of the current study lie in the comprehensive sample used. To our knowledge, no other population-based study has had a sample spanning 35 years with a broad age range of 25-74 years and the possibility to identify people with war experiences from the general population. As our results have shown, war veterans and even the war generation differ significantly from the general population when it comes to nightmares, and future studies of nightmare prevalence would benefit from identifying these kinds of participants in their sample.

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DISCLOSURE STATEMENT

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SUPPLEMENTAL MATERIAL

Tables S1 and S2 present the exact prevalence figures of nightmares in different age groups in the whole sample, and in the general population with the war generation excluded. Tables S3 and S4 present the exact prevalence figures of nightmares in different study years in the whole sample and in the general population with the war generation excluded. Tables S5-S9 present the exact prevalence figures of nightmares and insomnia symptoms among the confirmed war veterans in different study years.

Table S1—Prevalence of nightmares for different age groups, war generation excluded, n = 58,598

	Men reporting nightmares (%)			Women reporting nightmares (%)		
Age (years)	Often	Sometimes	Never	Often	Sometimes	Never
25-30	1.7	33.5	64.8	4.0	48.8	47.2
31-35	1.8	32.7	65.5	3.7	43.2	53.1
36-40	2.3	33.8	63.9	4.3	44.3	51.5
41-45	2.8	34.3	62.9	4.3	43.9	51.8
46-50	3.3	37.5	59.2	4.2	44.0	51.8
51-55	3.2	38.4	58.4	5.7	44.0	50.2
56-60	4.1	40.6	55.2	4.4	47.2	48.3
61-65	5.2	42.1	52.7	4.7	46.4	48.8
66-70	4.4	45.3	50.3	4.7	46.8	48.5
71-74	6.7	43.3	50.0	7.4	44.0	48.6
Total	2.9	36.2	60.9	4.4	45.1	50.5

Table S2—Prevalence of nightmares for different age groups, whole sample, n = 69,813

	Men reporting nightmares (%)			Women reporting nightmares (%)		
Age (years)	Often	Sometimes	Never	Often	Sometimes	Never
25-30	1.7	33.5	64.8	4.0	48.8	47.2
31-35	1.8	32.7	65.5	3.7	43.2	53.1
36-40	2.3	33.8	63.9	4.3	44.3	51.5
41-45	2.8	34.3	62.9	4.3	43.9	51.8
46-50	4.0	36.7	59.3	4.6	42.9	52.5
51-55	4.4	38.3	57.3	6.6	41.2	52.2
56-60	5.7	38.9	55.4	5.8	40.9	53.4
61-65	6.0	39.2	54.7	5.2	40.9	53.9
66-70	4.4	45.3	50.3	4.7	46.8	48.5
71-74	6.7	41.6	51.8	6.7	44.2	49.1
Total	3.5	36.2	60.3	4.8	43.5	51.7

Table S3—Prevalence of nightmares in different study years, whole sample, n = 69,813

	Men reporting nightmares (%)			Women reporting nightmares (%)		
Year	Often	Sometimes	Never	Often	Sometimes	Never
1972	4.7	34.6	60.6	6.2	42.0	51.8
1977	3.8	32.9	63.4	6.1	37.7	56.2
1982	3.3	34.0	62.7	4.9	39.9	55.2
1987	3.2	32.5	64.3	3.8	41.8	54.4
1992	2.9	36.1	61.0	3.7	45.6	50.7
1997	3.4	40.8	55.8	3.9	48.1	48.0
2002	3.0	37.9	59.1	3.8	46.7	49.4
2007	3.3	42.4	54.3	4.6	49.5	46.0
Total	3.5	36.2	60.3	4.8	43.5	51.7

Table S4—Prevalence of nightmares in different study years, war generation excluded, n = 58,598

	Men reporting nightmares (%)			Women reporting nightmares (%)		
Year	Often	Sometimes	Never	Often	Sometimes	Never
1972	2.8	33.3	63.9	5.5	44.5	50.0
1977	2.5	31.8	65.7	5.3	41.2	53.5
1982	2.6	33.4	64.0	4.5	41.6	54.0
1987	2.8	32.3	64.9	3.8	41.8	54.5
1992	2.9	36.1	61.0	3.7	45.6	50.7
1997	3.2	40.9	55.9	3.9	48.2	47.9
2002	3.0	37.9	59.1	3.8	46.7	49.4
2007	3.3	42.4	54.3	4.6	49.5	46.0
Total	2.9	36.2	60.9	4.4	45.1	50.5

Table S5—Nightmares and insomnia among the war veterans (men only) in 1972

	Did not serve on the front lines	Served on the front lines; did not get wounded	Wounded on the front lines; non-permanent injury	Wounded on the front lines; is a war invalid
Nightmares				
Often (%)	3.1	7.09	8.25	12.12
Sometimes (%)	33.5	35.63	38.48	43.43
Never (%)	63.4	57.28	53.28	44.44
n	3,924	1,016	473	198
Insomnia				
Often (%)	5.3	9.51	11.97	15.23
Sometimes (%)	26.5	34.09	36.55	32.49
Never (%)	68.2	56.39	51.47	52.28
n	3,929	1,009	476	197

Table S6—Nightmares and insomnia among the confirmed war veterans (men only) in 1977

	Did not serve on the front lines	Served on the front lines; did not get wounded	Wounded on the front lines; non-permanent injury	Wounded on the front lines; is a war invalid
Nightmares				
Often (%)	2.7	6.85	5.64	9.80
Sometimes (%)	31.9	34.86	39.22	35.29
Never (%)	65.5	58.29	55.15	54.90
n	4,288	832	408	204
Insomnia				
Often (%)	5.2	9.80	12.70	11.60
Sometimes (%)	27.3	34.00	34.50	32.90
Never (%)	67.5	56.30	52.80	55.60
n	4,298	839	409	207

Table S7—Exact prevalence figures of nightmares among the war generation in different study years, n = 11,215

	Men reporting nightmares (%)			Women reporting nightmares (%)		
Year	Often	Sometimes	Never	Often	Sometimes	Never
1972	8.07	36.91	55.02	7.23	38.14	54.63
1977	6.59	35.36	58.05	7.52	31.37	61.10
1982	6.24	36.13	57.63	6.24	34.63	59.13
1987	7.85	34.30	57.85	3.91	42.17	53.91
1997	6.64	38.75	54.61	4.55	44.81	50.65
Total	7.17	36.23	56.60	6.97	35.33	57.70

Table S8—Exact prevalence figures of insomnia symptoms among the war generation in different study years, n = 11,364

	Men reporting insomnia (%)			Women reporting insomnia (%)		
Year	**Often**	**Sometimes**	**Never**	**Often**	**Sometimes**	**Never**
1972	10.72	35.05	54.23	12.82	39.42	47.75
1977	10.94	34.06	55.00	14.55	37.43	48.02
1982	10.44	32.37	57.19	15.61	39.56	44.83
1987	11.95	35.86	52.19	11.97	50.58	37.45
1997	11.72	37.00	51.28	13.64	48.05	38.31
Total	10.85	34.38	54.76	13.95	39.42	46.63

Table S9—Exact prevalence of nightmares and insomnia symptoms among the age group 46-74 years in 2002 and 2007, n = 9,983

	Men	**Women**
Nightmares		
Often (%)	4.18	4.85
Sometimes (%)	41.91	47.77
Never (%)	53.91	47.38
Insomnia		
Often (%)	9.65	13.58
Sometimes (%)	39.21	47.81
Never (%)	51.14	38.61