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# Frequency and distribution of sleep problems and insomnia in the adult population in Germany

## Results of the German Health Interview and Examination Survey for Adults (DEGS1)

### Background

On average people spend approximately one third of their lifetime sleeping [1]. For humans, sleep is vital and plays an essential role as part of biological and psychological regeneration processes [2]. Sleep deprivation is associated with psychological and physical impairments such as daytime fatigue, lack of concentration, stress, poorer general health, and poor mental well-being as well as impairments in social functioning [4, 8, 9, 10]. Problems in sleep onset and maintaining sleep associated with daytime fatigue and social and vocational impairments are referred to as insomnia. For a diagnosis of insomnia the classification systems ICD-10 and DSM-IV-TR require among other things the symptoms to persist at least a month. In the International Classification of Sleep Disorders, 2nd Edition, (ICSD-2), however, there is no specific time criterion, but merely a chronic lack of restfulness or poor quality of sleep (given adequate opportunities and conditions for sleeping) being required. In contrast to only occasionally occurring problems in sleep onset and maintaining sleep, therefore, the presence of larger and more complex symptoms over a longer time period is required for insomnia to be diagnosed. By establishing figures of 10–30 %, epidemiological studies worldwide document high prevalence rates

of disturbed sleep in terms of insomnia [1, 7]. Sleep deprivation, but also an increased duration of sleep (hypersomnia), are linked with an increased risk for a variety of mental and somatic health disorders [3, 8, 9]. For example, both "short" and "long" sleepers display a significantly increased mortality compared to "normal" sleepers [3]. Among others, this may well be because sleep deprivation displays an age-independent dose–response relationship to overweight and obesity, high blood pressure and metabolic syndrome [3]. Increased mortality from hypersomnia, on the other hand, is possibly due to the fact that people with increased sleep duration also suffer from other mortality-entailing diseases. For example, sleep apnea is associated with an increased incidence of strokes [10]. Not least, insomnia represents a risk factor a later occurrence of depression. Compared to undisturbed sleep, the risk of becoming ill with this affective disorder is doubled [11].

The economic cost of sleep disturbances is high. A Canadian study estimates the direct and indirect costs of insomnia in the province of Quebec to be approximately 1 % of their gross national product [12]. The indirect costs due to sick leave days, drop in performance and productivity loss were found to be three to five times higher than the cost of treatment and medication [12, 13]. However, there is no respective data available for Germany.

Despite the well-known associations of disordered sleep with serious health impairments, the relevance of sleep disorders to the field of public health continues to be underestimated. Amongst other things, this is expressed in a significantly lower number of corresponding publications that are listed in Medline compared, for example, to those about smoking or obesity.<sup>1</sup> Therefore, questions pertaining to sleep were integrated into the national representative German Health Interview and Examination Survey for Adults (DEGS1) for the 18–79 year age groups. As there were no specific instruments included as part of the preceding German National Health Interview and Examination Survey 1998 (GNHIES98) to cover sleep disturbances (only as part of the *Zerssen Beschwerde Skala* there were two unspecific questions regarding each insomnia and hypersomnia problems), for the first time, the DEGS1 study now offers differentiated, nationally representative data, using an established instrument for the assessment of sleep disturbances in a major German epidemiological health survey. The large sample enables stratified analyses according to various sociodemographic characteristics such as age, sex, socio-

<sup>1</sup> Search terms: public health AND sleep: 1031 hits; public health AND obesity: 6123 hits; public health AND smoking: 9807 hits (accessed 08 Jan 2013).

economic status, size of municipality or geographical region. The aim of this study is to report on the frequency and distribution of sleep problems (disturbances in sleep onset and maintaining sleep), poor quality of sleep, effective sleep time, the use of physician-prescribed or over-the-counter (OTC) sleeping pills, as well as the prevalence of insomnia syndrome in the adult population.

## Methods

### Sample

The German Health Interview and Examination Survey for Adults (“Studie zur Gesundheit Erwachsener in Deutschland”, DEGS) is part of the health monitoring system at the Robert Koch Institute (RKI). The concept and design of DEGS are described in detail elsewhere [14, 15, 16, 17, 18]. The first wave (DEGS1) was conducted from 2008–2011 and comprised interviews, examinations and tests [19, 20]. The target population comprises the residents of Germany aged 18–79 years. DEGS1 has a mixed design which permits both cross-sectional and longitudinal analyses. For this purpose, a random sample from local population registries was drawn to complete the participants of the German National Health Interview and Examination Survey 1998 (GNHIES98), who re-participated. A total of 8,152 persons participated, including 4,193 first-time participants (response rate 42 %) and 3,959 revisiting participants of GNHIES98 (response rate 62 %). In all 7,238 persons attended one of the 180 examination centres, and 914 were interviewed only. The net sample (n=7,988) permits representative cross-sectional and time trend analyses for the age range of 18–79 years in comparison with GNHIES98 (n=7,124) [12]. The data of the revisiting participants is suitable for longitudinal analyses.

This article represents a cross-sectional analysis on the frequency and distribution of sleep disturbances in the German adult population. The analyses are conducted with a weighting factor which corrects deviations in the sample from the population structure (as of 31 Dec 2010) with regard to age, sex, region and nationality, as well as community type and educa-

tion [18]. Calculation of the weighting factor also considered re-participation probability of GNHIES98 participants, based on a logistic regression model. A non-response analysis and a comparison of selected indicators with data from census statistics indicate a high level of representativity of the net sample for the residential population aged 18–79 years of Germany [18]. To take into account the weighting as well as the correlation of the participants within a community, the confidence intervals were determined with the survey procedures for complex samples of SAS 9.3 [24]. Differences are considered statistically significant if the 95 % confidence intervals of the prevalence estimators do not overlap. Descriptive odds ratios were determined using binary logistic regression and—in the case of multi-level, nominal criterion variables—using multinomial logistic regression (PROC SURVEYLOGISTIC, SAS v9.3). Socioeconomic status (SES) was determined using an index which includes information on school education and vocational training, professional status and net household income (weighted by household needs) and which enables a classification into low, middle and high status groups [21].

### Instruments

Items on effective sleep time, quality of sleep and consumption of sleeping pills were taken from the Pittsburgh Sleep Quality Index (PSQI) [22] (German version: Riemann and Backhaus [23]). Two items regarding problems of sleep onset and maintaining sleep were developed by the RKI. As demanded by both ICD-10 and DSM-IV, all items referred to the period of 4 weeks prior to the time of survey. To approximate a diagnosis of “insomnia”, information on the daytime consequences of sleeping problems such as feeling tired and feeling exhausted were taken from the SF-36 health survey [24].

### Effective sleep time

Effective sleep time was assessed by asking how many hours the participants commonly spent sleeping at night during the previous 4 weeks. Time spent in bed without sleeping was not to be included. An-

swers could be given in whole hours. In the case of night or shift work, the effective sleep time was to be stated for the then usual sleeping times.

### Problems in sleep onset and maintaining sleep

Participants were also surveyed with regard to the frequency of problems of sleep onset and maintaining sleep in the previous 4 weeks. The response options for both questions were: “Not at all during the past 4 weeks”, “Less than once a week”, “Once or twice a week”, “Three times a week or more”. Based on ICD-10 and DSM-IV-TR, problems of sleep onset or maintaining sleep were considered of clinical relevance if they occurred three times or more a week.

### Quality of sleep

Quality of sleep was assessed asking: “How would you rate the quality of your sleep during the past 4 weeks?” Response options were “very good”, “quite good”, “quite poor” or “very poor”.

### Consumption of sleeping pills

With regard to the consumption of sleeping pills participants were asked how often in the past 4 weeks they had been taken prescription or OTC sleeping pills. Response options were as follows; “not at all during the past 4 weeks”, “less than once a week”, “once or twice a week”, or “three times per week or more”.

### Insomnia

Diagnostic criteria for a primary insomnia according to the DSM-IV-TR and/or a non-organic insomnia according to the ICD-10 require sleep onset problems or problems maintaining sleep to occur three times or more a week for a period of 4 weeks or the occurrence of non-restorative sleep (DSM-IV-TR) and/or poor quality of sleep (ICD-10) for this period and at this frequency. In addition the presence of daytime consequences of sleep problems (e.g. daytime fatigue, exhaustion or impaired social functioning) are required. Consequently, the following algo-

rhythm was employed in order to approximate a diagnosis of “insomnia syndrome” from the survey data: Participants, who in the previous 4 weeks reported sleep onset problems once or twice a week *and* problems maintaining sleep once or twice a week *or* sleep onset problems three times or more *or* problems maintaining sleep three times or more, *as well as* quite poor or very poor quality of sleep *and* who had additionally reported having been “always” or “mostly” tired and/or exhausted in the previous 4 weeks, were classified as screening positive.

## Results

### Sleep onset problems

A total of 11.1 % of all participants reported problems with sleep onset occurring 3 times or more per week during the previous 4 weeks (■ Tab. 1). Overall 16.5 % of the participants stated they had sleep onset problems once to twice a week, approximately one quarter of the participants experienced sleep onset problems less often than once a week and, finally, 47.1 % had no sleep onset problems. Regarding only potentially clinically relevant sleep onset problems (3 times per week and more), women (13.6 %) were significantly more frequently affected than men (8.6 %). With increasing age, the percentage amongst women over 60 years almost doubled to 18.1 % compared with 18–39 year olds. In contrast, the rate of sleep onset problems amongst men remained virtually constant at less than 10 % across the age groups. Thus, the significant overall sex differences are to be exclusively traced back to the differences in the 60- to 79-year-old age group.

### Problems maintaining sleep

Generally, problems maintaining sleep were far more frequent than problems with sleep onset. As to the previous 4 weeks, approximately one quarter of all participants reported being affected three times or more per week by problems maintaining sleep. A total of 18.8 % were affected once or twice a week and 22.3 % less than once a week by these problems, 36.0 % were not affected (■ Tab. 1). Over-

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## Frequency and distribution of sleep problems and insomnia in the adult population in Germany. Results of the German Health Interview and Examination Survey for Adults (DEGS1)

### Abstract

Sleep disturbances are associated with a variety of physical and mental health disorders and cause high direct and indirect economic costs. The aim of this study was to report the frequency and distribution of problems of sleep onset and maintaining sleep, sleep quality, effective sleep time and the consumption of sleeping pills in the adult population in Germany. During the 4 weeks prior to the interview, about one third of the respondents reported potentially clinically relevant problems initiating or maintaining sleep; about one-fifth reported poor quality of sleep. When additionally considering impairments during the daytime such as daytime fatigue or exhaustion, a prevalence of

5.7 % for insomnia syndrome was found. Women were twice as likely to be affected by insomnia syndrome as men. Significant age differences were not seen. Persons with low socioeconomic status had an increased risk of insomnia (odds ratio [OR] 3.44) as did people residing in West Germany (OR 1.53). Women with low socioeconomic status (OR 4.12) and men living in western German (OR 1.79) were more affected. The results illustrate the considerable public health relevance of insomnia-related sleep disturbances.

### Keywords

Sleep disturbances · Sleep quality · Insomnia · Prevalence · Health survey

## Häufigkeit und Verteilung von Schlafproblemen und Insomnie in der deutschen Erwachsenenbevölkerung. Ergebnisse der Studie zur Gesundheit Erwachsener in Deutschland (DEGS1)

### Zusammenfassung

Schlafstörungen sind mit einer Vielzahl von körperlichen und psychischen Gesundheitsstörungen verbunden und verursachen hohe gesundheitsökonomische und volkswirtschaftliche Folgekosten. Ziel der hier vorliegenden Studie war es, die Häufigkeit und Verteilung von Ein- und Durchschlafstörungen, der Schlafqualität, der Schlafdauer, des Schlafmittelkonsums sowie des Insomniesyndroms in der deutschen Erwachsenenbevölkerung zu berichten. Etwa ein Drittel der Befragten hatte während der letzten 4 Wochen potenziell klinisch relevante Ein- oder Durchschlafstörungen, etwa ein Fünftel berichtete zusätzlich über eine schlechte Schlafqualität. Unter zusätzlicher Berücksichtigung von Tagesbeeinträchtigungen wie Müdigkeit und/oder Erschöpfung ergab sich

eine Prävalenz von 5,7% für ein Insomniesyndrom. Frauen waren doppelt so häufig von Insomnie betroffen wie Männer, signifikante Altersunterschiede gab es nicht. Personen mit niedrigem Sozialstatus (OR: 3,44) und Personen mit Wohnsitz in Westdeutschland (OR: 1,53) hatten ein erhöhtes Risiko für Insomnie, wobei Frauen mit niedrigem Sozialstatus (OR: 4,12) und westdeutsche Männer (OR: 1,79) stärker betroffen waren. Die Ergebnisse verdeutlichen die hohe Public-Health-Relevanz von Insomnie-bezogenen Schlafstörungen.

### Schlüsselwörter

Schlafstörungen · Schlafqualität · Insomnie · Prävalenz · Gesundheitssurvey

all, significantly more men than women were affected by problems maintaining sleep with potential clinical relevance (three times per week and more). With age, there was a significant increase in problems maintaining sleep across all the age groups for both men and women, with the rate of problems maintaining sleep almost doubling from an already high basic prevalence of 17.9 % amongst 18–39 year

olds to 34.4 % amongst the over 60 year olds. For men—starting at a comparatively low initial prevalence of 9.5 %—it even tripled to 29.0 %.

### Quality of sleep

A total of 21.2 % of the participants rated their quality of sleep as “quite poor”, 1.9 % as “very poor”. Vice a versa, more than

**Tab. 1** Prevalence of sleep problems, quality of sleep, consumption of sleeping pills and average effective sleep time (previous 4 weeks) (DEGS)

	Total % (95 % CI)	Women % (95 % CI)			Men % (95 % CI)				
		18–39 years	40–59 years	60–79 years	Total	18–39 years	40–59 years	60–79 years	Total
<b>Sleep onset problems (SOP)</b>									
Not at all	47.1 (45.8–48.5)	47.8 (44.2–51.4)	45.8 (43.1–48.6)	32.9 (29.8–36.1)	43.0 (41.3–44.8)	49.4 (45.8–53.1)	53.0 (49.6–56.4)	51.0 (47.5–54.6)	53.3 (49.3–53.2)
Less than 1×/week	25.3 (24.0–26.6)	25.8 (22.8–29.0)	24.7 (22.3–27.3)	22.3 (19.5–25.3)	24.8 (22.8–26.1)	29.8 (26.4–33.4)	25.1 (22.6–27.8)	22.4 (19.6–25.6)	26.1 (24.5–27.7)
1× or 2×/ week	16.5 (15.5–17.5)	16.0 (13.3–19.0)	16.8 (14.8–19.0)	26.0 (23.0–29.3)	19.0 (17.5–20.5)	13.1 (10.9–15.7)	13.0 (11.0–15.4)	16.9 (14.5–19.7)	14.0 (12.7–15.5)
3× or more/ week	11.1 (10.2–12.1)	10.4 (8.4–12.8)	12.7 (10.9–14.7)	18.1 (16.4–21.6)	13.6 (12.3–15.0)	7.6 (5.8–10.1)	8.9 (6.9–11.2)	9.6 (7.7–12.0)	8.6 (7.4–10.0)
<b>Problems maintaining sleep (PMS)</b>									
Not at all	36.0 (34.5–37.5)	42.2 (38.2–46.1)	30.6 (27.9–33.5)	23.2 (20.5–26.1)	32.5 (30.6–34.4)	49.3 (45.6–53.1)	35.8 (32.7–39.1)	31.4 (28.1–34.9)	39.5 (37.2–41.7)
Less than 1×/week	22.3 (21.0–23.6)	24.8 (21.7–28.5)	20.6 (18.5–23.1)	18.9 (16.2–21.8)	21.6 (19.9–23.3)	25.1 (22.0–28.5)	23.8 (21.1–26.8)	18.7 (16.0–21.9)	23.0 (21.3–24.9)
1× or 2×/ week	18.8 (17.7–19.8)	15.2 (12.8–17.9)	20.5 (18.3–23.0)	23.5 (20.6–26.7)	19.5 (18.1–21.0)	16.1 (13.3–19.2)	18.0 (15.5–20.7)	20.8 (18.1–23.8)	18.0 (16.5–19.6)
3× or more/ week	23.0 (21.8–24.2)	17.9 (15.2–20.9)	28.2 (25.5–31.1)	34.4 (31.5–37.5)	26.4 (24.9–28.0)	9.5 (7.4–12.1)	22.4 (19.8–25.2)	29.0 (25.6–32.7)	19.5 (17.8–21.3)
<b>Quality of sleep</b>									
Very good	15.8 (14.7–17.0)	17.6 (15.2–20.4)	15.9 (14.0–18.1)	10.9 (8.9–13.2)	15.1 (13.9–16.5)	17.5 (14.6–20.8)	15.0 (12.6–17.8)	17.6 (15.0–20.4)	16.5 (14.9–18.3)
Quite good	61.1 (59.6–62.6)	58.2 (54.8–61.5)	57.5 (54.5–60.5)	60.5 (57.1–63.9)	58.6 (56.7–60.5)	64.7 (60.8–68.4)	63.5 (60.1–66.8)	62.3 (58.9–65.7)	63.6 (61.6–65.6)
Quite poor	21.2 (20.0–22.5)	22.6 (19.8–25.8)	23.6 (21.1–26.3)	26.7 (23.8–29.9)	24.1 (22.6–25.8)	17.3 (14.6–20.4)	19.4 (16.8–22.3)	17.5 (15.0–20.4)	18.2 (16.6–19.9)
Poor	1.9 (1.5–2.4)	1.5 (0.8–2.8)	2.9 (2.0–4.3)	1.9 (1.1–3.1)	2.2 (1.6–2.9)	0.5 (0.2–1.1)	2.1 (1.3–3.5)	2.6 (1.5–4.4)	1.7 (1.2–2.3)
<b>Consumption of sleeping pills</b>									
Not at all	94.3 (93.6–94.8)	96.2 (94.3–97.6)	94.2 (92.6–95.5)	84.0 (81.4–86.4)	92.1 (91.0–93.1)	98.2 (96.6–98.9)	96.6 (94.9–97.7)	93.7 (91.8–95.2)	96.4 (95.6–97.1)
Less than 1×/week	1.9 (1.6–2.3)	1.9 (1.0–3.5)	2.2 (1.4–3.2)	4.4 (3.3–5.9)	2.7 (2.1–3.4)	1.0 (0.5–2.1)	1.1 (0.7–1.8)	1.2 (0.8–2.0)	1.1 (0.8–1.5)
1× or 2×/ week	1.8 (1.5–2.2)	1.0 (0.5–2.0)	1.8 (1.1–2.9)	4.9 (3.6–6.6)	2.4 (1.8–3.1)	0.5 (0.1–1.6)	1.2 (0.6–2.4)	2.5 (1.6–4.1)	1.3 (0.9–1.9)
3× or more/ week	2.0 (1.7–2.4)	0.9 (0.3–2.5)	1.8 (1.2–2.7)	2.5 (1.6–3.9)	2.8 (2.2–3.6)	0.3 (0.1–0.9)	1.1 (0.5–2.1)	2.5 (1.6–3.9)	1.2 (0.8–1.7)
<b>Effective sleep time</b>									
≤5 h	12.3 (11.3–13.4)	8.2 (6.2–10.8)	14.6 (12.6–16.9)	15.9 (13.5–18.7)	12.8 (11.4–14.4)	8.3 (6.4–10.6)	13.7 (11.5–16.2)	13.7 (11.4–16.5)	11.8 (10.5–13.3)
6–8 h	81.6 (80.3–82.8)	81.9 (78.6–84.8)	80.5 (78.1–82.8)	78.6 (75.6–81.3)	80.5 (78.8–82.0)	85.2 (82.2–87.8)	83.3 (80.3–85.8)	78.4 (75.4–81.2)	82.8 (80.9–84.5)
≥9 h	6.1 (5.4–6.8)	9.9 (7.8–12.3)	4.9 (3.6–6.5)	5.5 (4.2–7.1)	6.7 (5.7–7.9)	6.5 (4.8–8.8)	3.0 (2.0–4.6)	7.8 (5.9–10.3)	5.4 (4.4–6.6)

CI confidence interval.

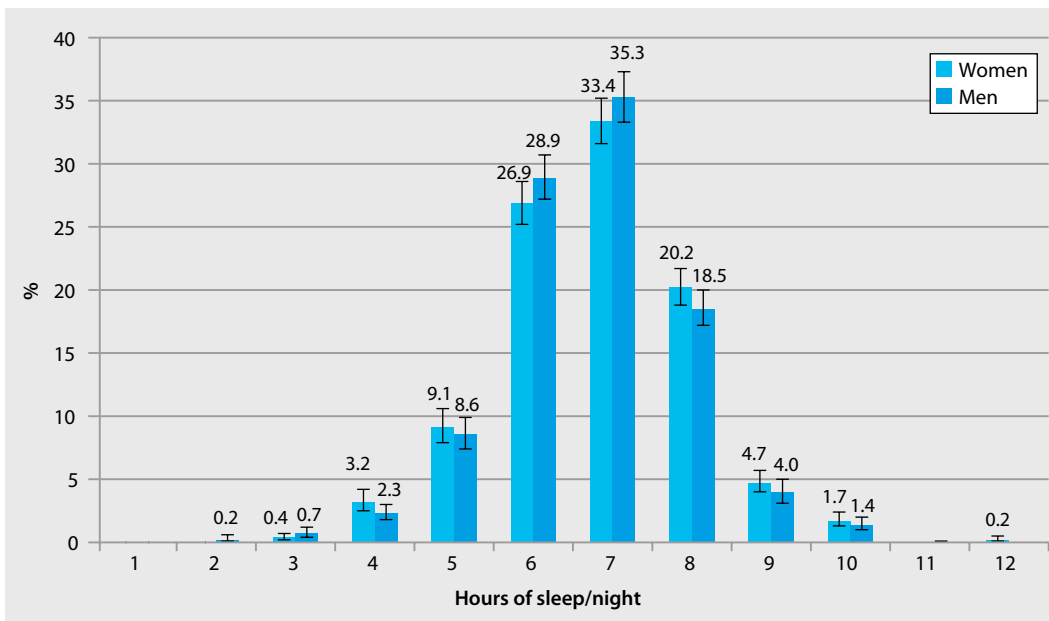
three quarters of the participants reported “quite good” or “very good” quality of sleep (■ Tab. 1). Generally, women rated their quality of sleep worse than men did. Only in the 60–79 year age group, the percentage of men with very poor quality of sleep was higher. The differences between the sexes in this age group, however, were not statistically significant. As regards age trends, there were no significant differ-

ences neither within the male group nor within the female group.

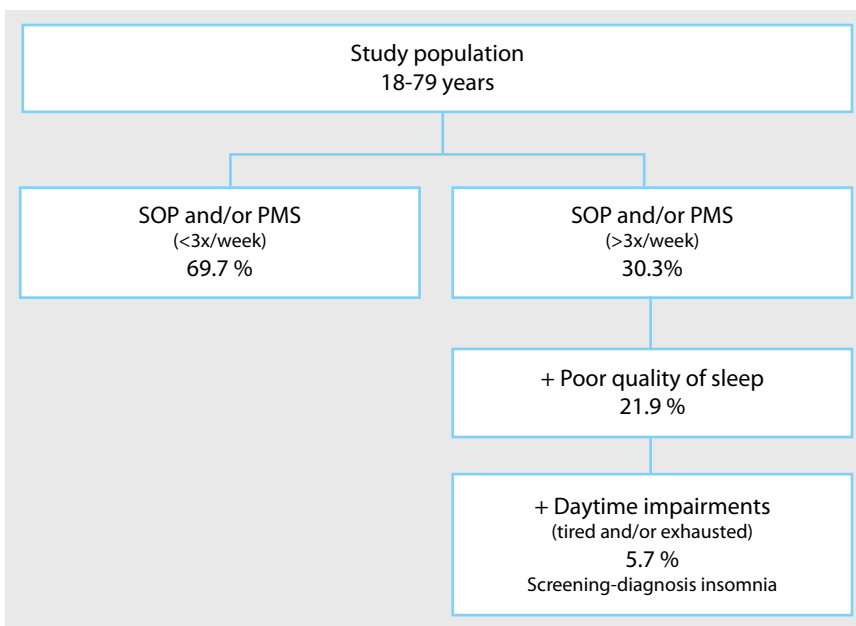
### Effective sleep time

Regarding the previous 4 weeks, approximately four fifths of the participants reported an average effective sleep time (i.e. not accounting for time awake) of between 6 and 8 h per night (■ Fig. 1). As

expected, the rate of those reporting 5 h of sleep or less was significantly higher (12.3 %) than the share of those with 9 h or more effective sleep time (6.1 %; ■ Tab. 1). Sex differences were not significant; however, there were differences with age: In the age group of the 40–59 year olds, the risk of “too little sleep” increased both for women (odds ratio [OR]: 1.80, 95 % CI 1.28–2.53; reference: 6–8 h of



**Fig. 1** ◀ Effective sleep time (in hours per night) in the German adult population (18–79 years)



**Fig. 2** ▲ Symptoms of sleep disturbances and prevalence of insomnia syndrome in the German adult population (18–79 years). *SOP* sleep onset problems, *PMS* problems maintaining sleep

sleep) as well as for men (OR 1.70, 95 % CI 1.22–2.37) compared with the 18–39 year old reference group. Among over 60-year-old women displayed a respective odds ratio of 2.02 (95 % CI 1.47–2.78), whilst in men the corresponding odds ratio was 1.75 (95 % CI 1.37–2.24) or 1.93 (1.52–2.45; odds ratios not shown in table).

With regard to “excessive sleep” (i.e. 9 h and more per day) there was again no difference between the sexes, yet there were differences with ageing (■ **Tab. 1**). Compared with 18–39 year olds, in wom-

en, the risk diminished significantly by the age of 40 years: Odds ratio amongst 40–59 year olds was 0.50 (95 % CI 0.34–0.75; reference: 6–8 h of sleep), whereby the odds ratio in over 60 year-olds was 0.58 (95 % CI 0.41–0.82). There was no clear age trend amongst men. Here the 18–39 year olds differed by a significantly lower risk of “excessive sleep” only with regard to the 40–59 year olds (OR 0.48, 95 % CI 0.29–0.80), whilst the over 60 year olds—compared to the 18–39 year olds—tended to have a greater but non-

significant risk of longer sleep time (OR 1.31, 95 % CI 0.85–2.01; odds ratios not shown in table).

### Consumption of sleeping pills

Overall, 5.7 % (95 % CI 5.2–6.4 %) of the participants reported having taken prescribed or OTC sleeping pills at least once in the previous 4 weeks. A total of 2 % of all participants reported having taken sleeping pills three times or more over the same period, 1.8 % once or twice and 1.9 % less than once a week (■ **Tab. 1**). Overall, 7.9 % (6.9–9.0 %) of women reported taking sleep medication during the previous 4 weeks. This is more than twice as much and significantly more frequent than men at 3.6 % (6.9–9.0 %; OR 2.32, 95 % CI 1.74–3.09; reference: men). There were significant differences between the 18 and 39 and the over 60 age groups. Both women and men over 60 years had a considerably higher risk for consuming sleeping pills (women: OR 4.86, 95 % CI 3.03–7.80; men: 3.62, 95 % CI 1.95–6.71), compared with the respective 18- to 39-year-old reference group (odds ratios not shown in table).

### Insomnia

The approximation of insomnia syndrome according to our screening al-

**Tab. 2** Prevalence of insomnia syndrome in the German adult population (18–79 years)

	Women		Men		Total	
	% (95 % CI)	OR	% (95 % CI)	OR	% (95 % CI)	OR
<b>Age group</b>						
18–39 years	7.2 (5.3–9.6)	0.87 (0.53–1.44)	2.7 (1.7–4.3)	0.71 (0.37–1.37)	4.8 (3.8–6.2)	0.81 (0.56–1.19)
40–59 years	8.1 (6.2–10.4)	0.99 (0.65–1.52)	4.8 (3.3–7.0)	1.32 (0.76–2.31)	6.4 (5.1–8.0)	1.09 (0.77–1.53)
≥60 years	8.1 (5.8–11.2)	Ref.	3.7 (2.4–5.6)	Ref.	5.9 (4.5–7.6)	Ref.
Overall	7.7 (6.5–9.2)		3.8 (2.9–4.8)		5.7 (4.9–6.6)	
<b>Social status</b>						
Low	13.1 (9.4–17.9)	4.12 (2.35–7.50)*	6.1 (3.9–9.4)	2.32 (1.03–5.22) *	9.7 (7.4–12.6)	3.44 (2.06–5.74)*
Middle	7.4 (6.0–9.1)	2.24 (1.32–3.76)*	3.5 (2.6–4.8)	1.31 (0.60–2.87)	5.5 (4.6–6.5)	1.86 (1.18–2.91)*
High	3.5 (2.2–5.4)	Ref.	2.7 (1.4–5.3)	Ref.	3.0 (2.0–4.6)	Ref.
<b>Municipality size</b>						
Rural <sup>a</sup>	9.8 (6.7–14.1)	1.28 (0.74–2.23)	3.0 (1.6–5.5)	0.70 (0.31–1.61)	6.3 (4.2–9.2)	1.06 (0.62–1.79)
Small town <sup>a</sup>	6.3 (4.6–8.5)	0.79 (0.48–1.29)	3.5 (2.1–5.8)	0.84 (0.40–1.75)	4.8 (3.8–6.0)	0.80 (0.53–1.20)
Medium town <sup>a</sup>	7.5 (5.4–10.4)	0.96 (0.57–1.60)	4.0 (2.7–6.0)	0.97 (0.50–1.88)	5.7 (4.3–7.5)	0.95 (0.61–1.49)
Large town <sup>a</sup>	7.8 (5.5–11.0)	Ref.	4.1 (2.5–6.8)	Ref.	6.0 (4.3–8.2)	Ref.
<b>Residential region: east/west</b>						
West	8.1 (6.6–9.8)	1.40 (0.91–2.16)	4.0 (3.1–5.3)	1.79 (1.01–3.18)*	6.0 (5.1–7.1)	1.53 (1.06–2.21)*
East	5.9 (4.1–8.4)	Ref.	2.3 (1.4–3.7)	Ref.	4.0 (2.9–5.4)	Ref.
<b>Residential region: north/south</b>						
North	9.7 (7.0–13.3)	1.41 (0.84–2.37)	3.0 (1.6–5.4)	0.70 (0.34–1.45)	6.3 (4.6–8.6)	1.14 (0.74–1.76)
Central	7.1 (5.6–8.9)	1.00 (0.63–1.57)	3.9 (2.6–5.8)	0.93 (0.53–1.64)	5.4 (4.2–6.9)	0.97 (0.67–1.42)
South	7.1 (4.9–10.0)	Ref.	4.1 (2.9–5.9)	Ref.	5.5 (4.3–7.2)	Ref.

OR odds ratio, CI confidence interval, Ref. reference. \*Significant result. <sup>a</sup>Rural (<5,000 inhabitants), small town (5,000 to <20,000 inhabitants), medium town<sup>a</sup> (20,000 to <100,000 inhabitants), large town<sup>a</sup> (≥100,000 inhabitants).

gorithm is depicted in **Fig. 2**. Overall, 30.3 % (95 % CI 29.0–31.7 %) of the participants reported problems with sleep onset or maintaining sleep at least 3 times per week. A total of 21.9 % (20.5–23.4 %) suffered additionally from poor quality of sleep. The additional consideration of adverse daytime effects, such as being frequently or always tired and/or exhausted, resulted in an overall prevalence for insomnia syndrome of 5.7 % (4.9–6.6 %). The frequency of insomnia according to sex, age, socioeconomic status and residential region—east/west (incl. Berlin) and north/south—are shown in **Tab. 2**. Women were significantly more frequently affected by insomnia than men (OR 2.15; 95 % CI 1.59–2.91; data not shown in table). Significant differences appeared also with regard to social status: Participants with low SES displayed a 3.5-times greater risk of insomnia compared to persons with high SES. Social differentiation impacts greater on women than men. Women with a low SES were four times as likely to have insomnia, whilst in contrast men of low SES

showed a doubling of the risk—as compared with members of high SES, respectively. There were no significant differences according to the size of municipality. Interestingly, however, there were differences between participants living in eastern and western Germany: Participants residing in western Germany (including Berlin) had a significantly elevated risk of insomnia. As can be seen from **Tab. 2**, it appears that this effect is attributable to males. In contrast, no differences were seen between the northern, central and southern regions of Germany (**Tab. 2**).

## Discussion

The aim of this study was to report on prevalence rates and distributions of problems of sleep onset and maintaining sleep, effective sleep time and quality of sleep, consumption of sleeping pills and the prevalence of insomnia in the German adult population aged between 18 and 79 years. In the following, the results are discussed along the examined sociodemo-

graphic parameters of age, sex, SES and residential region.

## Characteristics of disturbed sleep

### Disturbances in sleep onset and maintaining sleep

Disturbances in sleep onset and maintaining sleep are common among the German adult population. According to our study, approximately one-third of the German adult population is affected by potentially clinically relevant problems with sleep onset and/or maintaining sleep. In this study, problems maintaining sleep occurring 3 times a week or more were more frequent at 23 % than problems with sleep onset at 11 %. In a representative study of German-speaking people aged 14 years and older in the area of the former Federal Republic of Germany (West Germany) conducted in 1991, 25 % of those surveyed reported at least occasionally having difficulty with sleep onset or maintaining sleep not caused by outside influences, while 7 % suffered frequently or constantly from these problems [25].

Similar symptom rates to those found in our study were also found in other countries [5, 26, 27]. Compared to the results of international studies, in particular, the prevalence of sleep onset disturbances amongst German adults is to be regarded as relatively high. Ohayon and Sagales [27] reported a 3.7 % prevalence for problems with sleep onset amongst the Spanish adult population attributing this comparatively low rate to better sleep hygiene and more regular bedtimes among Spaniards. In a Japanese representative sample, an overall frequency of 7.2 % of problems with sleep onset was established [5]. In contrast, by establishing a rate of 12.3 % for the Taiwanese adult population, Kao et al. [26] reported a similarly high prevalence as can be established for Germany by our study.

Also, potentially clinically relevant problems maintaining sleep appear to be more frequent in the German adult population than in other countries. Thus, an overall rate of 17.6 % for problems maintaining sleep [27] was reported for Spain, a frequency of 15.2 % for Japan [5] and a prevalence of 9.4 % for the Taiwanese population [26]. A variety of sociocultural factors—such as sleep hygiene, alcohol consumption, bedtimes, nicotine and coffee consumption—and other sociocultural aspects may well play a role in causing more frequent problems maintaining sleep in German adults.

In line with the result of international studies, problems with sleep onset and maintaining sleep occur considerably more frequently amongst German females than males. In our study, females were affected by a doubling of rates of both problems with sleep onset and maintaining sleep with age, while in males an age-related trend was only evident for problems maintaining sleep. The detected three-fold increase in problems maintaining sleep in males, however, was quite remarkable. However, at somewhat lower levels, comparable trends were also found in other international studies [5, 26, 27].

### Effective sleep time

With regard to the average effective sleep time per night, there was also a comparatively higher percentage in the German

adult population at 12.3 % of both short sleepers (5 h and less) and long sleepers (9 h and more). The percentage of short sleepers in the Japanese population for instance was only 4 % (3.2 % long sleepers) [5], and in the Taiwanese population only 3.2 % (no figures reported for long sleep time) [26].

### Quality of sleep and consumption of sleeping pills

One in four participants reported impairments in the quality of sleep. The prevalence of poor quality of sleep in the German adult population is, therefore, almost as high as among adults in other countries [5, 26]. The overall frequency of consumption of sleeping pills in the German adult population was 5.7 % and thus comparable to that of the Spanish population at 5.5 % [27], despite a significantly higher prevalence of problems with sleep onset and maintaining sleep in Germans. A significantly higher consumption of sleeping pills was reported for France at 11.7 % [28] and, in contrast, a lower prevalence of 3.5 % was found in the UK, whilst—contrary to the findings of this study—in both countries significantly higher usage rates were reported for women. Similar to the findings of this study, however, older people ( $\geq 60$  years) both in France and in the UK reported significantly more frequently the use of prescription or OTC sleeping pills.

### Insomnia

By reporting problems with sleep onset and maintaining sleep and additionally impaired quality of sleep as well as daytime consequences of sleeping problems, a total of 5.7 % of the participants of this study met our criteria for a screening diagnosis of insomnia syndrome. This figure is in the range between the frequency of 4 % of insomnia in Germany requiring treatment, which was established over 10 years ago by Hajak [30] and a prevalence of 7 % for Germany reported by Ohayon and Zulley [6] in 2001 for a screening diagnosis of insomnia derived from a combination of poor quality of sleep and symptoms of insomnia. This suggests that the algorithm chosen in this study represents a valid approxi-

mation of the actual insomnia prevalence in the German adult population.

Similar insomnia rates were found in other countries; however, some rates were even higher: in Spain, for example, the prevalence rate for an insomnia diagnosis according to DSM-IV was 6.4 % [27]—in spite of a lower rate of problems with sleep onset and maintaining sleep compared to Germany. In Italy the prevalence of insomnia was 7 % [31]. A representative study for the French-speaking part of Canada arrives at an insomnia prevalence of 9.5 % [4], using a similar screening algorithm to that employed in this study. The significantly higher prevalence of insomnia observed in the UK (22 %) is attributed by Hajak [30]—amongst others—to comparatively better and frequent treatment of insomnia patients in Germany.

Women in Germany are affected twice as often by insomnia than men. This reflects the results of several international studies that consistently show that women are affected 1.5–2 times more frequently by insomnia (than men) [4, 6, 27, 31]. Unlike in previous studies, we found no significant age trend for insomnia in ours. One reason for this could be different age spectra and a differing choice of age groups in other studies compared to ours. For example, insomnia studies conducted in Europe by Ohayon et al. [6, 27, 31] included participants from the age of 15 on—unlike in our study. Consequently, the Ohayon studies show age groups of 15–25 years, for which the lowest insomnia prevalence rates are reported.

The risk of exhibiting an insomnia syndrome for men and women differs greatly by socioeconomic status. Among women, middle SES already accounts for a doubling of risk compared to high SES, whereas in women of low SES the risk is actually four times greater. Using a representative, population-based sample of various regions in the USA, Patel et al. [32] were able to show that income and educational effects as well as employment and family status remained independent predictors for the occurrence of insomnia—even after gradual adjustment for self-assessed state of health, the presence of a mental disorder, overweight and obesity, stress, alcohol abuse and smoking.

The distribution of insomnia across the geographical regions of Germany was hitherto unknown. Whilst there were no differences between the north and south regions or between rural and urban areas, people residing in western Germany surprisingly reported insomnia complaints more often than people living in eastern Germany. At this point we can only speculate as to the reasons for this. In general, the state of health of East and West Germans has become much the same over the years [33]. In 2001, the Allensbach Institute for Public Opinion Research ascertained—as part of a repeat survey 10 years after the German re-unification—that psychosomatic complaints, including non-specific sleep disturbances, were mentioned less often in eastern Germany in 2001 than in 1991, whilst in western Germany an opposite trend was observed [34]. A perpetuation of this trend is just as feasible a cause for this as changes in the basic conditions for health, for example with regard to population shifts such as birth rates, mortality rates or migratory processes [33].

### Limitations and strengths

Since the use of a detailed sleep-diagnostic interview such as the Sleep-EVAL System [35] was not feasible for reasons of survey economy, one limitation of this study is that information on the sleep behaviour of the participants is only available on the basis of self-administered questionnaires. A diagnosis of insomnia referring to ICD-10 or DSM-IV criteria had, therefore, to be approximated. Also, our screening diagnosis has not been externally validated. However, comparisons with the results of previous studies suggest that the algorithm chosen in this study allows for a valid approximation of the actual insomnia prevalence within the population. Furthermore, we cannot distinguish between primary insomnia and insomnia due to other reasons (e.g. physical conditions or mental disorders). However, previous results relatively consistently indicate that primary insomnia constitutes approximately one-third of all insomnia diagnoses [27, 31]. Strengths of this study consist in the considerable generalisability of the results

and the ability to perform stratified analyses due to the large and representative sample. Future analyses with this sample will examine associations of sleep disturbances and further indicators of physical and mental health.

### Conclusion

**The prevalence of insomnia syndrome in the German adult population at just fewer than 6 % is to be viewed as high and of considerable relevance with regard to health policy—not least due to the high direct and indirect economic costs of sleep disturbances. Insomnia conditions can generally be treated relatively inexpensively [12]. To this end, psychoeducation such as the teaching of “sleep hygiene” rules, the cognitive restructuring of dysfunctional sleep-related thoughts (e.g. “everybody needs 8 h of sleep per night”), exposure therapy with triggering sleep preventing situations, as well as the learning of relaxation techniques but also medication therapy by a physician have, amongst others, proven to be effective [36].**

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