Abnormal Sleep Duration Is Associated with a Higher Risk of Accidental Injury

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Abstract

Objective. Develop normative data for adult sleep duration and determine if nonstandard sleep time relates to the likelihood of accidental injury.

Study Design. Cross-sectional analysis.


Methods. The National Health Interview Survey, 2004-2013, was examined for adult sleep time and accidental injury within the past 3 months. The mean hours slept per night was determined. The relationship between sleep time and incidence of accidental injury was determined for any injury, injury while driving, and injury while working, adjusting for demographic variables.

Results. Among 221.4 million adults (raw sample, N = 282,692), the mean sleep time was 7.17 hours (95% confidence interval [95% CI], 7.16-7.18 hours). Men and women slept very similar times (7.14 vs 7.17 hours, respectively), and sleep time decreased until the fifth decade (minimum, 6.99 hours), increasing each decade thereafter; 2.81% of adults reported being accidentally injured in the preceding 3 months. Too little sleep and excessive sleep times were both associated with higher rates of accidental injury (odds ratio per hour of deviation from mean, 1.16 [95% CI, 1.12-1.19]), adjusting for age, sex, marital status, and education level. Similar increased odds ratios were noted for injury while driving (1.11 [95% CI, 1.01-1.22]) and injury while at work (1.12 [95% CI, 1.04-1.20]) with sleep time deviation.

Conclusion. Most adults sleep between 7 and 8 hours nightly. Adults with sleep time outside this range, with either less or more sleep, have increased rates of accidental injury. These data highlight the need for sufficient quantity and quality of sleep in preventing accidental injury.

Keywords

sleep time, sleep duration, injury, accident, sleep apnea, snoring, sleep apnea, epidemiology

A reasonable amount of quality, restorative sleep is required for the maintenance of the healthy human state, both physically and mentally. Well-known associations have been identified between sleep-related disorders (obstructive sleep apnea [OSA], snoring, etc) and many medical conditions (eg, diabetes, obesity, hypertension).1,2 In addition, OSA has been associated with higher rates of bodily injury and road injury as compared with rates from individuals without OSA.3-5

Although significant research has been focused on quality of sleep, less information is available about the relationship between quantity of sleep and associated health conditions. For example, it is possible that individuals may get good-quality sleep and not suffer from OSA but simply sleep an insufficient number of hours to achieve the restorative benefits of sleep itself. This study sought to determine if there was a relationship between sleep time and likelihood of accidental injury in multiple settings; it also sought to determine contemporary data for normative sleep times on a national basis. As otolaryngologists are frequently involved in the care of sleep disorders, they should also be informed about the risks of not only poor-quality sleep (ie, OSA) but also the risks of insufficient quantity of sleep as they counsel patients regarding sleep disorders.

Methods

The data source for this study consisted of the National Health Interview Survey as aggregated in the Integrated Health Interview Survey for the calendar years 2004 to 2013. This study protocol was reviewed by the committee on clinical investigations from the investigator’s hospital and deemed as exempt from review, as it utilizes a publicly available, de-identified data set. Our group has used these data extensively to characterize the epidemiology of several otolaryngologic conditions.6-9 Survey data were extracted and imported into SPSS 22.0 (IBM Inc, Chicago, Illinois) and subjected to internal consistency checks. The data set...
was restricted to adults (≥18 years) and to those reporting typical sleep times between 3 and 13 hours per night, to eliminate spurious entries for sleep time. Data were extracted regarding marital status, education level (categorized elementary, high school, or college and beyond) and age (categorized further by decade and tertile).

Injury data were also tabulated and imported into SPSS 22.0. The occurrence of injury was a predefined question in the data set regarding whether an injury occurred within the 3 months prior to survey sampling. This was further classified as injury during driving and injury doing paid work. Descriptive data for reported sleep times were computed, as well as sleep times according to age decade and sex. Graphic univariate relationships between sleep time and the injury variable were qualitatively analyzed, revealing that the degree of deviation from the mean reported sleep time was increasingly related to the likelihood of injury. Therefore, the absolute value of the deviation in sleep time from the population mean sleep time was computed for each individual. Next, the association between injury and the absolute deviation of sleep time from the mean sleep time was determined with multivariate logistic regression analysis adjusting for age, sex, education level, and marital status.

Data are reported as mean ± standard error of the mean or with the 95% confidence interval (CI) for the population sample, where appropriate. Statistical methods to allow for the multistage, stratified, and weighted sample design of the National Health Interview Survey were utilized to produce nationally representative estimates from the raw sample. Statistical significance was set at \( P = .05 \). Where appropriate, 95% CIs for the odds ratios were computed.

**Results**

A total of 282,692 adults were surveyed, representing 221.4 million adults in the United States, annually (51.7% women; mean age, 46.0 years). The histogram of sleep time distribution is depicted in **Figure 1**. The mean reported sleep time was 7.16 hours (95% CI, 7.15-7.16 hours). **Table 1** depicts the univariate relationships between demographic factors and sleep time. Overall, 2.81% of adults reported being accidentally injured in the prior 3 months. The most commonly reported injuries were injury during driving (0.2%) and injury during paid work (0.5%).

**Table 2** presents the univariate relationships between demographic variables and likelihood of injury. **Figure 2** depicts the relationship between degree of deviation from sleep time from the mean and the likelihood of injury. Both long and short sleep times were associated with higher rates of accidental injury \( (P < .001) \). On multivariate analysis adjusting for age, sex, education level, and marital status, each 1-hour increase or decrease in sleep time from the mean was associated with an odds ratio of 1.16 (95% CI, 1.12-1.19) increase in the risk of any injury \( (P < .001) \). Similarly, long sleep and short sleep were associated with increased odds of injury during driving \( (1.11 \ [95\% \ CI, \ 1.01-1.22], \ P = .026) \) and increased odds of injury during paid work \( (1.12 \ [95\% \ CI, \ 1.04-1.20], \ P = .002) \).

**Discussion**

Healthy sleep, of both sufficient quality and quantity, are essential for the short- and long-term health of the individual. The current data demonstrate that long sleep and short sleep are both associated with higher rates of accidental injury in adults in the United States. In fact, the greater the degree of deviation of sleep from the mean sleep time of the population, the greater the likelihood of accidental injury: those sleeping 4 hours or 12 hours had an almost doubling of the rate of accidental injury. Although the odds ratios per hour of sleep deviation were relatively small, note that the current data quantify injury in only the prior 3 months, which is a relatively narrow interval. The advantage of using a small period for injury quantification is that it enhances recall rates for recent injury, but it fails to capture an annual rate of accidental injury, which would likely be higher.

We recently quantified sleep patterns for US adults using an alternative survey, the Behavioral Risk Factor Surveillance System. In that study, the mean sleep time was 7.06 hours,
closely in keeping with the current data. Extensive evidence exists in the literature that a sleep duration between 7 and 8 hours is associated with better health.4 Both too much (excessive) sleep time and too little (insufficient) sleep time are associated with poorer health outcomes, in terms of morbidity and mortality.1 For example, abnormal sleep durations are associated with hypertension, metabolic syndrome, and diabetes mellitus.11 Abnormal sleep times are also associated with neurobehavioral problems, such as decreased working memory, poor cognition, and mood disorders.12 Interestingly, average sleep times have decreased overall in the United States by 1.5 to 2 hours over the past 50 years.1

A relatively large body of evidence exists correlating sleep disorders that contribute to poor-quality sleep (eg, OSA, periodic limb movement disorder) with not only physical and mental diseases but also accidental injury. Many organic sleep disorders are associated with higher rates of automobile accidents and work-related injury. For example, patients with untreated OSA syndrome have an odds ratio of 5 to 6.5 for experiencing a traffic crash as compared with nonapnea controls.5 While these studies identify poor sleep quality as a risk factor for injury, they do not capture the risks associated with abnormal sleep quantity for accidental injury. A study by Lombardi and associates did identify a significant elevated risk for work-related injury with abnormal sleep times, as well as higher odds ratios for injuries at extremes of sleep duration.13

The current data bring to light an important relationship between sleep quantity and the likelihood of accidental injury. Although it might be intuitive that abnormally short sleep time would lead to subsequent day fatigue and an injury-prone situation, it is not as intuitive that abnormally long sleep time would have a similar association with accidental injury. Whereas short sleep times may be related to external factors limiting access to sleep, excessively long sleep times may reflect an underlying poor quality of sleep leading to health disturbance. For example, patients who snore in the absence of OSA may be forced to leave the bedroom by their partners, resulting in decreased sleep time; alternatively, snoring may produce frequent arousals that then necessitate excessive overall sleep time to make up for fragmented sleep. Otolaryngologists need to be aware of the implications of short and long sleep times as they address patients with concerns about snoring, sleep quality, and OSA.

**Conclusions**

Both long and short sleep times are associated with higher rates of accidental injury with almost linearly increasing rates of injury as sleep times deviate further from a 7-hour mean. Otolaryngologists should be aware of the implications of sleep time and risk of injury as they counsel patients with sleep-related disorders. Further research is necessary to determine the underlying reasons for these associations.

**Author Contributions**

Neil Bhattacharyya, concept, data analysis and extraction, manuscript composition and approval of final version.

**Disclosures**

**Competing interests:** Neil Bhattacharyya, consultant, IntersectENT; consultant, Entellus; consultant, Sanofi Inc. Material contained in this manuscript does not conflict with the above relationships. 

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**References**


**Table 2. Likelihood of Injury According to Demographics.**

<table>
<thead>
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<th>Variable</th>
<th>%</th>
<th>SEa</th>
<th>P Value</th>
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<tr>
<td>Lowest tertile</td>
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<td>Middle tertile</td>
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<tr>
<td>Highest tertile</td>
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</tr>
<tr>
<td>Sex</td>
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<td></td>
</tr>
<tr>
<td>Male</td>
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<td>0.05</td>
<td>.240</td>
</tr>
<tr>
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aStandard error of the population estimate.

![Image](https://via.placeholder.com/150)

**Figure 2.** Variation in rate of accidental injury according to total sleep time.


