PAPER II

A comparison of insomnia and depression as predictors of disability pension. The HUNT study

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The HUNT Study

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Abstract

Study Objectives

Depression and insomnia are common and frequently co-morbid. Both are associated with impaired occupational functioning. The objective of this study was to compare their relative impact upon medically certified disability pension award.

Design

Historical cohort study

Setting

Data from a population-based health survey in Nord-Trøndelag County in Norway (HUNT-2) was linked with a comprehensive national social security database.

Participants

Participants within working age (20-66) not already claiming disability pension were included in the study (N=37 308).

Interventions

N/A

Measurements and Results

We compared insomnia and depression as predictors of disability pension award between 18-48 months after the health survey. Both insomnia and depression approximately doubled the risk of disability pension award after adjustment for multiple health and sociodemographic factors. Co-occurrence between insomnia and depression was less prevalent (2.1%) than expected and produced an additive risk for disability pension award. Potentially confounding factors were similar in depression and insomnia. After adjustment for age, somatic diseases, socioeconomic factors, health behaviors, and night/shift work accounted for relatively little of the effects. In contrast, adjustments for somatic symptoms and anxiety did explain much of the effect in both depression and insomnia, but is problematic as it might partly represent over-adjustments. Due to higher prevalence, insomnia predicted more work-related disability than depression in terms of population attributable fractions.

Conclusions

Depression is consistently recognized as a major contributor to work disability and is frequently the eliciting diagnosis in disability pension award. Our results suggest that insomnia has an equally important and independent role, particularly amongst the younger group, but rarely found in official registries of disability pension causes. This suggests that this potentially treatable factor has considerable economic impact, and should receive more attention in clinical and public health management.

Introduction

Depression and insomnia are common conditions with similar prevalence rates in the general population of about 10 %.[1, 2] They frequently co-occur, but their individual influences on clinical trajectories and outcomes are uncertain.[3] Although independently recognized as nosologic entities, people experiencing both insomnia and depression are usually given only one diagnosis; depression usually considered the primary cause. Sleep disturbances including insomnia are traditionally accepted as symptoms of depression.[4] However, this concept of secondary insomnia has been challenged, and recent evidence suggest that insomnia and depression may be better understood as co-occurring conditions.[5] Both insomnia and depression are associated with a range of negative outcomes, including worse reported quality of life[6] and increased medical morbidity.[7] Both are associated with impaired occupational functioning. Cost of illness studies have suggested that the economic burden of insomnia in the USA, ranges between US$92-107 billion,[8] whilst the decline in work performance alone during depressive episodes is estimated to cost US$44 billion per year.[9]

Across developed countries, between 1 % and 5 % of gross domestic product is spent on disability benefits.[10] In the United States, 10 % of all social expenditure is on disability benefits (including veteran's and worker's compensation, employer disability payments, Social Security Disability Insurance, and Supplementary Security Income).[10] According to official statistics, about one in three benefit awards are for mental disorders,[10] commonly depression. Insomnia, on the other hand, is seldom identified in benefit statistics. However, these are usually derived from physician diagnoses, and factors such as patient preferences, stigma and legislative practices may influence what diagnosis is recorded.[11] Thus, the statistics may not necessarily reflect the true underlying cause of disability, and recent studies have suggested that they may underestimate the true effect of anxiety and depression,[12] and effectively ignore insomnia as an independent risk factor for occupational disability.[13] The objective of this study was to compare the individual and combined impact of insomnia and depression on award of a disability pension in a large surveyed population in Norway.

Methods

Summary of design

By linking exposure data from a large cross-sectional survey with outcome data from routine national statistics, a historical cohort study was constructed. The Health Study of Nord-Trøndelag County (HUNT-2) carried out in Norway between August 1995 and June 1997. Award of a disability pension 18 to 48 months after the survey was obtained from the Norwegian National Insurance Administration and linked using national identity numbers.

Participants and procedures

All 92 100 inhabitants of Nord-Trøndelag County, Norway, aged 20 to 89 years, were invited to a clinical examination as part of a general health screening programme: HUNT-2. Of these, 65 648 (71 %) attended a physical examination, where they received a second set of questionnaires, which 52 814 (80 %) completed. Participants reaching the retirement age of 67 years during the follow-up were excluded (*n*=11 123) for this analysis, as were participants who were receiving a disability pension at baseline (*n*=3 964), and those who were awarded a disability pension within 18 months of the baseline interview (*n*=419). The analysed sample comprised 37 308 people: 19 936 women and 17 372 men. In a follow-up study of randomly selected non-participants,[14] the most common reasons for not attending the health screening in the working age population were 1) not finding the time or need for a health examination and 2) serious physical illness.

Insomnia

DSM-IV diagnostic criteria for insomnia comprise difficulty falling asleep, maintaining sleep, or experiencing non-restorative sleep for a period no less than one month, resulting in impaired daytime functioning.[4] In this study, insomnia was defined as an answer of "often" or "almost every night" to either of the questions: "Have you had problems in getting to sleep in the last month?" or "During the last month, have you ever woken too early and not been able to get back to sleep?"[13]

Depression

The Hospital Anxiety and Depression scale (HADS) is a self-report questionnaire comprising 14 four-point Likert-scaled items, of which seven measure depression (HADS-D). Originally intended for use in screening patients in a general hospital setting, no items on somatic complaints or sleeping difficulties are included. A cut-off score of 8 on the depression

subscale defines caseness with a sensitivity and specificity of about 0.80 according to DSM-III and IV, ICD-8 and 9,[15] and has been widely used in previous research.

Outcome: disability pension award

The criterion for awarding disability pensions in Norway is an application stating cause-specific and lasting reduced functional ability due to an acknowledged medical condition. The medical condition is physician certified and further examined by specialists when appropriate. Adequate treatment and rehabilitation must have been attempted. In principle, any medical condition that causes a greater than fifty percent lasting reduction of work capability can warrant disability pension award. The Norwegian National Insurance Administration records information on all awards of disability pension. Correct registration is a prerequisite for transfers of payments and the records are thus highly accurate. Using national personal identification numbers, these data were linked to those from the HUNT-2 survey[12, 13]. All participants had explicitly consented to such linkages being made.

Other covariates

Selection and operalization of other covariates was carried out based on findings from other analyses of work related disability and mental disorders based on the same dataset.[12, 13] Information on age and gender was gathered from the national population registry. Since benefits are principally awarded for health reasons, we adjusted for number of self-reported somatic diseases and symptoms, and HADS-anxiety.[12] Socioeconomic status was identified through two variables: social status of current job according to the Ericson, Goldthorpe and Portocarero (EPG) scheme,[16] and education grouped by three levels. Night-, or shift work, was recorded by self-report. Health-related behaviours recorded in the survey (daily cigarette smoking, potentially problematic alcohol consumption according to CAGE criteria,[17] and being physically active for one or more hours the previous week) were included as candidate covariates.

Statistics

By combining depression and insomnia, four mutually exclusive categories were defined for comparison: insomnia alone, depression alone, comorbid insomnia and depression, and a reference category of neither depression nor insomnia. Logistic regression analyses were used to investigate the relative associations of depression and/or insomnia and award of a disability pension. Potential confounders were added to the model in the order summarised above. Finally we tested if any increased risk from comorbid insomnia and depression was additive

or multiplicative. Since disability pension award is associated with increased age and female gender, we also tested whether these factors modified associations of interest. Population attributable fractions (PAF) were calculated (and presented as percentages) from the unadjusted model, a model adjusted for somatic disease, SES/education and health behaviour, and also the fully adjusted model.

Role of the funding source

No funding source had any influence on the study.

Results

Of the 37,308 participants, 3000 (8.0 %) were defined as having insomnia alone (of these 68.6 % had no additional somatic diagnosis), 2138 (5.7 %) had depression only, and 800 (2.1 %) were defined as having comorbid insomnia and depression (table 1). Those with depression or insomnia shared baseline associations with higher age, lower education and lower socio-economic status compared to the reference group. Adverse health behaviours (smoking, high alcohol consumption, and physical inactivity) were increased in groups with either insomnia or depression compared to the reference group: more so for depression than insomnia. In contrast, somatic diseases were more common in the group with insomnia alone than in those with depression alone.

In total, 915 (2.5 %) of the participants were awarded disability pension during the follow-up period. Approximately one in twenty participants with either insomnia (5.1 %) or depression (4.6 %) alone received a disability pension over the subsequent four years, excluding the 18 months immediately after the health survey. The presence of both conditions doubled this likelihood to 9.5 %. Both conditions predicted disability pension award during the follow-up period, with unadjusted odds ratios of 2.81 (2.35-3.38) for insomnia alone, 2.52 (2.02-3.13) for depression alone and 5.50 (4.28-7.06) for both (table 2). In the model adjusted for somatic disease, SES/education and health behaviour, both insomnia and depression alone predicted disability pension whilst comorbid insomnia and depression further doubled this risk. In the model including all covariates, the odds ratio for insomnia remained significant, while depression was borderline non-significant. The risk of disability pension award associated with insomnia exceeded that of depression regardless of which covariates were adjusted for (table 2).

There was no statistically significant interaction between insomnia and depression in predicting disability pension award. The associations were stronger for those under the age of 45 than over 45 in all groups: insomnia (2.93 (1.90-4.51) vs. 1.77 (1.43-2.17)), depression (2.95 (1.82-4.99 vs. 1.52 (1.18-1.96)) and comorbid insomnia and depression (8.64 (5.36-13-90 vs. 2.65 (1.94-3-62)). Gender did not modify the associations of interest (data not shown).

Based on the model adjusted for somatic disease, SES/education and health behaviour, the population attributable fraction for disability pension award from insomnia alone (4.0%) was

larger than that from depression (2.5%) which again was larger than that from comorbid insomnia and depression (1.5%) (table 2).

Of those with only insomnia that went on to award of disability pension, more than half (51.0% (43.1-58.9)) ultimately received a musculoskeletal diagnosis. Of those awarded a disability pension, only 15.7 % (9.9-21.4) of those with previous insomnia were awarded a disability pension for a mental diagnosis in contrast to 29.6 % (20.6-38.6) of those with depression (table 3).

Discussion

In a large well-characterised population, we investigated depression and insomnia as predictors of disability pension award 18-48 months later. These two conditions had a slightly lower prevalence to that found in other studies [5-7], and co-occurrence was less common than that suggested [6,7]. We found that insomnia was as strong a risk factor for disability pension award as depression, after adjustment for a range of confounders. The two risk factors were effectively independent and additive. In terms of population attributable fractions, insomnia accounts for as much work-related disability as do depression and comorbid insomnia/depression together, predominantly because of a greater prevalence.

Strengths and limitations

The main strength of the study is the historical cohort design, conducted on a large sample representative of the working age population with a high participation rate. Our measures of disability pension stem from routinely collected official registries, whose accuracy is high (even following participants who migrate) and unlikely to be influenced by exposure status. At baseline, neither participants nor administrators were aware of the hypothesis tested here, reducing the possibility of influencing subsequent behaviour through participation.

The most important limitation of the study concerns our lack of data on the non-attendees. Higher rates of disability pension award and serious illness among non-attendees than participants has been reported for this population.[18, 19] Health selection might lead to an underestimation of the associations of interest, and of confounding by health status.

Many of the measures in this survey relied on self-reported information. The HADS was developed for use in general hospital settings and biological symptoms are excluded to avoid identification of false positive cases. Since many other depression inventories include sleep items, the HADS was particularly suitable for this analysis. The case finding properties of the HADS have been found to be comparable to, or even outperforming, general practitioners in primary care settings.[20] Our proxy measure of DSM-IV insomnia has been employed in previous relevant publications.[13] Although our measure enquired about problems over the last month, we did not have a specific item on duration. There was also no question on functional limitation relating to insomnia, or nonrestorative sleep.[21] However, inclusion of items on daytime impairment from poor sleep would have introduced circularity to the association of interest. For having measured insomnia symptoms the estimated prevalence was rather low,[22]

but justifiably so considering the known curvilinear age-insomnia association and the restricted age span in the present study. We included a range of covariates as possible confounders of the associations.

As with any observational study, a causal relationship cannot be inferred absolutely between exposure and outcome. An eighteen month interval was imposed between exposure and outcome ascertainment to reduce the likelihood of impending retirement having an influence on reported mental state. However cognitive changes, financial insecurity, loss of role functioning and social integration associated with temporary sickness absence at the time of the survey cannot be absolutely ruled out as underlying factors.

Interpretation

After taking these limitations into account, the results of our study indicate that insomnia is an important and underestimated prequel to work-related disability, at least comparable to depression. From benefit statistics, insomnia is rarely, if ever, identified as a factor in occupational disability, although depression frequently so, leading to major health initiatives[23]. In fact, the outcome associations with insomnia were stronger (although differences were not statistically significant) than those with depression in all regression models. The model including all covariates is most likely over-adjusted, and to be considered conservative estimates of the true effects of insomnia and depression on work-related disability. It is not possible to empirically decide the true degree of confounding (as opposed to mediating) in this historical cohort design. Age is an obvious confounder, while for instance anxiety and somatic symptoms are likely to be both confounders and mediators. Regardless of this, the conclusion that insomnia exceeded depression as risk factor for work-related disability was robust across all levels of adjustments. It could however be argued that the validity of these comparisons diminishes successively by the adjustment steps as we remove insomnia, somatic symptoms and anxiety, all factors that are embedded in the depression construct.

There are several possible explanations for under-reporting of insomnia in official statistics. Insomnia is usually considered as secondary to other conditions.[3] However in this population base sample 25% of those with insomnia reported no other health condition at baseline. According to a National Institutes of Health consensus paper, the most common comorbidities with insomnia are psychiatric disorders (particularly depression), cardiopulmonary disorders and conditions associated with pain (e.g. musculoskeletal syndromes).[3] Previous

investigations of the public health impact of insomnia have been criticized for not addressing this comorbidity.[24] Comorbidity with health conditions was adjusted for in the analyses, and did indeed reduce the estimates for insomnia, but still left a doubled risk of disability pension award. Further attenuation following adjustment for health behaviours and demographic factors was trivial for insomnia and limited for depression, indicating that reported health conditions are the most important confounding factor. The model including covariates anxiety and somatic symptoms is most likely highly over-adjusted. Nevertheless, also in this model Insomnia remains a significant predictor of disability pension during follow-up, while depression was marginally non-significant. In our study, we cannot rule out that insomnia is a symptom of unreported disease in remission or at prodromal stages at baseline, but do not believe that this is likely to completely account for the findings.

Another possible explanation is the uncertain extent to which depression and insomnia can be considered as separable conditions.[5] We believe it is unlikely that insomnia is simply acting as a marker of depression severity, since three thousand people with insomnia did not meet case levels across a range of other depressive symptoms. The stronger impact of comorbid insomnia and depression compared to depression alone might reflect underlying severity. However, some authors have suggested that the concept of secondary insomnia has been exaggerated beyond empirical support and that insomnia should rather be understood as a separate comorbid condition.[25] The lack of an interaction effect between insomnia and depression indicate that the variables additively contribute towards increasing the risk of disability pension. Thus, in comorbid cases, successful treatment of either should reduce the risk of disability. Treatment of either condition may even reduce disability related to both. We have previously demonstrated that depression is an independent predictor of disability pension officially awarded for non-mental diagnoses.[12] This study suggests the same is true for insomnia.

Finally, the population attributable fractions (based on estimates after the fifth step of the adjusted model) provide a theoretical estimate of what proportion of the outcome could be avoided if we were able to remove the given exposure. In this case, successful treatment of insomnia would theoretically achieve more in terms of reducing disability pension awards than an equivalent success rate in treating depression. A first step could then be to improve recognition of insomnia and improve access to effective interventions. There are several studies pointing to a potential improvement in how insomnia generally is treated,[26] and improved use of better treatment modalities may thus represent a potential means for

preventing or reducing work-related disability. The significantly greater risk of disability pension for both insomnia and depression among those younger that age 45, suggests these factors are even more important if receiving adequate and effective treatment could increase the likelihood of continuing wage earning capacity.

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The first author had full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

Ethical approval

HUNT-2 was approved by the National Data Inspectorate and the Board of Research Ethics in Health Region IV of Norway. Written informed consent was obtained from all subjects included in this study.

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Table 1 – Sample characteristics and outcome frequency across insomnia, depression and co-morbid insomnia and depression

	None n=31 370	Insomnia only n=3 000	Depression only n=2 138	Both N=800
Female gender (%)	16 718 (53.3)	1 763 (58.8)	1 006 (47.1)	449 (56.1)
Age, mean (SD)	41.66 (12.34)	45.20 (12.59)	45.95 (11.24)	45.91 (11.44)
Education (%)				
Compulsory only	7 251 (23.1)	982 (32.7)	774 (36.2)	307 (38.4)
College	15 801 (50.4)	1 362 (45.4)	968 (45.3)	370 (46.3)
University level	8 318 (25.5)	656 (21.9)	396 (18.5)	123 (15.4)
Socioeconomic status (%)				
I (highest)	2 954 (9.4)	276 (9.2)	205 (9.6)	52 (6.5)
II	5 552 (17.7)	473 (15.8)	278 (13.0)	102 (12.8)
III	6 132 (19.5)	582 (19.4)	368 (17.2)	147 (18.4)
IV	4 766 (15.2)	429 (14.3)	480 (22.5)	143 (17.9)
V + VI	3 769 (12.0)	304 (10.1)	238 (11.1)	86 (10.8)
VII (lowest)	4 911 (15.7)	552 (18.4)	361 (16.9)	154 (19.3)
Not working or not applicable	3 286 (10.5)	384 (12.8)	208 (9.7)	116 (14.5)
Night/shift work (%)	6 206 (19.8)	607 (20.2)	380 (17.8)	152 (19.0)
Consumption of too much alcohol during the last 14 days (%)	3 427 (10.9)	449 (15.0)	396 (18.5)	138 (17.3)
Daily cigarette smoking (%)	5 739 (18.3)	665 (22.2)	555 (26.0)	213 (26.6)
Mean (SD) number of somatic diagnoses	0.25 (0.54)	0.42 (0.71)	0.36 (0.65)	0.52 (0.77)
Mean (SD) number of somatic symptoms	1.42 (1.14)	2.12 (1.19)	2.04 (1.23)	2.67 (1.16)
Anxiety	3.6 (2.72)	5.67 (3.36)	7.77 (3.64)	10.19 (3.99)
Physically active ≥ 1 hour the last week (%)	24 210 (77.2)	2 226 (74.2)	1 373 (64.2)	497 (62.1)
Disability pension award (%)	588 (1.9)	153 (5.1)	98 (4.6)	76 (9.5)

Table 2 – Odd ratios (95 % CI) for disability pension during follow up in logistic regression analysis, and population attributable fractions (PAF) for crude and fully adjusted estimates

	None	Insomnia only	Depression only	Both
1 Crude	Ref	2.81 (2.35-3.38)	2.52 (2.02-3.13)	5.50 (4.28-7.06)
2 + Adj. Gender, age	Ref	2.22 (1.85-2.68)	2.06 (1.65-2.57)	4.49 (3.47-5.80)
3 + Adj. Somatic disease	Ref	2.03 (1.68-2.45)	1.94 (1.55-2.43)	3.92 (3.02-5.09)
4 + Adj. Education and SES	Ref	2.00 (1.66-2.41)	1.86 (1.48-2.32)	3.73 (2.87-4.85)
5 + Adj. Health behavior	Ref	1.98 (1.64-2.39)	1.78 (1.42-2.23)	3.57 (2.75-4.65)
6 + Adj. Night/Shift work	Ref	1.98 (1.64-2.39)	1.78 (1.42-2.23)	3.57 (2.75-4.64)
7 + Adj. Somatic symptoms	Ref	1.61 (1.33-1.95)	1.48 (1.18-1.86)	2.58 (1.97-3.37)
8 + Adj. Anxiety	Ref	1.47 (1.21-1.79)	1.20 (0.94-1.53)	1.89 (1.41-2.54)
PAF, crude model		5.2	3.5	1.8
PAF, adj. through step 5		4.0	2.5	1.5
PAF, fully adjusted model		2.5	0.9	1.0

Table 3 – The official diagnoses those with insomnia, depression and both were awarded disability pension for during follow-up. Percents (95 % Confidence Intervals)

	Mental*	Muscle-Skeletal*	Other Diagnosis*
Insomnia only	15.7 (9.9 – 21.4)	51.0 (43.1 – 58.9)	33.3 (25.9 – 40.8)
Depression only	29.6 (20.6 – 38.6)	35.7 (26.2 – 45.2)	34.7 (25.3 – 44.1)
Both	25.0 (15.3 – 34.7)	42.1 (31.0 – 53.2)	32.9 (22.3 – 43.5)

* ICD-10 Broad diagnosis categories in official registries, based on physicians' certification