

## The Natural History of Insomnia : A Population-Based 3-Year Longitudinal Study

<sup>1,2</sup>Charles M. Morin, PhD; <sup>1,2</sup>Lynda Bélanger, PhD; <sup>1,2</sup>Mélanie LeBlanc, PhD; <sup>1</sup>Hans Ivers, PhD; <sup>1,3</sup>Josée Savard, PhD; <sup>4</sup>Colin A. Espie, PhD; <sup>2,5</sup>Chantal Mérette, PhD; <sup>6</sup>Lucie Baillargeon, MD; <sup>7,8</sup>Jean-Pierre Grégoire, PhD

<sup>1</sup>École de psychologie, Université Laval, Québec City, QC, Canada

<sup>2</sup>Centre de recherche Université Laval-Robert Giffard, Québec City, QC, Canada

<sup>3</sup>Centre de recherche en oncologie de l'Université Laval, Québec City, QC, Canada

<sup>4</sup>Department of Clinical Psychology, Southern General Hospital, University of Glasgow, Glasgow, Scotland

<sup>5</sup>Département de psychiatrie, Université Laval, Québec City, QC, Canada

<sup>6</sup>Unité de recherche clinique en médecine familiale, Pavillon Centre Hospitalier, Université Laval, Québec City, QC, Canada

<sup>7</sup>Faculté de pharmacie, Université Laval, Québec City, QC, Canada

<sup>8</sup>Unité de recherche en santé des populations de l'Université Laval, Québec City, QC, Canada

**Acknowledgement / Funding:** This study was supported by grant MT42504 from the Canadian Institutes of Health Research.

**Correspondence:** Charles M. Morin, PhD, Université Laval, École de psychologie,

Pavillon Félix-Antoine Savard, Québec City, QC, G1K 0A6, Canada

cmorin@psy.ulaval.ca

## Abstract

**Background:** Despite its high prevalence, little information is available about the natural history of insomnia. The extent to which episodes of insomnia will persist or remit over time is difficult to predict. We examined the natural history of insomnia and describe the most common trajectories over 3 years.

**Methods:** Three hundred eighty-eight adults (mean [SD] age, 44.8 [13.9] years; 61% women) were selected from a larger population-based sample on the basis of the presence of insomnia at baseline. They completed standardized sleep/insomnia questionnaires at 3 annual follow-up assessments. For each follow-up assessment, participants were classified into 1 of 3 groups (individuals with an insomnia syndrome, individuals with insomnia symptoms, and individuals with good sleep) on the basis of algorithms using standard diagnostic criteria for insomnia. Rates of persistent insomnia, remission, and relapse were computed for each group.

**Results:** Of the study sample, 74% reported insomnia for at least 1 year (2 consecutive assessments) and 46% reported insomnia persisting over the entire 3-year study. The course of insomnia was more likely to be persistent in those with more severe insomnia at baseline (ie, insomnia syndrome) and in women and older adults. Remission rate was 54%; however, 27% of those with remission of insomnia eventually experienced relapse. Individuals with subsyndromal insomnia at baseline were 3 times more likely to remit than worsen to syndrome status, although persistence was the most frequent course in that group as well.

**Conclusion:** These findings indicate that insomnia is often a persistent condition, in particular when it reaches the diagnostic threshold for an insomnia disorder.

## Introduction

Approximatively 30% of adults report symptoms of insomnia, and 6% to 10% meet diagnostic criteria for an insomnia disorder.<sup>1-5</sup> Several demographic (eg, female sex and increasing age), medical (eg, pain), and psychological (eg, anxiety and depression) factors have been associated with insomnia,<sup>1-10</sup> and insomnia has been linked with increased work absenteeism, disability, and health care costs and higher risk of hypertension and depression.<sup>5,7,9-17</sup>

Despite evidence that insomnia is a prevalent condition, information about its natural history and long-term course is scarce.<sup>18</sup> The few longitudinal studies available indicate that insomnia can be a persistent condition and that chronicity is often associated with significant medical and psychiatric morbidity.<sup>5,10,17,18</sup> Studies have reported persistence rates varying extensively, from 40% to 69% for periods ranging from 1 to 20 years.<sup>5,10,19-21</sup> Studies of community-living elderly adults have also reported variable rates of chronic insomnia, ranging from 40% to 75% for periods of 2 to 3½ years,<sup>22-24</sup> with annualized rates of chronicity of 15.4% to 22.7%.<sup>25</sup>

As for prevalence estimates, data on the longitudinal course of insomnia vary considerably across studies and are difficult to interpret because of differences in insomnia definitions, samples, and follow-up intervals. Moreover, most longitudinal studies have examined few time points, often using data from baseline and only 1 additional follow-up assessment.<sup>20,26,27</sup> In this context, when insomnia is reported over several years, it is unclear whether it has persisted continuously or was interrupted by periods of remission. The extent to which insomnia represents a chronic condition as opposed to a recurring transient episode remains unclear. Few studies have examined how insomnia evolves with time and its persistence, remission, and relapse rates. With increasing evidence of significant medical and psychiatric morbidity associated with

chronic insomnia, improved knowledge about its natural course is important to determine the need for treatment and to evaluate long-term prognosis and health outcomes.

The objectives of the present study were to examine the natural course of insomnia in terms of persistence, remission, and relapse and to describe the most frequent trajectories of insomnia over 3 years. Individuals with an insomnia syndrome at baseline were compared with those presenting subsyndromal insomnia symptoms to examine whether initial severity of sleep difficulties led to different courses over time.

## **Method**

### **Study context and sample selection**

Data from this study are derived from a larger epidemiological study conducted in the province of Québec, Canada. The study began with a population-based telephone survey to document the prevalence of insomnia and determinants of treatment seeking behaviors (see Morin et al<sup>2</sup>). Sample selection involved random-digit dialing and use of the Kish method.<sup>28</sup> At the end of the telephone interview, respondents were invited to participate in the longitudinal phase of the study, which involved completion of several postal evaluations over 3 years. The first evaluation was conducted 1 month after the telephone interview, and the remaining evaluations were conducted 1, 2, and 3 years later.

### **Participants and procedure**

Of the 2001 respondents who completed the telephone interview, 1467 (73.3%) agreed to participate in the longitudinal study. Of these, 105 were excluded because they reported having received from a health care professional a diagnosis of a sleep disorder other than insomnia. The first evaluation was mailed to 1362 participants; 997 returned the questionnaires, and 852 were deemed eligible for the longitudinal study. Of those, 44 additional participants were excluded because they reported another sleep disorder not reported at the telephone interview; an additional 97 participants who

received a self-help behavioral intervention for insomnia in the context of another study<sup>29</sup> were also excluded from the present analyses because that intervention could alter the natural course of insomnia.

Because the present study was about persistence, remission, and relapse of insomnia, only data for individuals with insomnia at baseline were included in the analyses. The cohort of individuals with good sleep at baseline was followed up to document the incidence and risk factors for insomnia; these data are reported elsewhere.<sup>30</sup> The sample of individuals with insomnia comprised 388 adults (mean [SD] age, 44.8 [13.9] years; 61% women; and 70.4% either employed or studying), including 119 participants with insomnia syndrome and 269 with symptoms of subsyndromal insomnia. Of these, 332 participants (85.6%) completed the 1-year follow-up, 305 (78.6%) completed the 2-year follow-up, and 260 (67.0%) completed the 3-year follow-up.

### **Sleep Status Groups**

After each evaluation, participants were classified into 1 of 3 groups on the basis of an algorithm that used a combination of diagnostic criteria for insomnia from the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision* and the *International Classification of Diseases, Tenth Revision*, and use of sleep-promoting medication. Responses from the Insomnia Severity Index<sup>31</sup> and the Pittsburgh Sleep Quality Index,<sup>32</sup> 2 instruments recommended for the evaluation of insomnia,<sup>33</sup> and from questions about use of sleep medication were used to evaluate the presence or absence of each criterion.

**Insomnia Syndrome.** Participants in the group with an insomnia syndrome met all diagnostic criteria for insomnia. They were dissatisfied or very dissatisfied (score of 3 or 4 on a scale of 0-4) with their sleep patterns and had symptoms of initial, middle, or late insomnia at least 3 nights per week for at least 1 month. Substantial distress or

daytime impairment related to sleep difficulties was also reported by those individuals (score of 3 or 4 on a scale of 0-4). Participants were automatically classified in the group with insomnia syndrome if they used prescribed sleep promoting medication at least 3 nights per week. Eighteen participants (15.1%) were included in this group on this basis alone; however, 14 (77.8%) met at least 1 criterion and 10 (55.6%) met 2 criteria for insomnia syndrome. Although not a standard criterion for a diagnosis of insomnia, use of sleep medication may mask the underlying symptoms, and our interest was in documenting the natural history of both treated and untreated insomnia.

**Insomnia Symptoms.** Participants classified in the group with symptoms of insomnia had initial, middle, or late insomnia at least 3 nights per week without fulfilling all diagnostic criteria for insomnia syndrome (ie, they could report being satisfied with their sleep, not report distress or daytime consequences, or not meet the criterion of symptoms for at least 1 month required for a diagnosis of insomnia). Also included in this group were individuals dissatisfied with their sleep but without symptoms of initial, middle, or late insomnia. Participants using prescribed sleep medication fewer than 3 nights per week or over-the-counter medication for sleep at least 1 night per week were classified in this group.

**Good Sleepers.** Participants with good sleep were satisfied with their sleep (ie, score of 0-2 on a scale of 0-4), did not report symptoms of initial, middle, or late insomnia, and did not use prescribed or over-the-counter medication to promote sleep.

## **Measures**

### **Insomnia Severity Index**

The Insomnia Severity Index<sup>31</sup> is a 7-item questionnaire that assesses the perceived severity in the previous month of problems with sleep onset, sleep maintenance, and early morning awakening problems; sleep satisfaction; interference of sleep difficulties with daytime functioning; noticeability of sleep problems; and distress

caused by sleep difficulties. A 5-point Likert scale was used to rate each item, yielding a total score ranging from 0 to 28. Scores can be classified into 4 severity categories: no insomnia (score, 0-7), subthreshold insomnia (score, 8-14), moderate insomnia (score, 15-21), and severe insomnia (score, 22-28). The Insomnia Severity Index has adequate psychometric properties and is sensitive to treatment response.<sup>31,34</sup>

### **Pittsburg Sleep Quality Index**

The Pittsburgh Sleep Quality Index<sup>32</sup> is a 19-item questionnaire that evaluates sleep quality and disturbances during 1 month. Seven component scores can be derived (eg, subjective sleep quality, sleep duration, habitual sleep efficiency), and a total score ranging from 0 to 21 can be obtained by adding the 7 component scores. A score of more than 5 suggests poor sleep quality. Psychometric properties of the original Pittsburgh Sleep Quality Index are well documented.<sup>32,34</sup>

Several questions were asked to evaluate use of prescribed and over-the-counter sleep medications: “During the past month, how many nights per week have you taken prescribed medication to help you sleep?” and “During the past month, how many nights per week have you taken over-the-counter medication (eg, Nytol or Sominex) to help you sleep?” Respondents were then asked to specify which product they had used in the previous month; their responses were further validated to ensure that the product was a recognized medication prescribed for insomnia (ie, benzodiazepine-receptor agonists or sedating antidepressants) or an over-the-counter product marketed as a sleep aid.

### **Statistical analyses**

The main end points were defined as follows. Episodes of persistent insomnia were defined as the presence of insomnia (symptoms or syndrome) on at least 2 consecutive assessments (ie, 1 year). Rates were calculated for intervals of 1, 2, and 3 years. Individuals with insomnia persisting for 1 year

reported insomnia at any 2 consecutive assessments during the study, those with insomnia persisting for 2 years reported insomnia at 3 consecutive assessments, and those with insomnia persisting for 3 years reported insomnia at all 4 assessments. A change from symptoms of insomnia to insomnia syndrome, and vice versa, at the subsequent assessment was also considered persistent insomnia. Remission of insomnia was defined as a change from either symptom or syndrome status to good sleep status. Relapse of insomnia was defined as a return to insomnia status (symptoms or syndrome) after reporting remission at the previous assessment. Four data points were available for each participant who could then show a combination of persistent insomnia (at 1-, 2-, or 3-year assessments), remission, and relapse during the 3-year duration of the study. For example, a participant could have episodes of persistent insomnia from baseline to the 1-year follow-up, followed by remission at the 2-year follow-up and relapse at the 3-year follow-up, or could report persistent insomnia for 2 years (3 consecutive assessments), followed by remission at the 3-year follow-up. Given the 3-year duration of the study and yearly assessment design, remission could be observed a maximum of twice and relapse only once during the course of the study.

Descriptive statistics were used to calculate persistence, remission, and relapse rates. Logistic regressions with simple effects tests were then performed to examine differences between rates. Generalized linear mixed model analysis of variance for categorical data (GLIMMIX, SAS/STAT version 9.1.3; SAS Institute, Inc, Cary, North Carolina) was used to test for temporal differences



(across follow-up assessments) between percentages, and likelihood ratios were calculated to assess in which direction change was most likely to occur.<sup>35</sup> Significance was set at  $\alpha < .05$ . Analyses were performed using commercially available software (SAS version 9.1; SAS Institute, Inc).

## Results

Analyses not requiring all data points were based on the total sample ( $n=388$ ), whereas analyses that required all data points (trajectories) were based on the subsample of 244 participants who completed all 4 assessments. Respondents who completed all assessments were older than those who did not (47.2 vs 40.9 years;  $t_{(386)}=4.40$ ;  $P<.001$ ). Scores for subsequent analyses were, thus, weighted on the basis of this age difference.

### **Persistence, remission and relapse rates**

Persistence, remission, and relapse rates are given in **Table 1**. Overall, 74.2% reported at least 1 episode of persistent insomnia (1 year: 2 consecutive assessments) during the study. Persistence of insomnia at all assessments (3-year persistence) was observed in 45.9% of the sample, with a significantly higher rate in the group with insomnia syndrome (66.1%) compared with the group with symptoms of insomnia (37.2%). Of the overall sample with insomnia at baseline, 54.1% went into remission at least once at subsequent assessments, with remission rates significantly higher in the group with symptoms of insomnia. Among individuals with remission, 26.7% eventually experienced relapse, with a rate significantly higher in the group with symptoms of insomnia.

Given the 1-year interval between assessments, an interim evaluation was conducted at 6 months to validate sleep status between the follow-up assessments. These analyses showed that 131 of 161 participants (81.4%) who reported insomnia at

both baseline and the 1-year follow-up (persistent insomnia) also had insomnia at 6 months and that 46 of 73 participants (63%) who reported remission of symptoms of insomnia at 12 months already met our remission criteria at the 6-month follow-up.

**Table 2** gives the rates of persistent insomnia according to sex and age. There were significant main effects for both sex ( $F_{[1238]} = 7.92$ ;  $P = .005$ ) and age ( $F_{[2238]} = 3.15$ ;  $P = .04$ ). Corrected pairwise comparisons completed within each sex group revealed higher persistence rates in women aged 55 years or older compared with their younger counterparts aged 18 to 34 years or 35 to 54 years. These age comparisons were not significant in men.

### **Course of insomnia over time**

**Table 3** gives the distribution of participants in each sleep status group at each follow-up assessment. These data are based on all available cases at each assessment. Of the 269 participants in the group with symptoms of insomnia at baseline, 38.4% were classified in the good sleepers group at the 1-year follow-up, 48.7% still had symptoms of insomnia, and 12.9% had insomnia syndrome. The distribution of individuals across the 3 status groups was similar at the 2- and 3-year follow-up assessments. Of the 119 participants in the insomnia syndrome group at baseline, 17% were in the good sleepers group 1 year later, while 37% were in the symptoms of insomnia group and 46% remained in the insomnia syndrome group. Comparisons of the proportions of individuals in each category at each assessment were nonsignificant for either symptoms of insomnia or insomnia syndrome subgroups.

Likelihood ratios were calculated to assess whether individuals in the group with symptoms of insomnia at baseline were more likely to demonstrate improvement or worsening over time. Results showed that at each follow-up, individuals in the group with symptoms of insomnia at baseline were approximately 3 times more likely to demonstrate improvement to good sleep than worsening to insomnia syndrome (odds:

2.97, 3.68, and 2.88, respectively, at the 1-, 2-, and 3-year follow-up assessments;  $P < .001$ ).

### **Most frequent trajectories**

To examine the course of insomnia, we identified an insomnia trajectory for each participant who completed all assessments ( $n=244$ ). The **Figure** shows the most frequent trajectories according to sleep status at baseline. In the group with symptoms of insomnia at baseline, the 2 most frequent trajectories accounted for 30.6% of the sample and 3 additional trajectories, each accounting for 9.4% of the sample, were the third most frequent; together, these 5 trajectories accounted for 61.2% of all trajectories in the group with symptoms of insomnia (Figure, A). The 3 most frequent trajectories in the group with insomnia syndrome at baseline accounted for 48.6% of all trajectories in that sample (Figure, B). For both the group with symptoms of insomnia and the group with insomnia syndrome, the most frequent trajectory was for individuals to remain in the same status as their baseline status at all time points. A total of 21.2% of individuals in the group with symptoms of insomnia at baseline remained in that status at all subsequent follow-up assessments (Figure, A; trajectory depicted by triangles) and 29.7% of individuals with insomnia syndrome at baseline remained in that status at all subsequent follow-up assessments (Figure, B; trajectory depicted by triangles). The second most frequent trajectory in the group with symptoms of insomnia (11.8% of the sample) was remission, with individuals demonstrating remission at the 1-year follow-up assessment and remaining in the good sleep group at all subsequent assessments (Figure, A; trajectory depicted by open circles). In the group with insomnia syndrome, the second most frequent trajectory was a change to symptoms of insomnia status at 12 months and remaining in that status at all subsequent assessments, a form of persistence, albeit less severe (10.8%; Figure, B; trajectory depicted by solid circles). The third most frequent trajectory in the group with insomnia syndrome was remission

and remaining in that good sleep status at all subsequent assessments (8.1%; Figure, B; trajectory depicted by open squares), whereas the third pole in the symptoms group was shared by 3 different trajectories indicative of a more fluctuating course (9.4% each; Figure, A; trajectories depicted by open and solid squares and solid circles).

### **Comment**

This longitudinal study showed that insomnia is often a persistent condition, especially in individuals with more severe insomnia at baseline. Although the course of insomnia can fluctuate over time, with periods of remission and relapse, the most common trajectory identified in this cohort was persistent insomnia. Nearly half of the sample (46%) reported persistent insomnia at all time points during the 3-year study, and 74% reported insomnia persisting for at least 1 year.

These results are consistent with the few previous longitudinal studies, which have reported persistence rates of 69% over 1 year<sup>19</sup> and between 40% and 45% for periods of 3, 10, and 20 years.<sup>5,20-25</sup> Female sex and older age have also been associated with higher persistence rates in previous studies.<sup>21,25</sup>

The finding that an insomnia syndrome at baseline is more likely to be persistent relative to subsyndromal insomnia indicates that initial insomnia severity can be a useful prognostic factor for long-term course. The main implication for clinical practice would be that when a patient reports insomnia that meets diagnostic threshold, clinicians should initiate treatment and not expect the condition to remit spontaneously. This is important because most individuals with insomnia usually do not receive treatment,<sup>18</sup> and untreated insomnia is associated with negative long-term health outcomes.<sup>16-18</sup>

While more severe sleep disturbances may be predictive of chronic insomnia, individuals with less severe subsyndromal insomnia at baseline were 3 times more likely to experience remission than worsening of insomnia during the next assessment periods. Although this higher remission rate suggests a more favorable course in

individuals with symptoms of insomnia, the most frequent long-term trajectory was persistence of symptoms. Which individuals will eventually experience remission or develop a full syndrome remains unknown. Repeated and longer follow-ups coupled with examination of prognostic predictors is needed to better understand factors associated with the development and persistence of insomnia.

The results indicate that insomnia can follow multiple trajectories over time. Although the most common course was persistence both for symptoms of insomnia (21.2%) and insomnia syndrome (29.7%), there were other trajectories of interest. For example, even in individuals who demonstrated remission, there was a significant relapse rate, with more than one-fourth reporting recurrence of sleep disturbances at the subsequent assessment. Whether individuals exhibiting such waxing and waning patterns also present different characteristics compared with those with more chronic insomnia would be of interest to better understand risk factors of insomnia. It is plausible that this fluctuating pattern is associated with life events, psychological factors, or health conditions.<sup>36,37</sup>

Some limitations warrant caution in the interpretation of the findings. The different rates (persistence, remission, and relapse) are based only on the data for participants who completed all follow-up assessments; it is possible that persistence rates are inflated because those with sleep problems may have been more inclined to sustain their participation in a study of insomnia. Another limitation pertains to the 1-year interval between assessments. Inasmuch as the reference period used by participants to self-evaluate their sleep was the previous month, it is plausible that sleep patterns during that 1 month were not entirely representative of the previous year. Future studies might use more frequent assessments (monthly) or a longer reference period to obtain more reliable data about insomnia. Some caution is also needed in interpretation of our various end points, such as persistence and remission of insomnia. While standard

diagnostic criteria use either 1-month (*Diagnostic and Statistical Manual of Mental Disorders*, Fourth Edition, Text Revision) or 6-month durations<sup>38,39</sup> to define persistent insomnia, there is no standardized definition of remission. The presence of comorbid disorders was not assessed in this sample, and future studies are needed to examine the role of medical and psychiatric disorders as moderators of the course of insomnia.

Despite these limitations, the present investigation offers some innovative features that should help move the field forward. The use of stringent criteria and operationalized algorithms to define insomnia and the differentiation between a full insomnia disorder and subsyndromal insomnia symptoms should help to better delineate the natural history of insomnia. Given the fluctuating course of insomnia over time, our findings also highlight the importance of conducting longitudinal follow-up assessments in clinical trials to determine whether acute treatment effects are sustained over time.

In summary, it is often difficult to predict early in its course whether insomnia will be transient or chronic. This study provides preliminary evidence to better understand the natural course of insomnia. Additional studies are needed, however, to identify moderating and mediating factors of persistence, remission, and relapse. With increasing evidence that persistent insomnia is associated with significant medical and psychiatric morbidity such as increased risk of psychiatric (eg, depression) and medical (eg, cardiovascular) disorders,<sup>3,5,7,10,16,17</sup> the present findings highlight the need for better understanding of the natural history of insomnia. Improved understanding of the long-term course of persistent insomnia would be helpful to guide the development of effective public health prevention and intervention programs to avert longterm negative outcomes.

**Table 1. Persistence, Remission, and Relapse Rates During the 3-Year Study (Weighted)**

Event	Rate (95% CI)		
	Symptoms of Insomnia at Baseline (n=170)	Insomnia Syndrome at Baseline (n=74)	All Study Participants (N=244)
Persistence			
1-y period	23.4 (17.0-29.7) <sup>a</sup>	11.3 (4.1-18.5) <sup>b</sup>	19.7 (14.7-24.7)
2-y period	8.4 (4.2-12.6)	9.0 (2.4-15.5)	8.6 (5.1-12.1)
3-y period	37.2 (30.0-44.5) <sup>a</sup>	66.1 (55.3-76.9) <sup>b</sup>	45.9 (39.7-52.2)
At least 1 y	69.0 (62.0-75.9) <sup>a</sup>	86.4 (73.5-94.2) <sup>b</sup>	74.2 (68.7-79.7)
Remission			
At least 1	62.8 (55.5-70.1) <sup>a</sup>	33.9 (23.1-44.7) <sup>b</sup>	54.1 (47.8-60.3)
Relapse			
	33.1 (26.1-40.2) <sup>a</sup>	11.8 (4.4-19.1) <sup>b</sup>	26.7 (21.1-32.2)

Abbreviation: CI, confidence interval.

<sup>a,b</sup>Rates for each line were compared between the symptoms of insomnia and insomnia syndrome samples. Subscripts indicate a significant  $\chi^2$  comparison at an  $\alpha$  level of 5%. Rates sum to more than 100% for each sample because subjects may have reported more than 1 type of event.

**Table 2. Rates of Persistent Insomnia for at Least 1 Year (1, 2, or 3 Years Combined) Across Sex and Age Groups (Weighted)<sup>a</sup>**

Sex	Age Group, y			
	18-34 (n=42)	35-54 (n=134)	55 or Older (n=68)	All Age Groups (N=244)
Men (n=96)	58.8 (10/17)	64.0 (32/50)	69.0 (20/29)	64.6 (62/96)
Women (n=148)	68.0 (17/25) <sup>b</sup>	77.4 (65/84) <sup>b</sup>	94.9 (37/39) <sup>b</sup>	80.4 (119/148)
All participants (N=244)	64.3 (27/42)	72.4 (97/134)	83.8 (57/68)	74.2 (181/244)

<sup>a</sup>Persistent insomnia is defined as presence of symptoms of insomnia or insomnia syndrome for at least 1 year. Values indicate the number of cases in each subgroup's sample size. Rates for each line were compared between symptoms of insomnia and insomnia syndrome samples.

<sup>b</sup>For comparisons involving women, there were significant differences between the 18 to 34 age group and the 55 and older age group and between the 36 to 54 age group and the 55 and older age group; all pairwise comparisons significant at an  $\alpha$  level of 1.3% ( $\alpha$  level of 5% adjusted for 3 comparisons).

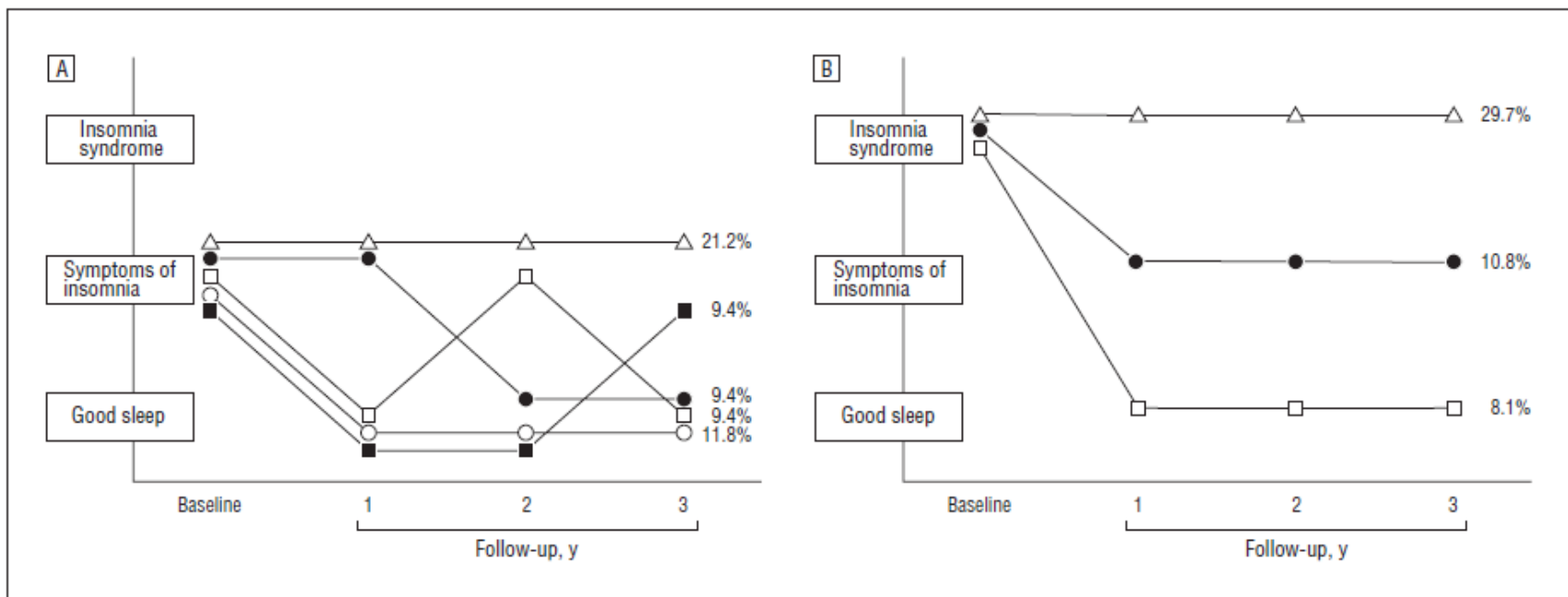
**Table 3. Sleep Status at Each Follow-up Assessment According to Insomnia Status at Baseline<sup>a</sup>**

Baseline Status	No. <sup>b</sup> (%)								
	Good Sleepers			Symptoms of Insomnia			Insomnia Syndrome		
	Follow-up, y								
	1	2	3	1	2	3	1	2	3
Symptoms of insomnia (n=269)	89/232 (38.4)	81/214 (37.9)	72/181 (39.8)	113/232 (48.7)	111/214 (51.9)	84/181 (46.4)	30/232 (12.9)	22/214 (10.3)	25/181 (13.8)
Insomnia syndrome (n=119)	17/100 (17.0)	17/91 (18.7)	19/79 (24.1)	37/100 (37.0)	34/91 (37.4)	28/79 (35.4)	46/100 (46.0)	40/91 (44.0)	32/79 (40.5)

<sup>a</sup>Data are based on all available cases at each time point.

<sup>b</sup>Denominators represent available cases at the given time point.





**Figure.** Most frequent trajectories of insomnia in individuals with symptoms of insomnia at baseline (A) and insomnia syndrome at baseline (B).

## References

1. Ohayon MM. Epidemiology of insomnia: what we know and what we still need to learn. *Sleep Med Rev.* 2002;6(2):97-111.
2. Morin CM, LeBlanc M, Daley M, Grégoire JP, Mérette C. Epidemiology of insomnia: prevalence, self-help treatments, consultations, and determinants of helpseeking behaviors. *Sleep Med.* 2006;7(2):123-130.
3. Ford DE, Kamerow DB. Epidemiologic study of sleep disturbances and psychiatric disorders: an opportunity for prevention? *JAMA.* 1989;262(11):1479-1484.
4. Mellinger GD, Balter MB, Uhlenhuth EH. Insomnia and its treatment: prevalence and correlates. *Arch Gen Psychiatry.* 1985;42(3):225-232.
5. Buysse DJ, Angst J, Gamma A, Ajdacic V, Eich D, Rössler W. Prevalence, course, and comorbidity of insomnia and depression in young adults. *Sleep.* 2008; 31(4):473-480.
6. LeBlanc M, Beaulieu-Bonneau S, Mérette C, Savard J, Ivers H, Morin CM. Psychological and health-related quality of life factors associated with insomnia in a population-based sample. *J Psychosom Res.* 2007;63(2):157-166.
7. Ohayon MM, Roth T. Place of chronic insomnia in the course of depressive and anxiety disorders. *J Psychiatr Res.* 2003;37(1):9-15.
8. Roth T, Ancoli-Israel S. Daytime consequences and correlates of insomnia in the United States: results of the 1991 National Sleep Foundation Survey II. *Sleep.* 1999;22(suppl 2):S354-S358.
9. Taylor DJ, Lichstein KL, Durrence H, Riedel BW, Bush AJ. Epidemiology of insomnia, depression, and anxiety. *Sleep.* 2005;28(11):1457-1464.
10. Breslau N, Roth T, Rosenthal L, Andreski P. Sleep disturbance and psychiatric disorders: a longitudinal epidemiological study of young adults. *Biol Psychiatry.* 1996;39(6):411-418.

11. Sivertsen B, Overland S, Neckelmann D, et al. The long-term effect of insomnia on work disability: the HUNT-2 historical cohort study. *Am J Epidemiol.* 2006; 163(11):1018-1024.
12. Daley M, Morin CM, LeBlanc M, Grégoire JP, Savard J, Baillargeon L. Insomnia and its relationship to health-care utilization, work absenteeism, productivity, and accidents [published online ahead of print August 25, 2008]. *Sleep Med.* doi:10.1016/j.sleep.2008.04.005.
13. Ozminkowski RJ, Shaohung SW, Walsh JK. The direct and indirect costs of untreated insomnia in adults in the United States. *Sleep.* 2007;30(3):263-273.
14. Simon GE, Vonkorff M. Prevalence, burden, and treatment of insomnia in primary care. *Am J Psychiatry.* 1997;154(10):1417-1423.
15. Walsh JK, Engelhardt CL. The direct economic costs of insomnia in the United States for 1995. *Sleep.* 1999;22(suppl 2):S386-S393.
16. Mallon L, Broman JE, Hetta J. Sleep complaints predict coronary artery disease mortality in males: a 12-year follow-up study of a middle-aged Swedish population. *J Intern Med.* 2002;251(3):207-216.
17. Suka M, Yoshida K, Sugimori H. Persistent insomnia is a predictor of hypertension in Japanese male workers. *J Occup Health.* 2003;45(6):344-350.
18. National Institutes of Health. National Institutes of Health State of the Science Conference Statement: manifestations and management of chronic insomnia in adults. *Sleep.* 2005;28(9):1049-1057.
19. Morphy H, Dunn KM, Lewis M, Boardman HF, Croft PR. Epidemiology of insomnia: a longitudinal study in a UK population. *Sleep.* 2007;30(3):274-280.
20. Jansson-Fröjmark M, Linton SL. The course of insomnia over one year: a longitudinal study in the general population in Sweden. *Sleep.* 2008;31(6):881-886.

21. Janson C, Lindberg E, Gislason T, Elmasry A, Boman G. Insomnia in men: a 10-year prospective population based study. *Sleep*. 2001;24(4):425-430.
22. Brabbins CJ, Dewey ME, Copeland JRM, et al. Insomnia in the elderly: prevalence, gender differences and relationships with morbidity and mortality. *Int J Geriatr Psychiatry*. 1993;8(6):473-480. doi:10.1002/gps.930080604.
23. Foley DJ, Monjan AA, Simonsick EM, Wallace RB, Blazer DG. Incidence and remission of insomnia among elderly adults: an epidemiologic study of 6,800 persons over three years. *Sleep*. 1999;22(suppl 2):S366-S372.
24. Ganguli M, Reynolds CF, Gilby JE. Prevalence and persistence of sleep complaints in a rural older community sample: the MoVIES Project. *J Am Geriatr Soc*. 1996;44(7):778-786.
25. Quan SF, Katz R, Olson J, et al. Factors associated with incidence and persistence of symptoms of disturbed sleep in an elderly cohort: the Cardiovascular Health Study. *Am J Med Sci*. 2005;329(4):163-172.
26. Foley DJ, Monjan AA, Izmirlian G, Hays JC, Blazer DG. Incidence and remission of insomnia among elderly adults in a biracial cohort. *Sleep*. 1999;22(suppl 2): S373-S378.
27. Mendelson WB. Long-term follow-up of chronic insomnia. *Sleep*. 1995;18(8):698-701.
28. Kish L. *Survey Sampling*. New York, NY: John Wiley & Sons Inc; 1965.
29. Morin CM, Beaulieu-Bonneau S, LeBlanc M, Savard J. Self-help treatment for insomnia: a randomized controlled trial. *Sleep*. 2005;28(10):1319-1327.
30. LeBlanc M, Mérette C, Savard J, Baillargeon L, Morin CM. Prospective data on insomnia incidence and risk factors in a population-based sample of good sleepers. *Sleep*. In press.

31. Bastien CH, Vallières A, Morin CM. Validation of the Insomnia Severity Index as a clinical outcome measure for insomnia research. *Sleep Med.* 2007;2(4):297-307.
32. Buysse DJ, Reynolds CF, Monk TH, Berman S, Kupfer DJ. The Pittsburgh Sleep Quality Index: a new instrument for psychiatric practice and research. *Psychiatry Res.* 1989;28(2):193-213.
33. Buysse DJ, Ancoli-Israel S, Edinger JE, Lichstein KL, Morin CM. Recommendations for a standard research assessment of insomnia. *Sleep.* 2006;29(9):1155- 1173.
34. Blais FC, Gendron L, Mimeault V, Morin CM. Assessment of insomnia: validation of three questionnaires. *Encephale.* 1997;23(6):447-453.
35. Agresti A. *An Introduction to Categorical Data Analysis.* New York, NY: John Wiley & Sons Inc; 1996.
36. Vollrath M, Wicki W, Angst J. The Zurich Study, VIII: Insomnia: association with depression, anxiety, somatic syndromes, and course of insomnia. *Eur Arch Psychiatry Neurol Sci.* 1989;239(2):113-124.
37. Jansson M, Linton SJ. Psychological mechanisms in the maintenance of insomnia: arousal, distress, and sleep-related beliefs. *Behav Res Ther.* 2007;45(3):511-521.
38. American Academy of Sleep Medicine. *International Classification of Sleep Disorders: Diagnostic and Coding Manual.* 2nd ed. Westchester, IL: American Academy of Sleep Medicine; 2005.
39. Edinger JD, Bonnet MH, Bootzin RR, et al; American Academy of Sleep Medicine Work Group. Derivation of research diagnostic criteria for insomnia: report of an American Academy of Sleep Medicine Work Group. *Sleep.* 2004;27(8):1567-1596.