



The natural history of insomnia: Focus on prevalence and incidence of acute insomnia

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ABSTRACT

Despite Acute Insomnia being classified as a distinct nosological entity since 1979/1980 (ASDC/DSM III-R), there are no published estimates of its prevalence and incidence or data regarding transition to chronic insomnia or remission. This lack of data prevents an understanding of: a) the pathogenesis of insomnia and b) when and how treatment should be initiated. The aim of the present study was to provide such data from two community samples. Samples were recruited in the USA ($n = 2861$) and the North East of the UK ($n = 1095$). Additionally, 412 Normal Sleepers from the UK sample were surveyed longitudinally to determine prospectively incidence, transition, and remission rates for acute insomnia and assess whether the acute insomnia was a first episode, recurrent episode, or co-morbid with symptoms of other illnesses. The prevalence of acute insomnia was 9.5% (USA) and 7.9% (UK). The prevalence of three acute insomnia subtypes in the UK were; First-Onset Acute Insomnia 2.6%; Recurrent Acute Insomnia 3.8%; and 1.4% Co-morbid Acute Insomnia. The annual incidence of acute insomnia in the UK sample was between 31.2% and 36.6%. Remission rates fluctuated depending upon the definition of acute insomnia and whether the current episode was first-onset or recurrent. These findings provide preliminary insights into the natural history of insomnia. Such data will serve to inform how and when acute insomnia should be managed and whether such interventions may serve to diminish subsequent morbidity, particularly with respect to Major Depression.

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1. Introduction

While much is known about the point prevalence of chronic insomnia, very little is known about the natural history of this disorder. What factors are associated with: the first ever episode of insomnia (first onset); the occurrence and non-occurrence of remission from acute insomnia; and the transition from acute to chronic insomnia. The importance of this topic is not limited to the need to know how and why acute insomnia occurs and how and why acute becomes chronic but extends to how and why acute and/or chronic insomnia are risk factors for psychiatric and medical illness (Collins et al., 2011; Neckelmann et al., 2007; Perlis et al., 2006; Riemann and Voderholzer, 2003; Taylor et al., 2003).

To date the clearest case for insomnia as a risk factor for subsequent morbidity has been made for Major Depression

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(Baglioni et al., 2011; Pigeon and Perlis, 2007). In this context it has been shown that insomnia: 1) often occurs in the absence of the Major Depression (Buysse et al., 1994); 2) precedes, and is a risk factor for, the first onset of the Major Depression (Ford and Kamerow, 1989; Breslau et al., 1996); 3) represents a risk factor for non-response/non-remission to treatments that target Major Depression (Pigeon et al., 2008); 4) often persists despite the successful treatment of (or natural remission of) the Major Depression (Iovieno et al., 2011; Pigeon et al., 2008); 5) represents a risk factor for recurrence of Major Depression (Ford and Kamerow, 1989; Breslau et al., 1996); 6) when targeted for treatment in the context of co-occurring Major Depression (with therapies that are insomnia specific) produces outcomes that are comparable to, and in some cases exceed, treatment outcomes with “Primary Insomnia” (Taylor et al., 2007; Manber et al., 2008); 7) when targeted for treatment in the context of co-occurring Major Depression (with therapies that are insomnia specific) produce outcomes that have additive effects with antidepressants (Fava et al., 2006; Manber et al., 2008). Taken together these findings, along with several commentaries and meta-analyses (Riemann

et al., 2001; McCrae & Lichstein, 2001; Billiard and Bentley, 2004; Lichstein, 2006; Smith and Perlis, 2006; Riemann, 2007), strongly support the notion that a better understanding of the natural history of insomnia will greatly inform the effort to create prophylactic interventions and/or better therapies for illness such as Major Depression.

Prior to exploring questions about the factors that predict transitions, temporal variations, and remission, two principle gaps in the literature need to be addressed: 1) how prevalent is acute insomnia? and 2) what is its incident rate per unit of time? In answering these questions a further difficulty arises, one not limited to acute insomnia but which has been historically evident in the epidemiological study of chronic insomnia; the failure to apply standard definitions and/or use standard assessments. Ohayon (2002) brought attention to this issue when he demonstrated that the prevalence of insomnia varied considerably based on how it was defined. He showed, in his systematic review of the literature, that many studies utilized questions (often only one or two) which characterized insomnia symptoms without regard to frequency, severity, chronicity and/or the report that the sleep initiation or maintenance difficulties had daytime consequences and/or were perceived by the subject as problematic. He further demonstrated that when such considerations were taken into account, the prevalence rates fluctuated widely. When defined generically, 30–48% of the population was found to have insomnia. When defined more specifically, by accounting for symptom frequency, the prevalence rates were reduced to 16–21%. When defined still more specifically, by taking into account daytime consequences, the prevalence rates were reduced further to 9–15%. These findings, which do not account for chronicity and/or differentiate between acute and chronic insomnia, underscore the need for contemporary studies to utilize standard definitions (if not standard assessments).

To date, only the Laval group have documented the natural history of insomnia prospectively, using a standard assessment approach and adopting standard definitional criteria (LeBlanc et al., 2007; Morin et al., 2009; LeBlanc et al., 2009). Whilst this study is largely focused on the expression of subsyndromal and syndromal insomnia over time, the second and third reports from this group highlight the transition from good sleep to subsyndromal insomnia. Given this approach it was found that 30.7% of good sleepers developed subsyndromal insomnia over one year (LeBlanc et al., 2009). Of these, 28.8% were first-onset events. These data, which are the first of their type, represent a compelling point of departure for the exploration of acute insomnia, which differs from subsyndromal insomnia because participants could be classified as subsyndromal irrespective of insomnia duration. That is, someone with initiation or maintenance problems, three days a week, for any duration (i.e. days, months, or years) would still be classified as subsyndromal provided they did not meet one of the other definitional criteria (e.g. sleep continuity perceived as a problem, daytime impairment, or sleep-related worry or distress).

Recently, an attempt was made to conceptualize and define Acute Insomnia (Ellis et al., 2012) in a manner that takes into account the core components of insomnia disorder (as delineated in the proposed DSM-V nosology; APA) (see Fig. 1). This definition was expanded to incorporate the presence of a trigger and a quantitative measure of the severity of the sleep complaint [i.e., a Sleep Onset Latency or Wake After Sleep Onset of 30 min or longer]. The advantage to adopting the construct of acute insomnia as opposed to subsyndromal insomnia is two fold. First, it has the added value of being consistent with the International Classification of Sleep Disorders-2nd Edition (AASM, 2005) and DSM-V classification systems (as both explicitly adopt the categorization of acute but not subsyndromal insomnia). Second, where subsyndromal insomnia implicitly suggests that treatment is not

warranted, acute insomnia allows both for the possibility of prophylaxis and early intervention.

The aim of the present study was to build upon the previous work by Ohayon (2002) and the Laval group. This was accomplished by; a) adopting the conventional constructs of acute insomnia from the DSM-V and from Ellis et al. (2012), b) employing a prospective longitudinal study with short follow-up durations to differentiate between acute and chronic insomnia, and c) discriminating between the prevalence and incidence of first-onset and recurrent episodes of acute insomnia.

2. Method

2.1. Recruitment and procedure study 1

Participants in the USA survey were recruited through an online opinion-polling agency (Zogby International). The purpose of the survey was to identify individuals with acute insomnia and/or individuals with normal sleep and to query them about their interest in participating in research and what level of assessment would be burdensome. The survey included four questions: two pertaining to sleep and two related to participation in research. The two sleep questions had a closed-ended response format (Yes/No/Not Sure). The first question was 'For the past six months, would you consider yourself a good sleeper? That is, do you reliably (5 or more nights per week) take less than 15 min to fall asleep, and are awake during the night for less than 15 min'. This was used to differentiate those reporting normal sleep (NS) from those with an insomnia (acute or chronic). The second question was 'Have you recently had problems falling or staying asleep? That is, were you reliably a good sleeper until 1–3 months ago, and suddenly found that it was difficult to sleep when you wanted to on three or more days a week?' This was used to differentiate between normal sleep (NS) and Acute Insomnia (AI). Participants from this study were not asked about co-morbid sleep disorders or physical or psychiatric illnesses.

2.2. Recruitment and procedure study 2

The UK population was recruited through a series of radio advertisements, on two local radio stations, and posters in local community settings (e.g. supermarkets), in the North East of the United Kingdom. The advertisements asked people, irrespective of their sleep status, to contact researchers for an interview about their sleep habits and problems. Participants were asked to either text the word 'SLEEP', or call and leave contact details, to a dedicated voicemail. The radio advertisements covered a period of three weeks (one week of advertisements, one week break, and one week of advertisements). Advertisements were broadcast between four and seven times each day with at least one broadcast every 4 h, thus distributing the broadcasts throughout the 24 h cycle. Contact details were collated from the voicemail and potential participants were systematically contacted by e-mail or telephone for interviews.

The telephone interview began with a brief description of the study and how long the interview should last (approximately 20 min). Potential participants were then asked to consent if they were willing to proceed. If a potential participant did not wish to continue they were asked for their age and gender for reporting purposes. Following consent, the interview began with four central questions:

- (1) 'Have you ever had a problem with your sleep?'
- (2) [If yes to the first question] 'Is this an ongoing problem at the moment?'
- (3) [If yes to the first and second questions] 'For how long has this been going on?'

A. The predominant complaint is dissatisfaction with sleep quantity or quality made by the patient (or by a caregiver or family in the case of children or elderly).

B. Report of one or more of the following symptoms:

- Difficulty initiating sleep
- Difficulty maintaining sleep characterized by frequent awakenings or problems returning to sleep after awakenings
- Early morning awakening with inability to return to sleep
- Non restorative sleep

C. The sleep complaint is accompanied by significant distress or impairment in daytime functioning as indicated by the report of at least one of the following:

- Fatigue or low energy
- Daytime sleepiness
- Cognitive impairments (e.g., attention, concentration, memory)
- Mood disturbance (e.g., irritability, dysphoria)
- Behavioral problems (e.g., hyperactivity, impulsivity, aggression)
- Impaired occupational or academic function
- Impaired interpersonal/social function
- Negative impact on caregiver or family functioning (e.g., fatigue, sleepiness)

D. The sleep difficulty occurs at least three nights per week.

E. The sleep difficulty is present for at least three months.

F. The sleep difficulty occurs despite adequate age-appropriate circumstances and opportunity for sleep.

Fig. 1. Proposed nosology for DSM-V defined insomnia disorder (adults).

(4) [If yes to the first and second questions] 'What is the nature of your sleep problem?'

The response format was closed for questions 1 and 2 (Yes/No) and participants were asked to estimate, in weeks/months/years, the answer to question 3. Question 4 was followed with a forced choice response consisting of four options: 'Getting Off to Sleep', 'Staying Asleep', 'Waking Too Early', or 'Feeling Unrefreshed on Waking'. Questions 1, 2, and 4 covered criteria A and B for a diagnosis of DSM-V defined Insomnia Disorder (see Fig. 1). The third question covered criterion E and was also used to differentiate Acute Insomnia (AI) (i.e. 3 days to 3 months) from chronic insomnia (CI) (i.e. 3 months or longer). The final question was always followed with a definition of insomnia which covered the other core components of the DSM-V definition of Insomnia Disorder (i.e. that their principle sleep complaint results in impairment in daytime functioning (criterion C), that it is present for at least three nights per week (criterion D), and that the difficulty occurs despite adequate opportunity to sleep (criterion F)). Additional prompts were used, where necessary, to arrive at definitive responses to each question (e.g. a list of markers of distress or impairment including memory impairments, concentration difficulties, fatigue, daytime sleepiness, distress, irritability, impaired occupational or psychosocial functioning, were provided if the participant was unsure whether their insomnia resulted in daytime dysfunction). Participants who answered in the negative to the first or second

question or did not meet the minimum criterion for insomnia were categorized as Normal Sleepers (NS). If a participant met partial criteria (e.g. a complaint in initiating sleep for three nights a week for the last month but with no daytime dysfunction) they were also classified as a normal sleeper.

Following the central questions, participants were then asked a series of seventeen questions to identify those with acute insomnia and indications of other sleep disorders or psychiatric/medical disorders (i.e. Co-morbid Acute Insomnia). These questions covered the main DSM-IV and International Classification of Sleep Disorders-2nd Edition criteria for five broad sleep disorder types (Hypersomnia: including Narcolepsy, Sleep-related Breathing Disorders, Parasomnias, Circadian Rhythm Disorders, and Restless Legs Syndrome and Periodic Limb Movement Disorder). For example: 'Do you experience a crawling, aching, itching or similar sensation in your legs, which gets worse towards bedtime and prevents you from getting to sleep because you feel the urge to move?'. Additionally, participants were asked to self report any co-morbid psychiatric or medical illnesses. The response format for these questions was closed (i.e. Yes, No or Unsure) and if participants answered in the affirmative on any question they were categorized as having Co-morbid Acute Insomnia. Participants who reported being unsure in response to any question were provided all the defining symptoms of the sleep disorder or co-morbid illness they were unsure of and, if necessary, in the case of sleep problems asked if a bed partner had ever reported them as having symptoms until a definitive yes/

no response was reached. Finally, all participants were asked to report their age and gender. Following the interview participants were thanked for their time and asked if they would like to take part in further follow-up surveys about their sleep.

Those who completed the interview and agreed to take part in the follow-up surveys were sent login details for an online survey, or were posted a paper copy of the survey the day following their telephone interview. In addition to the central and supplementary questions (i.e. covering the nature of the sleep problem and comorbid psychiatric and medical illnesses) from the interview, the surveys were structured to acquire additional information on sleep quality, quantity, and timing, and the subtype and severity of insomnia. Insomnia severity was assessed using the Insomnia Severity Index: ISI (Morin, 1993). The ISI is self-report 7-item questionnaire which asks about the severity of the principle complaint (3 items), levels of sleep-related distress (1 item), interference to daily functioning (1 item), the impact on quality of life (1 item), and levels of satisfaction with current sleep patterns (1 item). Moreover, a series of measures covering, personality, psychological adjustment, sleepiness and fatigue, quality of life, daily hassles and life events, coping styles and strategies, and sleep-related dysfunctional beliefs and preoccupations were also included. Participants were also provided two-weeks of sleep diaries at each assessment point. Follow-up surveys were generated

and delivered to participants at one month, three months, and six months following the baseline assessments.

For the present analysis of the incidence of acute insomnia, only transitional data on sleep status (from normal sleep to acute insomnia) between baseline, one month, and three months, is reported. Transition from normal sleep at baseline to acute insomnia was measured in two ways to examine the impact of definitional criteria on incidence rates.

- The DSM-V diagnosis for Insomnia Disorder (i.e. a principle sleep complaint in initiating or maintaining sleep or early morning awakening, despite adequate opportunity to sleep, for at least three nights per week, resulting in impairment in daytime functioning (i.e. Criteria A-F). This was measured using the same four central questions used in the interview with two additional questions, one asking whether their current sleep pattern results in daytime impairment (yes/no), and one on the number of nights affected in a typical week (response between 0 and 7). To aid participants in determining whether or not they had daytime dysfunction the same markers of daytime impairment, outlined in the telephone interview, were included as examples next to the question.
- The second measurement strategy was based on the DSM-V criteria for Insomnia Disorder but with the additional 'case'

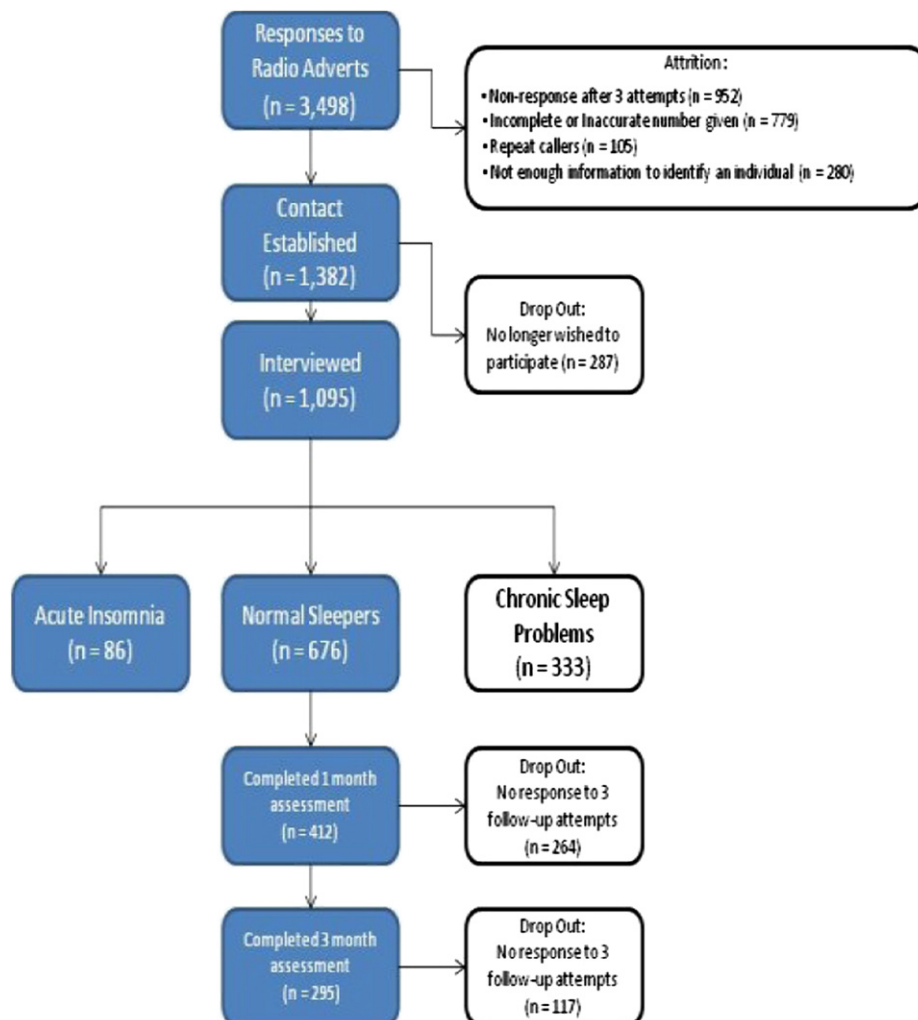


Fig. 2. Participant flow in the UK sample.

criteria for acute insomnia outlined by Ellis et al. (2012). In this instance for a new 'case' of acute insomnia, participants had to additionally report the following: a) a reported Sleep Latency (SL) or Wake After Sleep Onset (WASO) of 30 min or longer, and b) there had to be a significant reduction, from ideal, in the individuals' Quality of Life (QoL) at the time of the onset of the insomnia episode. Participants were asked to estimate their usual SL, WASO (in minutes) for the first dimension and a single self-report question assessed whether there had been '...a significant reduction in their Quality of Life around the time that their insomnia started'. Additionally, participants had to score above 14 on the Insomnia Severity Index (the clinical cut off score) (Bastien et al., 2007) to be defined as having a case of acute insomnia under these criteria.

Acute insomnia (within the UK sample) was also subtyped into the following categorizations using all the questions (central and supplementary) asked at the interview and in the surveys; 1) First Onset Acute Insomnia (FOAI), 2) First Onset Co-morbid Acute Insomnia (FOCAI) 3) A Recurrent Episode of Acute Insomnia (REAI).

FOAI was defined on the basis that a) the individual met the criteria for acute insomnia, b) they reported never having had a sleep problem previously, and c) they reported no other sleep disorder or medical/psychiatric illness.

FOCAI was defined on the same basis as FOAI except the participant also met the criteria for another sleep disorder or self-reported a medical/psychiatric illness.

REAI was characterized the same as FOAI but the participant had reported a previous sleep problem.

2.3. Statistical analysis

Prevalence and incidence rates were calculated using descriptive data (i.e. actual reporting numbers and percentages). Differences between the sleeper groups (i.e. Normal Sleeper, Acute Insomnia & FOAI, FOCAI, REAI) were analysed using independent *t*-tests and one-way ANOVAs for continuous variables and Chi Square test was used for dichotomous variables.

3. Results

3.1. Prevalence rates

The Zogby online survey was distributed to, and completed by, 2861 panel members, 886 (31.23%) female (24 people did not provide their gender). Age was recorded by grouping (18–24, 25–34, 35–54, 55–69, 70+) and age-related data for 16 participants was missing. The majority of participants fell within the 55–69 age grouping (1351 participants 47.49%). On the basis of the two questions asked, participants were characterized as either Normal Sleepers (NS: *n* = 1870, 65.36%) or those with Acute Insomnia (AI: *n* = 271, 9.47%). Note: 720 individuals were not classified owing either to the participants uncertainty (responding with "not sure") or to the necessary indeterminacy re: category given the individual's pattern of responses to the given questions (e.g., "Yes" to the endorsement of normal sleep and "Yes" to the endorsement of recent problems, on 3 or more days per week, with falling or staying asleep).

Of the 3498 messages and texts received to the dedicated voicemail for the UK survey, complete data from 1095 interviews was obtained (31.3%) (see Fig. 2 for participant flow). Additionally, of the 1382 individuals correctly identified, and called, 287 (20.77%) no longer wished to participate in the interview. Of those, 179 (62.37%) were female and 108 (37.63%) were male and

Table 1
Prevalence data by country.

	USA (<i>n</i> = total respondents 2861)				UK (<i>n</i> = total respondents 1095)				
	Actual numbers	% of total sample	Age groupings		Sex	Actual numbers	% of total sample	Mean age (SD)	Female (%)
			18–24 <i>n</i> = 25 (% of total sample)	25–34 <i>n</i> = 174 (% of total sample)					
Normal Sleepers	1870	65.36%	12 (48%)	108 (62.07%)	913 (67.58%)	676	61.74%	26.66 (10.57)	507 (75%)
Acute Insomnia	271	9.47%	5 (20%)	22 (12.64%)	120 (8.88%)	86	7.85%	35.31 (10.65)	52 (60.47%)

Table 2
Sample characteristics by sleeper group.

	Actual numbers reporting <i>N</i> = 1095	Mean age (Standard deviation)	Gender (% Female)
Normal Sleepers	676 (61.74%)	26.66 (10.57) ^a	507 (75%) ^a
First-Onset Acute Insomnia	29 (2.65%)	26.1 (9.93) ^b	20 (69%) ^b
A Recurrent Episode of Acute Insomnia	42 (3.84%)	45.5 (11.13) ^{abc}	20 (47.6%) ^{abc}
First-Onset Co-morbid Acute Insomnia	15 (1.37%)	34.33 (10.90) ^c	12 (80%) ^c
Exclusions for sleep problems outside acute insomnia timeframe (less than 3 days – over 3 months)	333 (30.41%)	43.67 (12.20)	173 (51.95%)

Numbers sharing the same letters are significantly different ($p < .05$).

the mean age was 33.05 (SD 13.04). Of those that did participate, 732 (66.85%) were female and 363 (33.15%) were male. The mean age of the responding sample was 32.72 (SD 13.81). There were no differences between responders and non-responders on age ($t(1379) = -.37, p < .05$) or gender (Chi Square (1) = 2.03, $p < .05$).

Based upon the central questions asked, participants were first characterized into the groups that were comparable between the two datasets (i.e. NS or AI). Of the 1095 participants, 676 (61.7%) were characterized as Normal Sleepers (NS) and 86 (7.9%) were characterized as having Acute Insomnia (AI). Data from 333 (30.4%) participants were excluded from further analysis for reporting a chronic sleep problem. Comparatively, the frequency distribution for the USA and UK datasets were largely similar; NS: USA = 65.4% vs. UK = 61.7% and AI: USA 9.5% vs. UK = 7.9%. The demographic profile of each of these categories is presented in Table 1.

3.2. Subgroup sample composition for the UK sample

Based upon the central and supplementary questions asked in the UK sample, of those with acute insomnia ($n = 86$), 29 (33.7%) were classified as First Onset Acute Insomnia, 15 (17.44%) were classified as having a First Onset of Co-morbid Acute Insomnia, and 42 (48.84%) were classified as having a Recurrent Episode of Acute Insomnia. The age and gender distributions based on these subgroups are presented in Table 2. A one-way ANOVA between the four groups showed an overall age difference ($F(3,757) = 43.91, p < .001$). Post-hoc Sheffe tests revealed no significant differences between each of the three short duration, or non-term, sleep disorder groups (i.e. NS, FOAI, FOCAI) but there was a significant difference between each of these three groups compared to those reporting a recurrent episode of acute insomnia, with those in the latter group being significantly older. In terms of gender, women reported more sleep problems than men in almost every grouping (although a recurrent episode of acute insomnia was slightly more prevalent in men) (Chi Square = 6.17, $df = 2, p < .05$). There was also a difference in gender between those reporting a sleep problem overall and normal sleepers (Chi Square = 8.25, $df = 1, p < .005$).

3.3. Follow up sample composition for the UK sample

Of the 676 normal sleepers at baseline, 412 (60.9%) took part in the one-month follow-up survey (309 females, 101 males, 2

unrecorded) mean age 27.7 (SD 11.4) and 295 (43.6%) took part in assessments at one month and at three months (220 females, 74 males, 1 unrecorded) with a mean age of 29.0 (SD 11.8). The demographic characteristics of the groups, by timeframe and diagnostic category, are provided in Table 3.

3.4. Incidence rates (prospective assessment of new onset insomnia)

When examined using the DSM-V criteria alone, the one month incidence of acute insomnia was 4.37% (18 out of the 412 participants), with 11 (61.1%) of those participants reporting it as a case of First Onset Acute Insomnia. The three-month incidence was 9.15% (27 out of the 295 participants), with 12 (44.4%) of those participants reporting it as a case of First Onset Acute Insomnia. Using the three-month figures an annual incidence rate of 36.6% was calculated, with 16.27% reporting it as a case of First Onset Acute Insomnia. Using the DSM-V with additional case criteria (i.e. SL or WASO of 30 min or longer, and a self-reported reduction in QoL), the one-month incidence of acute insomnia reduced to 3.4% (15 out of the 412 participants), with 11 (73.33%) of those participants reporting it as a case of First Onset Acute Insomnia. The three-month incidence acute insomnia was 7.8% (23 out of the 295 participants), with 14 (60.86%) of those participants reporting it as a case of First Onset Acute Insomnia. Taking into account the three month findings, the annual incidence rate, based upon these criteria, was calculated at 31.2% with 18.98% of those participants reporting a case of First Onset Acute Insomnia.

3.5. Incidence rates (prospective assessment of remission)

In terms of remission, based on the DSM-V nosology, 11 out of the 14 (78.57%) participants who had acquired acute insomnia by one month had remitted by three months (3 participants with FOAI and 1 participant with REAI were lost to follow up). When using the DSM-V and additional case criteria, 8 of the 12 (67%) people who had acquired insomnia by one month had remitted by three months (3 participants with FOAI were lost to follow up). There was a substantial range in remission rates by subtype (FOAI and REAI) with 7 out of the 8 (87.5%) of the FOAI participants and 4 out of the 6 (67%) of the REAI participants remitting under the DSM-V criteria. Finally, 6 out of 8 (75%) FOAI participants and 2 out of the 4 (50%)

Table 3
Sample characteristics by diagnostic criteria and subtype.

		Actual numbers reporting	Mean age (Standard deviation)	Gender (% Female)
Incidence at 1 month ($n = 412$)	DSM-V	18 (4.37%)	27.67 (8.87)	12 (67%)
	DSM-V + Case Criteria	15 (3.4%)	27.33 (8.97)	9 (60%)
Incidence at 3 months ($n = 295$)	DSM-V	27 (9.15%)	27.22 (11.53)	22 (81.5%)
	DSM-V + Case Criteria	23 (7.8%)	26.09 (10.3)	14 (60.9%)
Remission (First Onset)	DSM-V	7 (87.5%)	26.57 (8.94)	3 (50%)
	DSM-V + Case Criteria	6 (75%)	27.67 (8.82)	3 (50%)
Remission (Recurrent)	DSM-V	4 (67%)	25.25 (3.78)	3 (75%)
	DSM-V + Case Criteria	2 (50%)	25 (7.07)	2 (100%)

REAI participants remitted under the DSM-V, with additional case criteria.

4. Discussion

The present study provides the first prevalence and incidence data for acute insomnia using a prospective design with high temporal resolution while taking into account 1) the potential comorbidity from other sleep disorders, illnesses and conditions, and 2) the distinction between new onset and recurrent acute insomnia. The results demonstrate that acute insomnia is highly prevalent (9.5% USA and 7.9% UK), that its annual incidence is between 31.2% and 36.6%. Additionally, the present study provides the first, albeit tentative, indication of the remission rates (78.57%) and transition rates (21.43%) from acute to chronic insomnia.

This study is a first step towards a systematic investigation of the natural history of insomnia. Knowing the prevalence, incidence, transition, and remission rates provides a first indication of the scale and scope of the problem. The next stage will be to determine the relative contribution of predisposing, precipitating, and perpetuating factors and how they link, or buffer against, the transition to chronic insomnia. Theoretically, it has been suggested that this transition is characterized by a variety of cognitive processes (e.g. catastrophic worry and dysfunctional beliefs) and behavioural actions (e.g. extending sleep opportunity) employed during the early phase of insomnia (Spielman, 1986; Spielman et al., 1987). Through an empirical examination of these theoretical pathways the question of how, and when, to intervene will be clarified. Further, if it is possible to prevent chronic insomnia, this will uniquely position the field to further explore how insomnia is related to the clinical course of depression and whether early interventions for insomnia influence the incidence and severity of Major Depression.

One limitation of the present study lies in the fact that the number and duration of previous episodes and duration of prior remissions cannot be derived from the present data. Similarly, the sampling strategy used (while higher resolution than preceding studies) does not allow for a determination of each participant's status between the measurement intervals. These issues, although not central questions in the present study, are relevant in terms of examining temporal variations and are worthy of future investigation. A second limitation is that both samples are not representative of the geographical regions studied, and in the case of the UK sample will also be subject to a self-selection bias due to the recruitment strategy used. These issues are definite drawbacks and as such the prevalence rates presented here should be viewed with caution until epidemiological data, using a more representative recruitment strategy is presented. This said, the incidence data was derived from individuals who were at the outset of the study good sleepers and unaware that the study would be longitudinal. Additionally, the selection of individuals for the prevalence data from the US was based upon individuals who are members of a polling agency which does not identify itself solely for sleep or health research. As such, there is likely to be less of a self-selection bias influencing these rates. There were also significant demographic differences in the overall makeup of the US and UK samples. Although this can be seen as an additional drawback, the similarities observed between the two datasets in terms of age (i.e. acute insomnia appears to affect younger age groups more than older age groups) underscore this as a likely risk factor. These issues notwithstanding, the cross site prevalence estimates for normal sleepers and people with acute insomnia were similar and the incidence data from the Laval study on subsyndromal insomnia and the acute insomnia data presented here were also broadly comparable (annual incidence rates calculated at 30.7% and 31.2% respectively, when using the DSM-V and additional case criteria).

In closing, the present study represents a good first step towards defining acute insomnia, its incidence and prevalence and the likelihood of remission or transition to chronic insomnia. Once replicated the next step will be to identify the factor, or factors, that reliably predict which individuals' transition to chronic insomnia. This will allow for the identification of individuals that would maximally benefit from treatment in the context of acute insomnia. Beyond this there is the issue of what the treatment itself should be. Traditional pharmacotherapy or Cognitive Behavior Therapy for Insomnia (CBT-I) may in such cases represent regimens that are either too intensive or not intensive enough. Accordingly, these issues remain substantial targets for future research but will ultimately serve as the evidence base for what constitutes standard practice.

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Authors contributions

Dr. Ellis – Designed the UK study, sought and obtained the funding, sought and obtained ethical approval, oversaw the data collection and data input, analysed the data, interpreted the results, and wrote the first draft and edited further drafts.

Dr. Perlis – Designed the USA part of study, sought and obtained ethical approval, oversaw the data collection and data input, interpreted the results, and wrote the first draft and edited further drafts.

Ms Neale – Sought and obtained ethical approval, co-ordinated and conducted interviews and data input, and edited first and further drafts.

Professor Espie – Informed the design of the study, provided administrative support, was involved in the interpretation of the results, edited drafts.

Professor Bastien – Informed the conception and design of the study, provided technical and material support, interpreted the results, and edited drafts.

All authors have given permission to submit the manuscript.

Conflict of interest

All authors declare that they have no conflicts of interest associated with this manuscript.

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