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Original Article

# Prevalence and associated factors of DSM-V insomnia in Norway: the Nord-Trøndelag Health Study (HUNT 3)

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ABSTRACT

*Background:* Many studies have assessed the prevalence of insomnia, but the influence of non-participants has largely been ignored. The objective of the present study was to estimate the prevalence and associated factors of insomnia in a large adult population using DSM-V (diagnostic and statistical manual of mental disorders, 5th ed.) criteria, also taking non-participants into account.

*Methods:* This cross-sectional study used data from a questionnaire in The Nord-Trøndelag Health Study (HUNT 3) performed in 2006–2008, and a subsequent non-participant study. The total adult population ($n$ = 93,860 aged $\geqslant$20 years) of Nord-Trøndelag County, Norway, was invited. Of these, 40,535 responded to the insomnia questionnaire. Among 42,024 eligible non-participants, 6918 (17%) responded to two insomnia questions.

*Results:* Insomnia was diagnosed by applying modified DSM-V criteria. The age-adjusted insomnia prevalence was estimated using the age distribution of all adult inhabitants of Nord-Trøndelag. Supplementary prevalence data were estimated by extrapolating data from the non-participant study. Additionally, the association between insomnia and self-reported health was estimated, adjusting for known confounders. The total age-adjusted prevalence of insomnia was 7.1% (95% confidence interval [CI], 6.9–7.4) (8.6% for women, 5.5% for men). Adjusting for non-participants, the prevalence estimate changed to 7.9% (95% CI, 7.3–8.6) (9.4% for women, 6.4% for men). Insomnia was more than eight times more likely (OR, 8.3; 95% CI, 6.2–11.1) among individuals with very poor versus very good self-reported health, adjusting for age, gender, employment status, chronic musculoskeletal complaints, anxiety and depression.

*Conclusions:* The adjusted insomnia prevalence estimate in Nord-Trøndelag was 7.9%. Insomnia was strongly associated with poor self-reported health.



## 1. Introduction

Insomnia has a strong effect on patients' health-related quality of life [1], and has a substantial economic impact on society [2–4]. It is also associated with a wide range of physical and mental health problems and found to be a predictor of depression, anxiety, and cardiovascular diseases [5–9]. Many studies have attempted to assess the prevalence of insomnia in their respective populations. However, the reported prevalence differs widely, from 2% [10] to 48% [11], mainly because of methodological variability [8,12]. Some of this variation may be due to different definition of insomnia as several studies have used non-standard diagnostic criteria. To our knowledge, no previous study has assessed the prevalence of insomnia in the general population using the recently published DSM-V criteria. Finally, it is surprising that almost all epidemiological studies ignored the influence of non-participants in their insomnia prevalence estimate.

The primary aim of the present large population-based cross-sectional study was to assess the prevalence of insomnia using the DSM-V [13] criteria, adjusting for prevalence data in non-responders. A secondary goal was to analyze the relative influence of age, gender, employment status, body mass index, systolic blood pressure, smoking, alcohol consumption, physical activity, chronic musculoskeletal complaints, anxiety, depression, and levels of self-reported health on insomnia.

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## 2. Methods

### 2.1. Study area

The county of Nord-Trøndelag is one of 19 Norwegian counties, and is located in the central region of Norway. The inhabitants are fairly representative of the Norwegian population, ethnically mainly consisting of Caucasians and lacking any cities with >25,000 inhabitants.

### 2.2. HUNT studies

The entire population of the Nord-Trøndelag County aged ⩾20 years was invited to participate in the Nord-Trøndelag Health Survey (HUNT) conducted in 1984–1986 (HUNT 1), in 1995–1997 (HUNT 2), and in 2006–2008 (HUNT 3). The main topic of HUNT 1 included arterial hypertension, diabetes, and quality of life, whereas the scope of HUNT 2 and HUNT 3 have expanded over time, to contribute to knowledge regarding a large number of health-related lifestyle factors and diseases, and risk factors of disease. The present study is based on data from HUNT 3.

### 2.3. Study population

Briefly, among 94,194 invited individuals, 93,860 were eligible to participate. Of these, 50,807 (54%) accepted the invitation, and filled in the first questionnaire (Q1) at home before the respondents attended the basic health examination. The participation rate was highest among men aged 70–79 years (67%) and women aged 60–69 (74%), and lowest among men aged 20–29 years (25%), and women aged 20–29 years (39%). A second questionnaire (Q2) focusing more on symptoms and diseases was handed out to everyone to be completed at home, and returned by mail in a prepaid envelope [14]. The present study was based on Q2, and a total of 40,535 (43%) responded to one or more of the sleep-related questions. The median number of days between attendance of the health examination, including the return of Q1, and the day on which Q2 was completed at home was two days (range, 0–30). About nine months after completion of the HUNT three survey, all non-participants still alive and living in Nord-Trøndelag county were invited to a non-participants study sent per mail including a two-page questionnaire and a prepaid envelope for return [14]. A total of 6918 (17%) responded to the questionnaires including questions about insomnia. No reminder was sent. Non-participants had lower socio-economic status, and a higher prevalence of diabetes mellitus, and psychiatric disorders.

### 2.4. Questionnaire

The Q2 included four questions about insomnia symptoms. Subjects were asked: 'How often during the last 3 months has it occurred that you: (1) Had difficulties falling asleep at night? (2) Woke up repeatedly during the night? (3) Woke up too early and couldn't get back to sleep? (4) Felt sleepy during the day?' For all the four questions there were three response options: 'Seldom or never', 'Sometimes', and 'Several times a week.' The non-participant study included questions 1 and 3. The reliability of the insomnia questions has been evaluated previously, and the overall agreement between questionnaire and interview for questions 1–3 was relatively good (kappa value, 0.51; 95% confidence interval [CI], 0.40–0.63) [15].

Among a wide range of topics in Q1 was the question regarding self-reported health: 'What is your health like now?', with four alternatives ranging from very poor to very good. Other topics relevant for this study were anxiety and depression assessed by Hospital Anxiety and Depression Scale (HADS) [16], smoking categorized as 'current daily smoking', 'previously daily smoking', and 'never daily smoking'. Reponses to questions on physical activity were categorized in frequency of exercise per week: never or less than once a week (physically inactive), once a week, two or three times per week, or daily or nearly daily. Subjects were classified as having chronic musculoskeletal complaints when they answered 'yes' to the screening question 'Have you had pain and/or stiffness in muscles and joints continuously for at least 3 months during the last year?' In addition, responders to alcohol questions were categorized into abstainers or not. No questions directly addressing social status were available; however, people employed in paid or voluntary work were asked questions regarding the amount of physical activity the work required: '(1) Work that mostly involves sitting; (2) Work that requires much walking; (3) Work that requires much lifting; (4) Heavy physical labor.' People answering none of these questions were scored as probably unemployed. The medical examination included blood pressure, weight and height measurements. Body mass index (BMI; $kg/m^2$) was calculated and, for the present study, subdivided into three groups: <25, 25–29.9, and ⩾30.

### 2.5. Diagnosis of insomnia

A proxy insomnia diagnosis was given in accordance with DSM-V [13]. Subjects were diagnosed with insomnia if answering 'several times a week' on at least one of the three questions: 'had difficulties falling asleep at night', 'woke up repeatedly during the night', and 'woke up too early and couldn't get back to sleep.' In addition, all had to answer 'several times a week' on the question 'felt sleepy during the day.' In the study of non-participants, questions 2 and 4 were not included, and subjects were considered 'possible insomniacs' if they had difficulties falling asleep at night and/or woke up too early, and could not get back to sleep 'several times a week.'

### 2.6. Ethics

This study was approved by the Regional Committee for Ethics in Medical Research.

### 2.7. Statistics

The prevalence of insomnia in men and women was estimated separately by age decade. Adjusted prevalence estimates with 95% CI were calculated using two different methods. First, the overall prevalence was age-adjusted, using the age distribution of all invited inhabitants in the county of Nord-Trøndelag as the standard population. The sex ratio was calculated using the age-adjusted prevalence of women divided by the age-adjusted prevalence of men. Second, adjustments were performed using insomnia prevalence results in four age groups (20–39, 40–59, 60–79, and ⩾80 years) for those in the non-participant study, by extrapolation of these data for the total group of non-participants. The prevalence of 'possible insomnia' (based solely on question 1 and 3 in both populations) had been calculated both for HUNT 3 participants and non-responder study participants in the non-responder study population. We calculated a non-participant study/HUNT 3 insomnia prevalence ratio separately for each age group, using the question 1 and 3 criteria. This ratio was then multiplied with the HUNT 3 responder-based prevalence, yielding a DSM-V prevalence estimate for non-participants. This was done for each age group. The two prevalence estimates of HUNT 3 participants and non-participants were then combined to make an estimate for the total adult population by summing the number of insomniacs in each age group (after ratio adjustment), and