The Course of Insomnia over One Year: a Longitudinal Study in the General Population in Sweden

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Study Objectives: The purpose of this study was to examine the course of insomnia in the general population over one year with an emphasis on prevalence, consequences, persistence, remission, and incidence of insomnia.

Design: This study employed a longitudinal design with a 1-year follow-up. Insomnia was defined as reporting problems sleeping for 3 nights or more per week during the past 3 months, problems with daytime symptoms or daytime functioning, and difficulties with sleep onset, sleep maintenance, or early morning awakening.

Participants: From a randomly selected sample of the adult general population (*N* = 3,000; 20 to 60 years), 1,746 individuals filled out a baseline and 1-year follow-up survey.

Results: The prevalence rates of insomnia were 6.8% to 9.7% at the 2 assessment points. The longitudinal analyses suggested that for 44.4% of the individuals with insomnia at baseline, insomnia was characterized by persistence (4.3% of the general population). For 56.6% of the individuals with insomnia at baseline, the condition remitted over one year (5.4% of the general population). The cumulative incidence of insomnia was 2.8% over the course of a year.

Conclusions: In summary, the results showed that insomnia is a prevalent condition in the general population associated with negative consequences and is characterized not only by persistence but also by relatively high remission and incidence.

Keywords: insomnia, course, prevalence, incidence, persistence, remission

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INSOMNIA IS ONE OF THE MOST PREVALENT SLEEP DISORDERS AND CAN BE CHARACTERIZED AS COMPRISING SUBJECTIVE SLEEP SYMPTOMS, ASSOCIATED negative daytime symptoms, and severe distress or impairment in vital areas of functioning.[1] Over the years, more than fifty studies on insomnia have been presented based on data collected in representative samples or populations.[2] These studies show that about one-third of the general population experience insomnia symptoms, 9% to 15% report insomnia symptoms with daytime consequences, 8% to 18% experience sleep dissatisfaction, and 6% fulfill the criteria for insomnia diagnoses. Although insomnia is often viewed as primarily a persistent condition,[3] this assumption may however be questioned since few epidemiological studies have longitudinally explored the course of insomnia in the population as a whole. It is consequently emphasized in recent review articles that future epidemiological studies should focus on the longitudinal course of insomnia.[2,4] The purpose of the present study was thus to fill this gap by studying the longitudinal course of insomnia in the general population.

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The Course of Insomnia

A number of retrospective and longitudinal studies have illuminated how insomnia unfolds over time. Retrospective studies demonstrate that about 80% of individuals with severe insomnia have had the problem for more than one year, with approximately 40% reporting more than 5 years.[5-7] In addition to retrospective studies, a few longitudinal studies have examined the course of insomnia in patient samples, e.g., patients with medical or psychiatric disorders and general practice attendees.[8-10] The findings from these longitudinal studies demonstrate that of those patients who report insomnia at baseline 40% to 47% still fulfill the criteria for insomnia at follow-up.[8,9] These studies also show that among patients with different conditions about 3% develop insomnia over the course of a year.[8,10]

A few reports are also available in the research literature about the longitudinal course of insomnia in the general population.[11-16] The results from these longitudinal studies show that of all individuals who report insomnia symptoms at baseline, 52% to 73% still reports such symptoms at follow-up.[11-13] Further, evidence suggests that previous complaints of insomnia predict complaints of initiating and maintaining sleep over time.[14] In addition, these longitudinal studies demonstrate that for about 5% of the individuals, insomnia symptoms develop per year.[11,12] It should be underscored that the course of insomnia may be affected by whether or not the condition was chronic or acute at the initial assessment, which could influence rates of persistence and remission at subsequent assessments. A feature of all the abovementioned studies is that insomnia has been defined by different components of poor sleep, e.g., type, frequency, and duration of sleep problem. Although the reported studies are important for providing information about the course of insomnia, the limited criteria for insomnia are problematic since diagnostic systems also underscore that there

should be not only components of poor sleep present but also negative daytime consequences, i.e., symptoms and functional interference.[17-20]

To our knowledge, the course of insomnia in the general population, taking into account also the daytime consequences of poor sleep, has only been examined in one previous study.[21] The results of that study suggested that about 10% fulfilled the criteria for insomnia (the past 2 weeks) at baseline. Of the participants with insomnia at baseline, 31% reported it again at the 1-year follow-up. Thus, 69% of those with insomnia at baseline no longer reported insomnia at follow-up. The findings also showed that approximately 6% of those without insomnia at baseline had developed insomnia at follow-up. In summary, the only available study using standardized criteria for insomnia show that insomnia is a prevalent condition, for 10% of the population it is a persistent condition, for two-thirds it is a recurrent condition, and for a small segment of the population it develops over time.

Since retrospective studies are associated with several potential methodological shortcomings (e.g., recall bias), prospective designs have been recommended, as they allow for stronger conclusions to be drawn. Although studies on the course of insomnia in patient samples are important, such investigations do not necessarily provide information about how insomnia unfolds over time in the population as a whole. Consequently, longitudinal studies in the general population are needed. An additional problem is that the majority of longitudinal studies that have been published almost exclusively have defined insomnia only by self-reported poor sleep (for an exception see Ford & Kamerow[21]). Instead, standardized criteria that include the assessment of daytime consequences are often recommended when determining insomnia.[17-20] A final problem with the majority of longitudinal studies that so far have been published is that the different aspects of the long-term course of insomnia have not been reported. Although several studies have examined the prevalence and consequences of insomnia, few investigations have investigated the persistence, remission, and incidence of insomnia in the population as a whole. It is thus difficult to estimate the proportion of individuals who suffer from persistent insomnia and recurrent insomnia as well as the proportion of individuals who develop new episodes of insomnia over time.

Aim of the Study

The overall aim with this investigation was to study the course of insomnia over one year in the general population. The focus of the study was to examine the prevalence, consequences, persistence, remission, and incidence of insomnia.

METHOD

Overview of the Design

This longitudinal study was carried out in the general population. The status of insomnia was assessed both at baseline and at the 1-year follow-up. The 1,746 individuals who returned the baseline and follow-up questionnaire were the focus of this study. The Örebro Hospital's Board on Research Ethics approved this study.

Participants

This study is a population-based investigation from a random sample of 3,000 residents, 20 to 60 years old, from 3 of 25 counties in Sweden (Södermanland, Värmland, and Västmanland). The 3 counties are representative of all Swedish counties in terms of socioeconomic status, gender, age, and living areas. The sample was obtained from public records, in which all residents are listed, of the 3 counties via simple random sampling. The age range, 20 to 60 years, was chosen as to provide a sample of adults in the general population.

Of the 3,000 residents, 2,076 participants (69%) returned the baseline questionnaire. To assess whether the baseline non-responders differed from the responders, an attrition analysis in 2 steps was performed.[22] In the first step, information about age and gender was collected from the public records of the 3 counties. When comparisons were made between the responders and the 924 non-responders on age and gender, the results showed that there was no difference between the groups on age and that there were slightly more women (52%) than men (48%) who returned the baseline questionnaire. In the 3 counties, there were in total 50.2% to 50.5% women and 49.5% to 49.8% men. In the second step, a computer-generated random sample was used to conduct a telephone interview assessing sleep problems of 49 non-responders (5.3% of the non-responders). The question that was asked by a research assistant to the 49 non-responders was: "Have you had problems sleeping during the past 3 months?" (response alternatives: yes/no). The results demonstrated that there were more responders (35%) than non-responders (29%), who reported a sleep problem during the past 3 months at baseline.

Measures and Procedure

The questionnaire was based on existing and validated surveys, and was constructed to determine a number of factors, including demographic variables, sleep, daytime symptoms, and daytime functioning. The following demographic parameters were assessed: age, gender, civil status (married or cohabitant/ living alone), and occupational status (employed/ student/ not employed/ sick leave or pension). The baseline questionnaire was sent to the 3,000 residents, along with a letter of introduction, information about the project and a stamped return envelope. The follow-up questionnaire was then mailed one year later to the 2,076 individuals who returned the baseline questionnaire. If a response was not received at both baseline and follow-up within 2 weeks a reminder was mailed. If an additional 2 weeks elapsed without a response, a second reminder was sent.

Insomnia

To assess insomnia, the following 3 domains were determined: sleep, daytime symptoms, and daytime functioning.[17-20] The 3 domains of sleep, daytime symptoms, and daytime functioning were determined with the Basic Nordic Sleep Questionnaire[23] and the Uppsala Sleep Inventory.[24] The measures are considered to be psychometrically sound and suitable to be employed in epidemiological research on insomnia.[22,24]

Table 1—Overview of the 1,746 Study Participants

Variables	The Study Participants
Mean age (years)	42 (11)
Gender (female)	53%
Civil status (married or cohabitant)	77%
Occupational status	
Employed	78%
Student	8%
Unemployed	8%
Sick leave or pension	6%

Means are presented with standard deviations in parentheses.

Table 2—The Course of Insomnia over One Year: 1,746 Participants

	Baseline			1-year follow-up			Course over time
		n	%		*n*	%	%
Insomnia	No	1,577	90.3	No	1,533	87.8	97.2
				Yes	44	2.5	2.8
	Yes	169	9.7	No	94	5.4	55.6
				Yes	75	4.3	44.4

Agreement between baseline insomnia and follow-up insomnia: $\kappa = 0.48$.

To determine sleep, the Basic Nordic Sleep Questionnaire[23] and the Uppsala Sleep Inventory[24] were used. The following initial question was asked (response alternatives: yes/ no): "Have you had problems sleeping during the past 3 months?" In addition to the question assessing the perception of a sleep difficulty during the past 3 months, "How often have you experienced problems sleeping during the past 3 months?" The response alternatives were: never or less than once per month/ less than once per week/ 1 or 2 days per week/ 3, 4, or 5 days per week/ every day. Further, these 3 questions were used to assess difficulties with sleep onset, sleep maintenance, and early morning awakening: "On average: How many minutes are you awake before you fall asleep?," "On average: If you wake up at night, how many minutes are you awake?," and "On average: How many minutes do you wake up too early (i.e. earlier than desired) in the morning?" To assess daytime symptoms, the Uppsala Sleep Inventory[24] was used, and the following overall question was asked: "What daytime symptoms have you experienced during the past 3 months due to poor sleep?" More specifically, the participants were asked to assess 10 daytime symptoms due to poor sleep from the following list of symptoms: concentration problems, memory problems, headache, low energy, tiredness, aching muscles, tenseness, sleepiness, irritability, and low mood (response alternatives: not at all = 1, somewhat = 2, relatively large = 3, and very large = 4). To determine daytime functioning, the Uppsala Sleep Inventory[24] was used and the following overall question was asked: "What consequences have you experienced during the past 3 months due to poor sleep?" More specifically, the participants were asked to assess potential, negative consequences of poor sleep in 3 functional domains: occupational, leisure, and social functioning (response alternatives: no negative consequences = 1, small negative consequences = 2, marked negative consequences = 3, large negative consequences = 4, and very large negative consequences = 5).

To fulfill the criteria for *insomnia*, the participant had to report (a) problems sleeping during the past 3 months, (b) problems sleeping ≥ 3 nights per week during the past 3 months, (c) problems with daytime symptoms (one or more symptoms: relatively large or more) or daytime functioning (one or more functional domains: marked negative consequences or more), and (d) sleep onset difficulties (≥ 30 min), sleep maintenance difficulties (≥ 30 min), or early morning awakening difficulties (≥ 30 min). An additional categorization, termed *good sleeper*, was defined as reporting no problems sleeping during the past 3 months, based on the question "Have you had problems sleeping during the past 3 months?"

Statistical Analysis

The data was first summarized with descriptive statistics. To estimate statistical differences on prevalence of insomnia at baseline between the individuals who returned only the baseline questionnaire and the participants who responded to both the questionnaires, chi-square analysis was used. To assess the concordance of the study participants' insomnia status between the baseline and follow-up, a tracking coefficient (kappa) was used with a 95% confidence level. In the epidemiological literature, tracking is used to describe the relative stability of the longitudinal course of a certain outcome variable.[25] It is considered that a kappa value > 0.75 indicates that there is an excellent agreement, a value of < 0.40 a poor agreement, and if the kappa value lies between these two, then there is a moderate agreement.[25]

RESULTS

Study Participants

Of the 3,000 residents, 2,076 participants (69%) returned the baseline questionnaire. In all, 1,746 of the 2,076 baseline responders (84%) also returned the follow-up questionnaire. The descriptive statistics for the 1,746 study participants are depicted in Table 1. To estimate whether there was a significant difference in terms of insomnia prevalence at baseline between the 330 individuals who returned the baseline but not the follow-up questionnaire and the 1,746 who responded to both the questionnaires, a chi-square analysis was conducted. The results showed that there was not a significant difference in terms of insomnia prevalence at baseline between the 330 individuals who returned only the baseline questionnaire and the 1,746 participants who responded to both the questionnaires ($\chi^2 = 1.59$, $P = 0.21$, $n = 2,076$).

Insomnia at Baseline and Follow-Up: Prevalence and Consequences

In Table 2, the number and percentage of the 1,746 study participants that fulfilled the criteria for insomnia at baseline and follow-up is shown. Of the 1,746 individuals at baseline and at the 1-year follow-up, 6.8% to 9.7% fulfilled the criteria

Table 3—Daytime Symptoms, Functioning, and Associated Consequences for Good Sleepers at Baseline and the Participants with Insomnia at Baseline and at the 1-Year Follow-Up

	Baseline		1-Year Follow-Up
	Good sleeper[a] (n = 1,114)	Insomnia (n = 169)	Insomnia (n = 151)
Concentration problems (1–4)	1.7 (0.8)	2.6 (0.8)	2.7 (0.9)
Memory problems (1–4)	1.7 (0.7)	2.5 (0.9)	2.5 (0.9)
Headache (1–4)	1.6 (0.7)	2.5 (1.0)	2.5 (1.1)
Low energy (1–4)	1.8 (0.7)	2.5 (0.9)	2.7 (0.9)
Tiredness (1–4)	2.0 (0.8)	2.9 (0.9)	3.0 (0.9)
Aching muscles (1–4)	1.5 (0.8)	2.4 (1.2)	2.4 (1.1)
Tenseness (1–4)	1.5 (0.9)	2.5 (1.0)	2.6 (1.0)
Sleepiness (1–4)	1.9 (0.7)	2.7 (0.9)	2.7 (1.0)
Irritation (1–4)	1.7 (0.8)	2.5 (0.8)	2.6 (0.9)
Low mood (1–4)	1.6 (0.8)	2.5 (0.9)	2.5 (0.8)
Occupational functioning (1–5)	1.8 (1.5)	2.8 (1.5)	3.0 (1.3)
Leisure functioning (1–5)	1.9 (1.6)	2.8 (1.5)	3.1 (1.3)
Social functioning (1–5)	2.0 (1.6)	2.9 (1.4)	3.2 (1.2)
Sick leave (yes)	0%	8%	10%
Health care consumption (yes)	0%	15%	16%
Sleep medication (yes)	0%	16%	18%

All ratings were on a 3-month interval. Means are presented with standard deviations in parenthesis. Response alternatives for the daytime symptoms: not at all = 1, somewhat = 2, relatively large = 3, and very large = 4. Response alternatives for the functional domains: no negative consequences = 1, small negative consequences = 2, marked negative consequences = 3, large negative consequences = 4, and very large negative consequences = 5. [a]Response "no" on the baseline question "Have you had problems sleeping during the past 3 months?"

for insomnia. The 3-month prevalence of insomnia was thus relatively similar at baseline and follow-up.

In Table 3, the descriptive statistics are shown for the 169 participants with insomnia at baseline and the 151 participants with insomnia at follow-up on daytime symptoms, functioning, and associated consequences on a 3-month interval. The proportion of the 169 participants with insomnia at baseline and the 151 participants with insomnia at follow-up who reported negative daytime symptoms during the past 3 months were as follows: tiredness (57% to 59%), sleepiness (54%), tenseness (54% to 56%), concentration problems (52% to 53%), headache (51% to 52%), low energy (49% to 53%), low mood (48%), irritation (46% to 50%), aching muscles (45%), and memory problems (43%). The proportion of the 169 participants with insomnia at baseline and the 151 participants with insomnia at follow-up that reported interference in the 3 functional domains during the past 3 months were as follows: occupational functioning (44% to 51%), leisure functioning (55% to 61%), and social functioning (54% to 64%). Of the participants with insomnia at baseline and follow-up, 8% to 10% reported having been on sick leave during the past 3 months due to poor sleep, 15% to 16% stated that they had consumed health care during the past 3 months due to poor sleep, and 16% to 18% reported having used sleep medication during the past 3 months due to poor sleep. For comparison, the table also shows the results on symptoms, functioning, and associated consequences for baseline good sleepers (n = 1,114). Compared with the baseline and follow-up insomnia groups, the data for the good sleeper group shows consistently a lower level on daytime symptoms, higher level of functioning, and no associated consequences.

The Course of Insomnia over One Year: Persistence, Remission, and Incidence

In Table 2, the course of insomnia over the course of a year, from baseline to the 1-year follow-up, is shown. The results show that for the individuals that fulfilled the criteria for insomnia at baseline, approximately 44% of those participants still reported complaints at follow-up. This means that for 4.3% of the general population, insomnia was a persistent condition. To assess the concordance of the study participants' insomnia status between the baseline and follow-up, a tracking coefficient (kappa) was employed. The results showed that the kappa value was 0.48 (0.41-0.55 95% CL), indicating a moderate agreement between baseline and follow-up insomnia.

Of the individuals that did fulfill the criteria for insomnia at baseline, approximately 56% no longer reported insomnia at follow-up. This means that for 5.4% of the general population insomnia was characterized by remission, i.e., the criteria for insomnia were fulfilled at baseline but not at follow-up. Of the individuals who did not fulfill the criteria for insomnia at baseline, 2.8% reported however complaints at follow-up. This indicates that the incidence of insomnia was 2.8% over the course of a year.

DISCUSSION

Taken as a whole, this longitudinal investigation in the general population has provided detailed information about the course of insomnia over time. More specifically, this study showed that insomnia is a prevalent condition that is associated with a number of negative consequences. The findings also suggested that for approximately 4% insomnia is a persistent con-

dition, that for more than 5% insomnia remits over the course of a year, and that for nearly 3% of the general population insomnia develops over one year.

These findings add to the existing literature in that the course of insomnia was specifically explored. First, the cross-sectional results in this study on the prevalence of insomnia, 6.8% to 9.7%, resemble studies demonstrating a prevalence of insomnia symptoms with daytime consequences of 9% to 15% and sleep dissatisfaction of 8% to 18% in the population.[2] Second, the longitudinal analyses on the persistence of insomnia suggested that, of the individuals with insomnia at baseline, 44.4% still reported the presence of insomnia at the 1-year follow-up. The results showed that there was a moderate agreement between baseline insomnia and follow-up insomnia ($\kappa = 0.48$). The current findings on the persistence of insomnia are in line with longitudinal studies on selected patient samples with medical or psychiatric disorders (40% to 47% report both baseline and follow-up insomnia)[8,9] and general population samples (52% to 73% fulfill criteria for both baseline and follow-up insomnia).[11-13] Third, the longitudinal analyses on the remission of insomnia indicated that, of the individuals with insomnia at baseline, 55.6% no longer reported insomnia at the 1-year follow-up. The results on the remission of insomnia resemble findings from patient samples (53% to 60% remission)[8,9] and somewhat less studies on general population samples (27% to 48% remission).[11-13] Fourth, the longitudinal analyses suggested that the cumulative incidence of insomnia was 2.8% over the course of a year. In other words, of those who did not fulfill the criteria for insomnia at baseline, approximately 3% had developed insomnia at follow-up. These results are in line with findings in longitudinal studies on patient samples (3% incidence per year)[8,10] and general population samples (5% incidence per year).[11,12]

The present study resembles a previous study in several ways.[21] To our knowledge, this study and the cited study are the only investigations of the course of insomnia in the general population, taking into account also the daytime consequences of poor sleep.[21] Both the investigations were epidemiological studies in the general population employing a 2-wave longitudinal design and taking into account daytime consequences in the assessment of insomnia. Although there were dissimilarities in the criteria used, both the studies showed that insomnia is a prevalent condition (about 10%) in the general population. The 2 studies also demonstrate that insomnia is a persistent condition for 30.9% to 44.4% and a remitting condition for 55.6% to 69.1% over the course of a year. Finally, both the studies showed that insomnia develops over the course of a year for between 2.8% and 6.2% of the general population.

The present investigation has theoretical implications for the conceptualization of insomnia. Given that the present study was only the second longitudinal study in the general population that used restrictive criteria for insomnia this study filled a gap by investigating the course of insomnia in the population as a whole. Although insomnia has previously often been viewed as primarily a persistent condition,[3] the current and previous results[21] suggest that insomnia is also characterized by relatively high remission and incidence figures. Both this and a previous study[21] show that insomnia is primarily a remitting condition and to a smaller extent a persistent disorder. The incidence rates reported in both the studies suggest also that insomnia is a condition characterized by steady development. Although insomnia seems to be characterized by chronicity for patients in treatment settings,[3] insomnia appears to be defined more by variability than stability in the population as a whole.

The current study has also implications for the implementation of interventions in research and clinical settings. The results of the present study show that almost 10% of the population report insomnia as a complaint. Although this suggests that insomnia is a prevalent condition, for a smaller segment of the population (4.3%) insomnia was a persistent condition and for nearly 3% insomnia developed over the course of a year. These rates of prevalence and incidence of insomnia are important statistics for planning and delivering health care. The figure on incidence of insomnia might also be an important guide to planning and delivering early assessment and treatment in the health care system. With that aim in mind, future research should focus on developing screening instruments that identify individuals who are at a high risk for future insomnia and early interventions that might hamper the development towards persistent insomnia.[26] A final clinical implication is that the implementation of interventions in research and clinical settings should also have a developmental perspective in focus. In other words, the researcher or clinician should be aware of the importance of assessing the patients´ history of insomnia and of the probability of spontaneous recovery, even within a treatment-free context.

The current investigation has some methodological disadvantages that must be kept in mind when interpreting the results as well as when considering future research. One initial difficulty is the use of self-report measures. This may impose some caution about the generalizability of the results to objective measures. A second problem in this study was the baseline participation rate at 69%. Although this is not uncommon in this type of research, it may restrict the generalizability of the findings. A third possible shortcoming of this study is that the sample of non-responders contacted via telephone was relatively small (5.3%) and therefore possibly not representative of the non-responders in this study. A related limitation of this study was that a selection bias was demonstrated; more women than men returned the baseline questionnaire and the responders complained more frequently about a sleep problem than the non-responders.

Some additional disadvantages should also be mentioned. First, chronicity of insomnia was not assessed at baseline. It is therefore important to emphasize that the course of insomnia may be affected by whether or not the condition was chronic or acute at the initial assessment, which could influence rates of persistence and remission at subsequent assessments. Hypothetically, individuals with chronic insomnia at baseline might be more likely to report insomnia again at follow-up and participants with acute insomnia at baseline might have a higher probability of following a course of remission over time. Second, it should be noted that the assessment of insomnia at baseline was based on whether the individuals fulfilled current criteria for insomnia, but not on whether the individuals had prior history of insomnia beyond the 3-month reference period. This precludes estimating the true incidence of new cases of insomnia, suggesting that the findings on incidence in this study should be interpreted cautiously. Future research might investigate true incidence (i.e.,

first onset in individuals with no prior history of insomnia) of insomnia as a complaint. Third, since full information about co-occurring disorders (e.g., psychological, sleep, or medical) was not assessed in this study, it is likely that the sample consisted of both participants with primary insomnia and participants with comorbid insomnia. As a consequence, it is difficult to generalize the findings of his study to either primary or comorbid insomnia. The longitudinal course of insomnia may hypothetically differ between primary insomnia, where the condition exists alone, and comorbid insomnia, where a wide range of factors may influence and be influenced by the sleep complaint. For example, since evidence suggests that insomnia and depressive disorders are intertwined over time,[27] coexisting depression may well be linked to the course of insomnia. A topic for future research is therefore to examine the longitudinal interrelationships between on the one hand physiological, psychological, and social factors and on the other hand insomnia.[2,4]

Taken together, this investigation in the general population showed that insomnia is a prevalent condition, often associated with negative consequences and characterized not only by persistence but also by relatively high remission and incidence over the course of a year. In summary, these findings have heuristic value for how the course of insomnia is to be viewed.

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