

Trends in Outpatient Visits for Insomnia, Sleep Apnea, and Prescriptions for Sleep Medications among US Adults: Findings from the National Ambulatory Medical Care Survey 1999-2010

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Study Objective: To examine recent national trends in outpatient visits for sleep related difficulties in the United States and prescriptions for sleep medications.

Design: Trend analysis.

Setting: Data from the National Ambulatory Medical Care Survey from 1999 to 2010.

Participants: Patients age 20 y or older.

Measurements and Results: The number of office visits with insomnia as the stated reason for visit increased from 4.9 million visits in 1999 to 5.5 million visits in 2010 (13% increase), whereas the number with any sleep disturbance ranged from 6,394,000 visits in 1999 to 8,237,000 visits in 2010 (29% increase). The number of office visits for which a diagnosis of sleep apnea was recorded increased from 1.1 million visits in 1999 to 5.8 million visits in 2010 (442% increase), whereas the number of office visits for which any sleep related diagnosis was recorded ranged from 3.3 million visits in 1999 to 12.1 million visits in 2010 (266% increase). The number of prescriptions for any sleep medication ranged from 5.3 in 1999 to 20.8 million in 2010 (293% increase). Strong increases in the percentage of office visits resulting in a prescription for nonbenzodiazepine sleep medications (~350%), benzodiazepine receptor agonists (~430%), and any sleep medication (~200%) were noted.

Conclusions: Striking increases in the number and percentage of office visits for sleep related problems and in the number and percentage of office visits accompanied by a prescription for a sleep medication occurred from 1999-2010.

Keywords: hypnotics, trends, outpatient care, National Ambulatory Medical Care Survey, insomnia

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INTRODUCTION

Appreciation of the importance of adequate sleep in maintaining health has greatly escalated in recent decades. Both the quality and quantity (short as well as long duration) of sleep have been related to a variety of health outcomes including mortality from all causes as well as numerous specific causes of morbidity and mortality.¹⁻⁷

Although universal agreement concerning what constitutes adequate sleep duration is lacking, the National Institutes of Health suggests that adults aim for 7-8 h of sleep per night.⁸ Approximately 28% of adults in the United States reported sleeping 6 h or less based on data from 2008 to 2010,⁹ and, approximately 28% of US adults who participated in the Behavioral Risk Factor Surveillance System (BRFSS) in 2006 reported insufficient rest or sleep for 14 or more days during a 30-day period.¹⁰ Furthermore, sleep duration may have declined in the United States,¹¹⁻¹⁵ although this supposition has been questioned.¹⁶

In addition to short sleep duration, sleep disturbances are frequently reported. These can include insomnia, sleep apnea, restless legs syndrome, and a host of other conditions.

In addition, the presence of various diseases such as chronic pain conditions, cancer, and cardiovascular disease and psychiatric disorders may affect the quality and quantity of sleep.¹⁷ A number of strategies are recommended to promote sleep quality and quantity, including a series of behavioral recommendations such as keeping to a routine sleeping schedule, the timing of eating and physical activity in relation to bedtime, avoidance of stimulants, and maintaining a bedroom environment conducive to sleep.¹⁸ In addition, pharmacologic options are available to treat insomnia.

Given the burgeoning interest in sleep health, the role of the medical sector in diagnosing and treating sleep related complaints and symptoms deserves study. There is limited information about the trends in outpatient visits for patients seeking help for sleep related problems and for trends in physician diagnoses of sleep related disorders. Previous analyses of data from the National Ambulatory Medical Care Survey have examined various aspects of prescription practices, including trends in sleep related reasons for visit, sleep related diagnoses, and patient and physician factors related to prescribing practices of hypnotic medications in children and adults using different sets of years of data between 1990 and 2007.¹⁹⁻²³ The increasing trend in treatment with hypnotic medications, possibly indicating overuse of medications with serious side effects, was a concern expressed in one of those studies.²³ To examine whether previously described trends in patient visits for sleep related reasons and diagnoses and in hypnotic medication use continued in recent years and to examine trends stratified by sex, race, and age groups, we examined national data.

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METHODS

We used data from the National Ambulatory Medical Care Surveys (NAMCS) from 1999 to 2010. NAMCS collects information about outpatient physician visits. Annual samples of nonfederally employed physicians engaged in office-based patient care as classified by the American Medical Association or the American Osteopathic Association were selected using a multistage probability design. The various stages of selection included primary sampling units (PSUs) (counties, county equivalents such as parishes and independent cities, towns, townships, minor civil divisions), physician practices within PSUs, and patient visits within practices, with the latter constituting the basic unit of analyses. Based on the probabilities of selection at the various stages of selection, sampling weights were calculated that, when used, allowed the national estimates to be derived. The numbers of participating physicians ranged from 1,087 in 1999 to 1,568 in 2007. Physicians and their staff were provided with forms to collect the requested data. Detailed information about the survey can be found elsewhere.²⁴

Physicians or their staff could provide up to three patient's reasons for the office visit. To identify patient visits prompted by a sleep related reason, we used the codes 1135.0 (disturbances of sleep), 1135.1 (insomnia), 1135.2 (sleepiness), 1135.3 (nightmares), 1135.4 (sleepwalking), and 1135.5 (apnea). Furthermore, physicians could enter up to three diagnostic fields using International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) codes for each visit. ICD-9-CM codes used to identify records with a physician's diagnosis of a sleep related problem are shown in Table 1. Because relatively few records included an ICD-9-CM code related to a sleep difficulty, we only report two categories of sleep difficulties: sleep apnea (ICD-9-CM codes 327.20, 327.21, 327.22, 327.23, 327.24, 327.25, 327.26, 327.27, 327.29, 780.51, 780.53, 780.57) and any sleep difficulty (all ICD-9-CM codes listed in Table 1 including sleep apnea). We also examined trends in the numbers of office visits that listed ICD-9-CM codes 89.17 (polysomnography) or 89.18 (multiple sleep latency testing). To generate these estimates, we used two data fields for diagnostic/screening services and two fields for therapeutic/preventive services for the years 1999-2000, two data fields for diagnostic services and two fields for ambulatory procedures for the years 2001-2004, two data fields for diagnostic services and four fields for other procedures (only the first two fields contained codes of interest) for the years 2005-2008, and nine data fields (only the first four fields contained codes of interest) for procedures for the years 2009-2010.

The surveys contained six data fields for recording medications from 1999 to 2002 and eight such fields from 2003 to 2010. To maintain consistency, we used only the first six such fields throughout. From 1999-2005, drug codes used the Food and Drug Administration's (FDA) National Drug Code Directory. From 2006-2010, Lexicon Plus®, a proprietary database of Cerner Multum, Inc. (Denver, CO) was used to code and classify medications.²⁵ We identified medications indicated in the treatment of insomnia by their generic name (Table 2). Numerous medications can potentially be used to induce sleep, but we limited ourselves to 10 medications that are approved by the FDA for use in insomnia.²⁶ Distinguishing between new prescriptions and refills is not feasible.

We present our results by age (20-39 y, 40-64 y, and 65+ y), sex, and race (white, black, and other). Because a high percentage of NAMCS records have missing race designations (16.9% to 32.8%), we used a variable that included imputed data for race.

We limited our analyses to patients who were age 20 y or older. Because the physician visit constitutes the unit of analysis, our estimates represent the percentage of outpatient visits by patients with a sleep related problem, a sleep related diagnosis, or a prescription for a hypnotic medication. We present numbers of visits and percentages of visits for all participants by individual year. For analyses stratified by sex, race, and age group, we aggregated data into 4-y intervals to improve the stability of the results. The age groups were determined *a priori* whereas the 4-y interval was selected after examining the number of office visits in subgroups. Tests for linear trends in the percentages of patients being prescribed medications were conducted by using orthogonal polynomial contrasts, which involve using sets of coefficients to conduct linear and nonlinear contrasts. T-tests were used to perform two sample tests of significance and chi-square tests were used to test for differences in percentages among age and race groups. Sampling weights were used to generate national estimates and percentages. The statistical programs SUDAAN (RTI International, Research Triangle Park, NC) and SAS (SAS Institute Inc., Cary NC) were used to conduct the analyses.^{27,28}

RESULTS

Sample sizes for adults age 20 y or older ranged from 17,223 in 1999 to 26,647 in 2007. During the study period, mean age ranged from 53.2 y in 2000 to 55.4 y in 2009 (P linear trend < 0.001), the percent of visits made by men remained stable, and the percent of visits made by white adults decreased significantly (P linear trend < 0.001) (Table 3).

The weighted number of office visits with insomnia as a stated reason increased from 4.9 million visits in 1999 to 5.2 million visits in 2009, whereas the number of office visits with any sleep disturbance as the stated reason for visit increased from 6,394,000 visits in 1999 to 10,224,000 visits in 2009 (Figure 1). In 2010, these numbers were 5.5 million and 8,237,000, respectively. In comparison, the number of office visits for any reason increased from 609 million visits in 1999 to almost 800 million in 2010 (Table 3). Insomnia was the stated reason for visit for 0.6% to 0.8% of all office visits by patients (P linear trend = 0.475), whereas any sleep disturbance as the reason for the office visit was for 1.0% to 1.2% of all visits with no significant trend (Table 4).

Insomnia was present in a significantly greater percentage of visits among women than men during 1999-2002. Significant variation in the percentage of visits for insomnia among age groups was observed in two of the three periods. A significant increase in the percentage of visits with any sleep disturbance as a reason of visit was observed for men (Table 5). Furthermore, a significantly greater percentage of office visits for a sleeping disturbance occurred among men than women in two of the three periods. No significant race differences were observed, but significant variation by age was present, with participants age 40-64 y having the greatest percentage of visits for any sleep disturbance.

Table 1—International Classification of Diseases, Ninth Revision, Clinical Modification codes for sleep related diagnoses

Description	Code	Description	Code
Alcohol-induced sleep disorders	291.82	Circadian rhythm sleep disorder	327.3
Drug-induced sleep disorders	292.85	...unspecified	327.30
Specific disorders of sleep of nonorganic origin	307.4	...delayed sleep phase type	327.31
Nonorganic sleep disorder, unspecified	307.40	...advanced sleep phase type	327.32
Transient disorder of initiating or maintaining sleep	307.41	...irregular sleep-wake type	327.33
Persistent disorder of initiating or maintaining sleep	307.42	...free-running type	327.34
Transient disorder of initiating or maintaining wakefulness	307.43	...jet lag type	327.35
Persistent disorder of initiating or maintaining wakefulness	307.44	...shift work type	327.36
Circadian rhythm sleep disorder of nonorganic origin	307.45	...in conditions classified elsewhere	327.37
Sleep arousal disorder	307.46	Other circadian rhythm sleep disorder	327.39
Other dysfunctions of sleep stages or arousal from sleep	307.47	Organic parasomnia	327.4
Repetitive intrusions of sleep	307.48	...unspecified	327.40
Other specific disorders of sleep of nonorganic origin	307.49	Confusional arousals	327.41
Organic sleep disorders	327	Rapid eye movement sleep behavior disorder	327.42
Organic disorders of initiating and maintaining sleep [organic insomnia]	327.0	Recurrent isolated sleep paralysis	327.43
Organic insomnia, unspecified	327.00	Parasomnia in conditions classified elsewhere	327.44
Insomnia due to medical condition classified elsewhere	327.01	Other organic parasomnia	327.49
Insomnia due to mental disorder	327.02	Organic sleep related movement disorders	327.5
Other organic insomnia	327.09	Periodic limb movement disorder	327.51
Organic disorder of excessive somnolence [organic hypersomnia]	327.1	Sleep related leg cramps	327.52
Organic hypersomnia, unspecified	327.10	Sleep related bruxism	327.53
Idiopathic hypersomnia with long sleep time	327.11	Other organic sleep related movement disorders	327.59
Idiopathic hypersomnia without long sleep time	327.12	Other organic sleep disorders	327.8
Recurrent hypersomnia	327.13	Sleep disturbances	780.5
Hypersomnia due to medical condition classified elsewhere	327.14	Sleep disturbance, unspecified	780.50
Hypersomnia due to mental disorder	327.15	Insomnia with sleep apnea, unspecified	780.51
Other organic hypersomnia	327.19	Insomnia, unspecified	780.52
Organic sleep apnea	327.2	Hypersomnia with sleep apnea, unspecified	780.53
...unspecified	327.20	Hypersomnia, unspecified	780.54
Primary central sleep apnea	327.21	Disruption of 24-h sleep-wake cycle, unspecified	780.55
High altitude periodic breathing	327.22	Dysfunctions associated with sleep stages or arousal from sleep	780.56
Obstructive sleep apnea (adult)(pediatric)	327.23	Unspecified sleep apnea	780.57
Idiopathic sleep related non-obstructive alveolar hypoventilation	327.24	Sleep related movement disorder, unspecified	780.58
Congenital central alveolar hypoventilation syndrome	327.25	Other sleep disturbances	780.59
Sleep related hypoventilation/hypoxemia in conditions classifiable elsewhere	327.26		
Central sleep apnea in conditions classified elsewhere	327.27		
Other organic sleep apnea	327.29		

The number of office visits for which a diagnosis of sleep apnea was recorded ranged from 1.1 million visits in 1999 to 8.4 million visits in 2009, whereas the number of office visits for which any sleep related diagnosis was recorded ranged from 3.3 million visits in 1999 to 15.2 million visits in 2009 (Figure 2). Physicians' diagnoses of sleep apnea increased from 0.2% of office visits to 0.7-1.0% of office visits (P linear trend < 0.001), and those of any sleep disorder increased from 0.5% to 1.5-1.8% (P linear trend < 0.001) (Table 4). Significantly increasing trends for sleep apnea were present for all subgroups except adults age 20–39 y. Significant variation in percentages was found by sex, race, and age group in most periods (Table 6). The percentage of office visits with a diagnosis of any sleep disorder increased

significantly in all subgroups. Significant variation in the estimates by sex, race (2007-2010), and age groups was present. During the study period, the number of office visits that listed polysomnography or multiple sleep latency testing increased (Figure 3).

The number of prescriptions for benzodiazepines ranged from 2.2 million in 1999 to 3.9 million in 2009; the number of prescriptions for nonbenzodiazepines ranged from 3.1 in 1999 to 19.7 million in 2009; the number of prescriptions for benzodiazepine receptor agonists ranged from 2.4 in 1999 to 18.5 million in 2009; and the number of prescriptions for any sleep medication ranged from 5.3 in 1999 to 23.3 million in 2009 (Figure 4). The percentage of office visits during which

a prescription for a benzodiazepine was issued did not change significantly during the study period (Table 4). However, strong increases from 1999 to 2010 in the percentage of prescriptions for nonbenzodiazepine sleep medications (~350%), benzodiazepine receptor agonists (~430%), and any sleep medication (~200%) were noted. Significant increases in the percentage

of office visits accompanied by a prescription for a nonbenzodiazepine, benzodiazepine receptor agonists, or any sleep medication occurred among most subgroups (Table 7). The percentage of office visits by patients age 65+ y during which a benzodiazepine receptor agonist was prescribed increased almost 1200% from 1999 (0.2%) to 2010 (2.5%) (data not shown). In a number of instances, significant variation in percentages by sex, race, or age group was present. For example, adults age 45–64 y had the highest percentage of prescriptions.

When analyses were limited to patients with any sleep related reason for visit or any sleep related diagnosis, the percentage of office visits during which a nonbenzodiazepine, benzodiazepine receptor agonist, or any hypnotic medication was prescribed increased significantly (all P trend < 0.050) (Figure 5).

The numbers of visits for which a sleep related reason is listed but no prescription for a hypnotic medication is listed, and visits for which a sleep related reason is not listed but a prescription is listed vastly outnumbered visits listing a sleep related reason and a prescription (Table 8). Significant increasing trends were observed in the percentages of visits for the presence of a sleep related reason and the issuance of a prescription for a hypnotic medication and for visits lacking

Table 2—Insomnia medications included in analyses

Analytic grouping	Class	Generic name
Benzodiazepine sleep aids ^a	Benzodiazepines	Estazolam
		Flurazepam
		Quazepam
		Temazepam
		Triazolam
Nonbenzodiazepine sleep aids ^a	Benzodiazepine receptor agonist ^a	Eszopiclone
		Zaleplon
		Zolpidem
	Melatonin receptor agonists	Ramelteon
	Tricyclic antidepressant	Doxepin
Any insomnia medication ^a		All of the above

^a Results presented for these groups of medications.

Table 3—Demographic characteristics of patients age 20 y or older, National Ambulatory Care Medical Survey 1999-2010

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	P trend
All office visits, unweighted no.	17,223	22,422	19,975	22,854	20,476	21,023	20,869	23,819	26,647	23,107	26,561	25,263	
All office visits, weighted no.	609,201,148	646,243,459	699,412,498	693,678,418	721,766,590	726,467,772	765,661,820	706,680,122	782,407,896	769,814,282	840,123,575	799,556,349	
Age (y)	53.6 (0.5)	53.2 (0.4)	54.3 (0.4)	54.2 (0.4)	54.0 (0.5)	54.5 (0.5)	54.9 (0.5)	54.6 (0.5)	54.9 (0.5)	55.2 (0.4)	55.4 (0.4)	54.8 (0.4)	< 0.001
Men, %	38.9 (0.7)	37.9 (0.8)	38.4 (0.7)	37.8 (0.7)	38.0 (0.8)	38.7 (0.8)	39.1 (0.8)	38.6 (0.7)	39.2 (0.7)	37.8 (0.9)	38.6 (0.7)	39.5 (0.7)	0.322
White, %	87.5 (1.0)	86.8 (1.5)	89.0 (0.7)	87.0 (1.2)	85.8 (1.2)	85.4 (1.1)	86.8 (1.0)	85.7 (1.0)	83.2 (1.2)	84.8 (1.3)	85.0 (1.1)	84.6 (1.1)	0.001

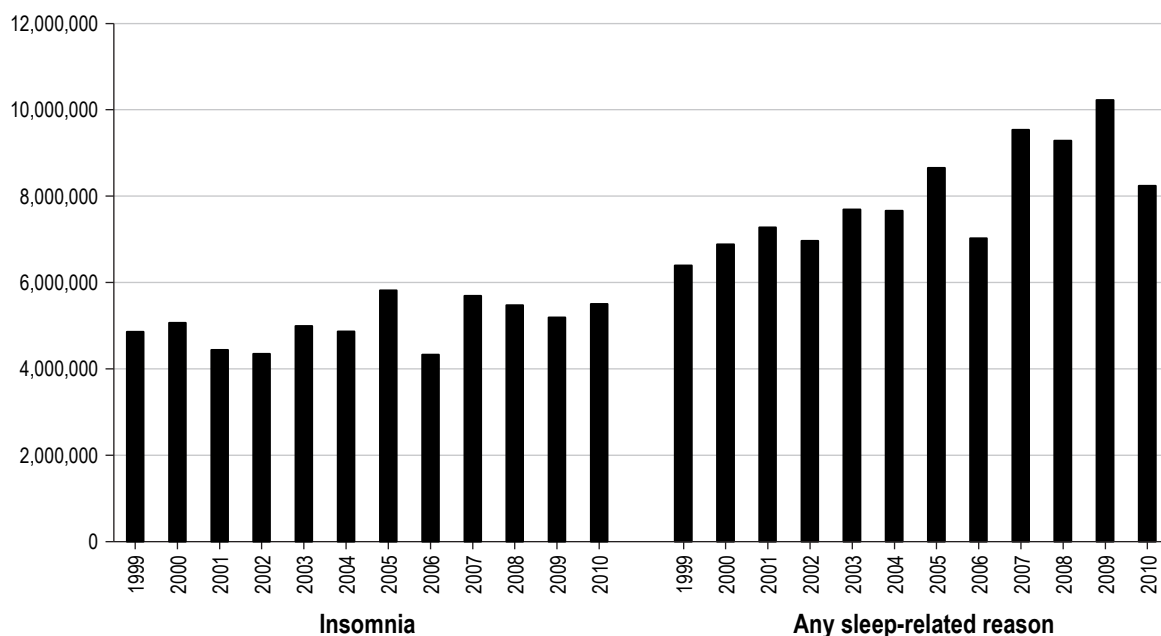


Figure 1—Numbers of office visits for insomnia or any sleep related reason for the visit among adults age 20 y or older, National Ambulatory Medical Care Survey 1999-2010.

a sleep related reason and the issuance of a prescription for a hypnotic medication. The percentage of visits lacking a sleep related reason and a prescription for a hypnotic medication

declined. Significant increases or decreases were present for the percentages of all four combinations of sleep related diagnosis status and prescription status.

Table 4—Percent (standard error) of office visits by patients age 20 y or older with a sleep disturbance as a stated reason for the office visit, a physician's diagnosis of a sleep related disorder, and a prescription for a hypnotic medication, by year, National Ambulatory Medical Care Survey 1999-2010

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	P trend
Reason													
Insomnia	0.6 (0.1)	0.8 (0.1)	0.6 (0.1)	0.6 (0.1)	0.7 (0.1)	0.7 (0.1)	0.8 (0.1)	0.6 (0.1)	0.7 (0.1)	0.7 (0.1)	0.6 (0.1)	0.7 (0.1)	0.475
Any sleep disturbance	1.0 (0.2)	1.1 (0.1)	1.0 (0.2)	1.0 (0.1)	1.1 (0.1)	1.1 (0.1)	1.1 (0.2)	1.0 (0.2)	1.2 (0.1)	1.2 (0.2)	1.2 (0.1)	1.0 (0.1)	0.342
Diagnosis													
Sleep apnea	0.2 (< 0.1)	0.3 (0.1)	0.3 (0.1)	0.5 (0.1)	0.3 (0.1)	0.5 (0.2)	0.4 (0.1)	0.6 (0.2)	0.7 (0.2)	0.7 (0.2)	1.0 (0.3)	0.7 (0.2)	< 0.001
Any sleep disorder	0.5 (0.1)	0.8 (0.1)	0.7 (0.1)	0.9 (0.1)	0.8 (0.1)	0.9 (0.2)	0.9 (0.1)	1.2 (0.2)	1.4 (0.2)	1.6 (0.2)	1.8 (0.3)	1.5 (0.2)	< 0.001
Medications													
Benzodiazepines	0.4 (0.1)	0.3 (0.1)	0.4 (0.1)	0.3 (< 0.1)	0.3 (0.1)	0.4 (0.1)	0.4 (0.1)	0.5 (0.1)	0.4 (0.1)	0.4 (0.1)	0.5 (0.1)	0.3 (< 0.1)	0.193
Nonbenzodiazepines	0.5 (0.1)	0.7 (0.1)	0.8 (0.1)	0.7 (0.1)	0.9 (0.1)	1.2 (0.1)	1.5 (0.2)	1.8 (0.2)	2.2 (0.2)	2.3 (0.2)	2.3 (0.2)	2.3 (0.2)	< 0.001
Benzodiazepine receptor agonists	0.4 (0.1)	0.5 (0.1)	0.7 (0.1)	0.6 (0.1)	0.8 (0.1)	1.0 (0.1)	1.3 (0.1)	1.6 (0.2)	1.9 (0.1)	2.1 (0.2)	2.2 (0.2)	2.1 (0.2)	< 0.001
Any sleep medication	0.9 (0.1)	1.1 (0.1)	1.2 (0.1)	1.0 (0.1)	1.2 (0.1)	1.6 (0.2)	1.9 (0.2)	2.2 (0.2)	2.6 (0.2)	2.7 (0.2)	2.8 (0.2)	2.6 (0.2)	< 0.001

Table 5—Percent (standard error) of office visits by patients age 20 y or older with a sleep disturbance as a stated reason for the office visit, by sex, race, age group, and 4-y intervals, National Ambulatory Medical Care Survey 1999-2010

Reasons for visit	Group	1999-2002	2003-2006	2007-2010	P trend
Insomnia					
By sex	Women	0.8 (0.1)	0.7 (0.1)	0.7 (0.1)	0.090
	Men	0.6 (0.1)	0.7 (0.1)	0.7 (0.1)	0.070
	P-value	0.004	0.311	0.271	
By race	White	0.7 (0.1)	0.7 (0.1)	0.7 (0.1)	0.764
	Black	0.6 (0.1)	0.5 (0.1)	0.6 (0.1)	0.796
	Other	— ^a	0.8 (0.2)	1.0 (0.2)	0.625
	P-value	0.238	0.061	0.318	
By age group	20-39 y	0.6 (0.1)	0.7 (0.1)	0.6 (< 0.1)	0.996
	40-64 y	0.8 (0.1)	0.8 (0.1)	0.9 (< 0.1)	0.442
	65+ y	0.8 (0.1)	0.5 (0.1)	0.5 (0.1)	0.056
	P-value	0.175	< 0.001	< 0.001	
Any sleep disturbance					
By sex	Women	1.0 (0.1)	1.0 (0.1)	1.0 (0.1)	0.823
	Men	1.0 (0.1)	1.2 (0.1)	1.4 (0.1)	0.009
	P-value	1.000	0.005	< 0.001	
By race	White	1.0 (0.1)	1.1 (0.1)	1.2 (0.1)	0.168
	Black	0.9 (0.2)	0.8 (0.1)	1.0 (0.1)	0.684
	Other	1.7 (0.4)	1.1 (0.3)	1.5 (0.3)	0.736
	P-value	0.168	0.104	0.175	
By age group	20-39 y	0.9 (0.1)	1.0 (0.1)	1.0 (0.1)	0.603
	40-64 y	1.2 (0.1)	1.3 (0.1)	1.5 (0.1)	0.073
	65+ y	0.9 (0.1)	0.8 (0.1)	0.9 (0.1)	0.789
	P-value	0.051	< 0.001	< 0.001	

^a Estimate does not meet standard for statistical reliability and precision (relative standard error $> 30\%$).

DISCUSSION

Our results provide current information about outpatient visits related to both sleep and to prescribing practices

of hypnotic medication in the United States during the past decade. Notably, the number of office visits for which patients sought care for sleep related difficulties and for which doctors

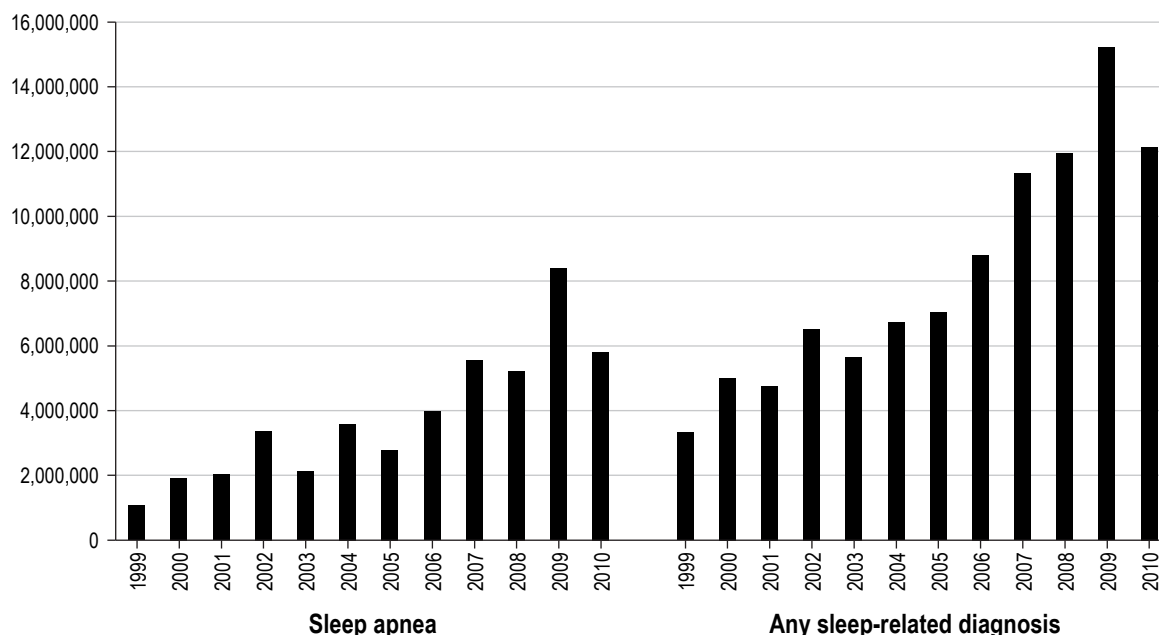


Figure 2—Numbers of office visits with a diagnosis of sleep apnea or any sleep related diagnosis among adults age 20 y or older, National Ambulatory Medical Care Survey 1999-2010.

Table 6—Percent (standard error) of office visits by patients age 20 y or older with a physician's diagnosis of a sleep disorder, by sex, race, age group, and 4-y intervals, National Ambulatory Medical Care Survey 1999-2010

Sleep disorder	Group	1999-2002	2003-2006	2007-2010	P trend
Sleep apnea					
By gender	Women	0.2 (< 0.1)	0.3 (0.1)	0.5 (0.1)	< 0.001
	Men	0.6 (0.1)	0.6 (0.1)	1.2 (0.2)	< 0.001
	P-value	< 0.001	< 0.001	< 0.001	
By race	White	0.3 (< 0.1)	0.4 (0.1)	0.8 (0.1)	< 0.001
	Black	— ^a	0.5 (0.1)	0.6 (0.1)	0.040
	Other	— ^a	— ^a	0.8 (0.2)	< 0.001
	P-value	< 0.001	0.660	0.034	
By age group	20-39 y	0.3 (< 0.1)	0.3 (0.1)	0.3 (0.1)	0.211
	40-64 y	0.5 (0.1)	0.5 (0.1)	1.1 (0.1)	< 0.001
	65+ y	0.2 (< 0.1)	0.3 (0.1)	0.7 (0.1)	< 0.001
	P-value	< 0.001	0.011	< 0.001	
Any sleep disorder					
By sex	Women	0.6 (0.1)	0.8 (0.1)	1.3 (0.1)	< 0.001
	Men	0.9 (0.1)	1.2 (0.1)	2.1 (0.2)	< 0.001
	P-value	0.002	< 0.001	< 0.001	
By race	White	0.8 (0.1)	1.0 (0.1)	1.6 (0.1)	< 0.001
	Black	0.6 (0.2)	0.8 (0.2)	1.2 (0.2)	0.009
	Other	— ^a	1.4 (0.3)	1.4 (0.2)	0.001
	P-value	0.085	0.361	0.011	
By age group	20-39 y	0.6 (0.1)	1.9 (0.1)	1.2 (0.1)	< 0.001
	40-64 y	1.0 (0.1)	1.1 (0.1)	2.0 (0.2)	< 0.001
	65+ y	0.5 (0.1)	0.7 (0.1)	1.3 (0.1)	< 0.001
	P-value	< 0.001	0.002	< 0.001	

^aEstimate does not meet standard for statistical reliability and precision (relative standard error > 30%).

diagnosed sleep related conditions, as well as the percentage of office visits related to these patient reasons and physicians' diagnoses, increased substantially during the study period. Furthermore, the number of prescriptions and the percentage of office visits during which a hypnotic medication was prescribed also increased significantly.

Whether or not the reported increase in office visits for sleep related difficulties represents an actual increase in the prevalence of sleep related difficulties in the population, or heightened awareness prompting more adults to seek medical care for sleep-related difficulties, or a combination of these two factors is unknown. Previous analyses of data from NAMCS have described trends in office visits for sleep complaints, in sleep related diagnoses by physicians, and in medication prescriptions to adult and pediatric patients consulting for sleep difficulties.^{19,22,23} Diagnoses of sleep apnea increased sharply from 1990 to 1998, and our analyses show continued large increases in diagnoses for sleep apnea from 1999 to 2010. Although we were not able to estimate how many of these diagnoses were confirmed by diagnostic testing, the numbers of office visits during which polysomnography or a multiple sleep latency test was performed increased during the study period. Notably, increases in the prevalence of obesity and diabetes, two conditions known to predispose for sleep apnea, have continued to increase in the United States.^{29,30}

Our analyses indicated that men had a higher percentage of office visits for medical care for sleeping difficulties than women. A previous meta-analysis found that women were more likely to experience insomnia than men.³¹ Perhaps, women are less likely to seek medical care for insomnia than men despite being more likely to experience it than men. We also found that

sleep apnea and any sleep disorder was more likely to be diagnosed in men than women. Previous research has noted that men are more likely than women to have sleep apnea and that women were less likely than men to attend a sleep clinic to seek care for a sleep apnea syndrome.³²

Our analyses did not show significant racial variation in the percentage of office visits for insomnia or any sleep related reason. An analysis of 2008 BRFSS data showed a greater percentage of African American participants reporting 30 days of insufficient rest or sleep than whites.¹⁰ Data from

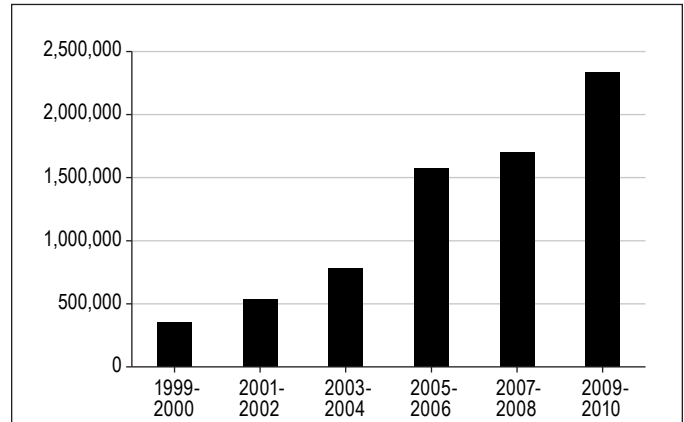


Figure 3—Average annual numbers of office visits that list polysomnography (ICD-9-CM 89.17) or multiple sleep latency testing (ICD-9-CM 89.18) among adults age 20 y or older, by 2-y intervals, National Ambulatory Medical Care Survey 1999-2010. The relative standard error for the period 2005-2006 was about 33% indicating that this estimate does not meet standards of reliability or precision.

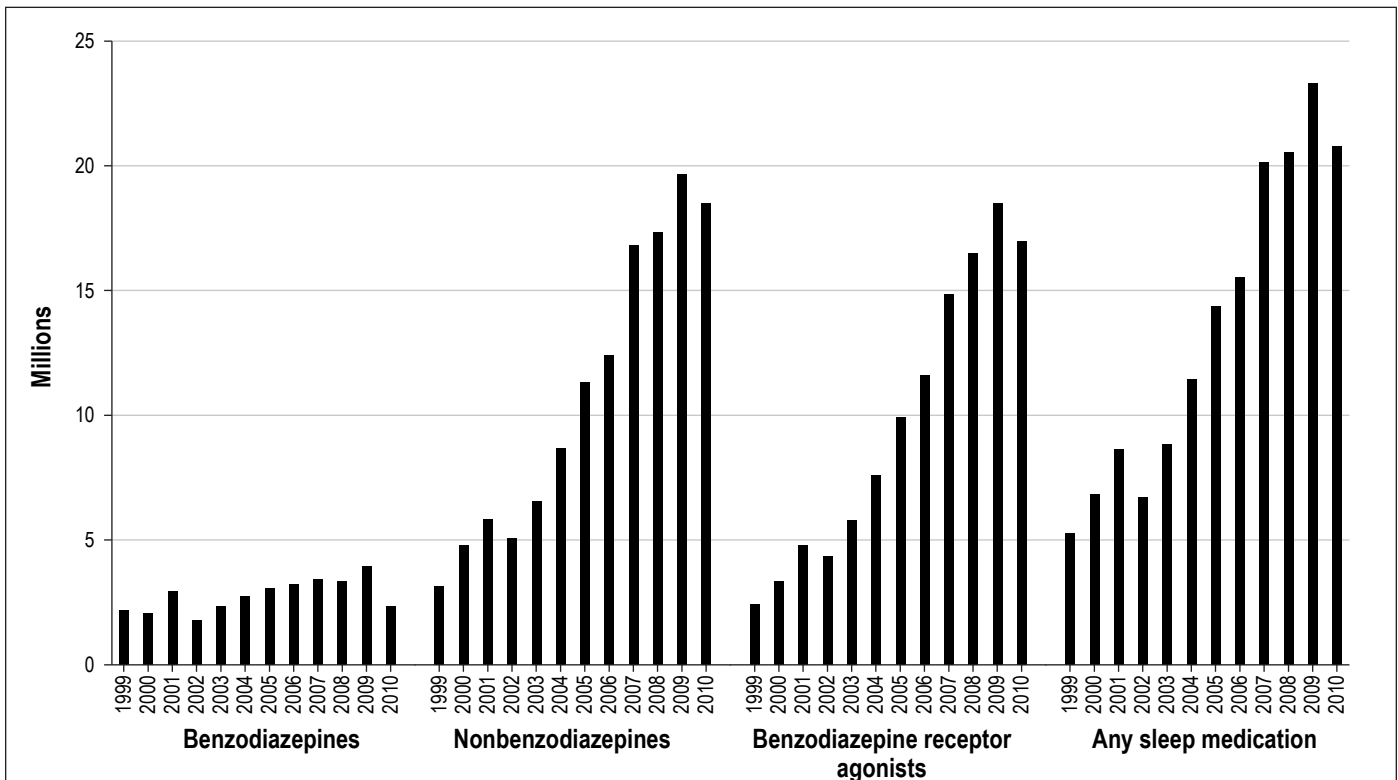


Figure 4—Annual number of office visits accompanied by a prescription for sleep medications, National Ambulatory Medical Care Survey 1999-2010.

the 1990 National Health Interview Survey showed a higher prevalence of African American adults who slept ≤ 6 h or ≥ 9 h than whites.³³ However, in other studies no significant racial differences in sleep related difficulties were observed.³⁴ In a

2010 poll, Asians were most likely to report getting a good night's sleep, followed by Hispanics, whites, and blacks, with little difference between the latter two groups.³⁵ In contrast, at least one study has reported that whites reported

Table 7—Percent (standard error) of office visits by patients age 20 y or older with a prescription for a hypnotic medication, by sex, race, age group, and 4-y intervals, National Ambulatory Medical Care Survey 1999-2010

Medications	Group	1999-2002	2003-2006	2007-2010	P trend
Benzodiazepine					
By sex	Women	0.3 (< 0.1)	0.4 (< 0.1)	0.4 (< 0.1)	0.030
	Men	0.4 (0.1)	0.4 (0.1)	0.3 (< 0.1)	0.798
	P-value	0.455	0.867	0.061	
By race	White	0.4 (< 0.1)	0.4 (< 0.1)	0.4 (< 0.1)	0.110
	Black	— ^a	0.5 (0.1)	0.3 (0.1)	0.097
	Other	— ^a	— ^a	— ^a	0.152
	P-value	0.005	0.406	0.003	
By age group	20-39 y	0.2 (0.1)	0.2 (< 0.1)	0.2 (< 0.1)	0.873
	40-64 y	0.3 (< 0.1)	0.4 (0.1)	0.4 (< 0.1)	0.232
	65+ y	0.4 (0.1)	0.5 (0.1)	0.5 (0.1)	0.171
	P-value	0.022	< 0.001	< 0.001	
Nonbenzodiazepine					
By sex	Women	0.8 (< 0.1)	1.4 (0.1)	2.4 (0.1)	< 0.001
	Men	0.6 (0.1)	1.2 (0.1)	2.0 (0.1)	< 0.001
	P-value	0.060	0.076	0.002	
By race	White	0.7 (< 0.1)	1.4 (0.1)	2.4 (0.1)	< 0.001
	Black	0.7 (0.2)	1.1 (0.2)	1.7 (0.2)	< 0.001
	Other	— ^a	1.1 (0.2)	1.3 (0.3)	0.189
	P-value	0.875	0.174	< 0.001	
By age group	20-39 y	0.4 (< 0.1)	0.9 (0.1)	1.4 (0.1)	< 0.001
	40-64 y	0.9 (0.1)	1.7 (0.1)	2.9 (0.1)	< 0.001
	65+ y	0.7 (0.1)	1.2 (0.1)	2.0 (0.1)	< 0.001
	P-value	< 0.001	< 0.001	< 0.001	
Benzodiazepine receptor agonists					
By sex	Women	0.6 (0.1)	1.3 (0.1)	2.2 (0.1)	< 0.001
	Men	0.5 (0.1)	1.1 (0.1)	1.9 (0.1)	< 0.001
	P-value	0.180	0.032	0.003	
By race	White	0.6 (< 0.1)	1.2 (0.1)	2.2 (0.1)	< 0.001
	Black	0.5 (0.2)	1.0 (0.2)	1.6 (0.2)	< 0.001
	Other	— ^a	1.0 (0.2)	1.3 (0.3)	0.213
	P-value	0.654	0.315	< 0.001	
By age group	20-39 y	0.3 (< 0.1)	0.9 (0.1)	1.3 (0.1)	< 0.001
	40-64 y	0.8 (0.1)	1.5 (0.1)	2.7 (0.1)	< 0.001
	65+ y	0.5 (0.1)	1.0 (0.1)	1.9 (0.1)	< 0.001
	P-value	< 0.001	< 0.001	< 0.001	
Any sleep medication					
By sex	Women	1.1 (0.1)	1.8 (0.1)	2.8 (0.1)	< 0.001
	Men	1.0 (0.1)	1.6 (0.1)	2.4 (0.1)	< 0.001
	P-value	0.246	0.094	< 0.001	
By race	White	1.0 (0.1)	1.8 (0.1)	2.8 (0.1)	< 0.001
	Black	0.9 (0.2)	1.5 (0.2)	2.1 (0.2)	< 0.001
	Other	1.3 (0.3)	1.3 (0.3)	1.5 (0.3)	0.592
	P-value	0.530	0.249	< 0.001	
By age group	20-39 y	0.6 (0.1)	1.1 (0.1)	1.6 (0.1)	< 0.001
	40-64 y	1.2 (0.1)	2.1 (0.1)	3.3 (0.1)	< 0.001
	65+ y	1.1 (0.1)	1.6 (0.1)	2.5 (0.1)	< 0.001
	P-value	< 0.001	< 0.001	< 0.001	

^aEstimate does not meet standard for statistical reliability and precision (relative standard error > 30%).

a greater frequency of sleep related complaints than African Americans.³⁶

Recently, a publication stated that the prevalence of obstructive sleep apnea is greater in African Americans than whites.³⁷ This conclusion was based on research composed of three studies that included 12 to 225 African American participants.³⁸⁻⁴⁰ In contrast, a population-based study that included 418 African Americans failed to show that African Americans had a significantly higher odds of having an apnea-hypopnea index ≥ 15 than whites,⁴¹ and the self-reported prevalence of sleep apnea by whites (4.9%) was higher than by African Americans (3.4%) in a large national survey.⁴² If the prevalence of obstructive sleep apnea is indeed higher in African Americans than whites, our analyses showing that whites have a higher

percentage of office visits with a diagnosis of sleep apnea than African Americans could indicate that African Americans in general are receiving suboptimal care for this condition.

Our analyses show that, from 2007 to 2010, but not during preceding periods, a higher percentage of office visits among whites than blacks resulted in a prescription for nonbenzodiazepines, benzodiazepine receptor agonists, and any sleep medications. This finding is consistent with previous research. In the Johnson County Osteoarthritis Project, whites were more likely to report using prescription sleep medication than African Americans.³⁴ It is conceivable that financial barriers are responsible for the racial difference.

Although the data sets that we explored are unable to provide explanations for the increases in the percentage of

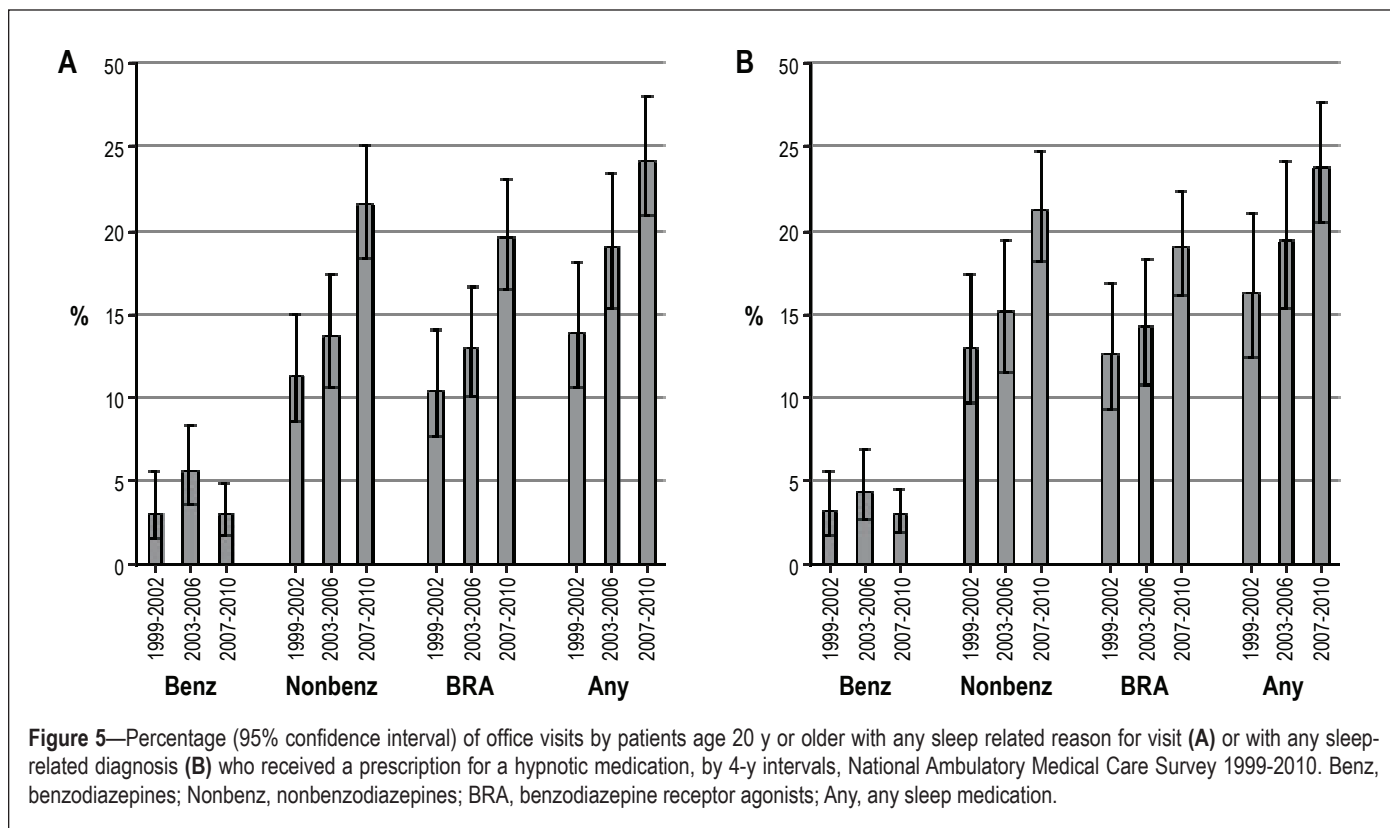


Figure 5—Percentage (95% confidence interval) of office visits by patients age 20 y or older with any sleep related reason for visit (A) or with any sleep-related diagnosis (B) who received a prescription for a hypnotic medication, by 4-y intervals, National Ambulatory Medical Care Survey 1999-2010. Benz, benzodiazepines; Nonbenz, nonbenzodiazepines; BRA, benzodiazepine receptor agonists; Any, any sleep medication.

Table 8—Unadjusted percentages (standard error) and numbers of combinations of any reason for sleep related visit or diagnosis and any hypnotic prescription, National Ambulatory Medical Care Survey 1999-2010

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	P trend
Percentages													
Reason +, hypnotic +	0.1 (0.0)	0.2 (0.1)	0.1 (0.0)	0.2 (0.0)	0.2 (0.0)	0.2 (0.1)	0.1 (0.0)	0.3 (0.1)	0.3 (0.1)	0.3 (0.1)	0.3 (0.1)	0.2 (0.0)	< 0.001
Reason +, hypnotic -	1.0 (0.2)	0.9 (0.1)	0.9 (0.1)	0.8 (0.1)	0.9 (0.1)	0.8 (0.1)	1.0 (0.2)	0.7 (0.1)	0.9 (0.1)	0.9 (0.2)	0.9 (0.1)	0.8 (0.1)	0.632
Reason -, hypnotic +	0.8 (0.1)	0.9 (0.1)	1.1 (0.1)	0.8 (0.1)	1.1 (0.1)	1.3 (0.1)	1.7 (0.2)	1.9 (0.2)	2.3 (0.2)	2.4 (0.2)	2.5 (0.2)	2.4 (0.2)	< 0.001
Reason -, hypnotic -	98.2 (0.2)	98.0 (0.2)	97.9 (0.2)	98.2 (0.1)	97.9 (0.2)	97.6 (0.2)	97.1 (0.3)	97.1 (0.3)	96.5 (0.2)	96.4 (0.3)	96.3 (0.3)	96.6 (0.2)	< 0.001
Diagnosis													
Diagnosis +, hypnotic +	0.1 (0.0)	0.1 (0.0)	0.1 (0.0)	0.1 (0.0)	0.2 (0.0)	0.1 (0.0)	0.1 (0.0)	0.3 (0.1)	0.4 (0.1)	0.4 (0.1)	0.4 (0.1)	0.3 (0.0)	< 0.001
Diagnosis +, hypnotic -	0.4 (0.1)	0.7 (0.1)	0.6 (0.1)	0.8 (0.1)	0.6 (0.1)	0.8 (0.2)	0.8 (0.1)	0.9 (0.2)	1.1 (0.2)	1.1 (0.2)	1.4 (0.2)	1.2 (0.2)	< 0.001
Diagnosis -, hypnotic +	0.7 (0.1)	0.9 (0.1)	1.1 (0.1)	0.9 (0.1)	1.1 (0.1)	1.4 (0.2)	1.7 (0.2)	1.9 (0.1)	2.2 (0.2)	2.2 (0.2)	2.4 (0.2)	2.3 (0.2)	< 0.001
Diagnosis -, hypnotic -	98.7 (0.1)	98.3 (0.2)	98.2 (0.1)	98.2 (0.1)	98.2 (0.2)	97.6 (0.2)	97.3 (0.2)	96.9 (0.3)	96.4 (0.3)	96.2 (0.3)	95.8 (0.3)	96.2 (0.3)	< 0.001
Numbers													
Reason +, hypnotic +	551,879	1,063,426	958,000	1,254,203	1,227,792	1,786,744	1,039,786	1,868,610	2,414,163	2,088,062	2,572,237	1,952,712	-
Reason +, hypnotic -	5,842,231	5,816,453	6,317,214	5,709,297	6,466,734	5,871,421	7,617,027	5,156,468	7,120,012	7,195,646	7,651,759	6,284,061	-
Reason -, hypnotic +	4,735,676	5,782,666	7,665,044	5,441,802	7,591,769	9,655,954	13,327,289	13,655,414	17,741,537	18,468,083	20,754,015	18,811,754	-
Reason -, hypnotic -	598,071,362	633,580,914	684,472,240	681,273,116	706,480,295	709,153,653	743,677,718	685,999,630	755,132,184	742,062,491	809,145,564	772,507,822	-
Diagnosis +, hypnotic +	848,769	768,091	778,077	791,675	1,229,096	1,039,749	1,045,970	2,142,835	2,923,645	3,432,040	3,191,345	2,506,251	-
Diagnosis +, hypnotic -	2,472,290	4,240,980	3,982,051	5,728,510	4,423,811	5,676,676	5,979,222	6,672,324	8,402,394	8,512,090	12,012,789	9,636,863	-
Diagnosis -, hypnotic +	4,438,786	6,078,001	7,844,967	5,904,330	7,590,465	10,402,949	13,321,105	13,381,189	17,232,055	17,124,105	20,134,907	18,258,215	-
Diagnosis -, hypnotic -	601,441,303	635,156,387	686,807,403	681,253,903	708,523,218	709,348,398	745,315,523	684,483,774	753,849,802	740,746,047	804,784,534	769,155,020	-

visits with sleeping difficulties as the patient's stated reason for visit, in the diagnosis of a sleep disorder, and in prescriptions for hypnotic medications, a number of possibilities could have contributed to the observed trends. The efforts of several organizations (National Sleep Foundation, American Academy of Sleep Medicine, Centers for Disease Control and Prevention, National Institutes of Health) that have been promoting awareness of the need for adequate sleep may have prompted increasing numbers of adults with sleeping difficulties to seek medical help. The dearth of data about trends in the public's awareness of the importance of sleep in maintaining health is a gap in knowledge that requires addressing. The potential effect of media stories about sleep health and the development of numerous websites featuring information and stories about sleep health is unknown. Direct-to-consumer advertising of sleeping medications on television and in other media venues may also have motivated patients to address sleeping troubles with their physicians, but scientific studies to support this possibility are lacking. A growing prevalence of chronic conditions, either singly or as multiple chronic conditions that affect sleep also may have influenced the trends we examined. With growing research into the health consequences of sleep, physicians also may have gained a greater appreciation for this area and an increased likelihood of asking their patients about possible sleep problems. For example, a query of PubMed using "sleep" as a title word and restricting publications to English only shows that the number of such publications increased from 1,091 in 1999 to 2,894 in 2010. In a 2005 poll, 29% of all participants reported that their physician had asked them about a sleep problem. In a 2010 poll, 48% of white participants, 42% of African American participants, 28% of Asian participants, and 40% of Hispanic participants reported that their physician had asked them about a sleep problem.^{35,43}

The estimated number of prescriptions for sleep medications that we generated is lower than previous estimates produced by others.⁴⁴ For example, the IMS Institute for Healthcare Informatics estimated that 52.3 million prescriptions for hypnotic medications and sedatives were filled in 2006 and 66 million in 2010. In comparison, we estimated that 20.8 million prescriptions for a hypnotic agent were issued in 2010 in the outpatient office setting. These estimates by the IMS Institute for Healthcare Informatics were produced from a series of proprietary databases—including IMS National Sales Perspectives, IMS National Prescription Audit, and IMS National Disease and Therapeutic Index—maintained by IMS Health. We examined a single setting, albeit an important one in the medical system, whereas prescriptions for sleeping medications are generated in other settings including outpatient facilities at hospitals, hospitals themselves, nursing homes and extended care facilities, and other settings. Consequently, our results include a fraction of all prescriptions for sleeping medications. Nevertheless, the trend of increasing numbers of prescriptions for sleeping medications is consistent with previously generated data.

Some of the difference in estimates may have been attributable to different sets of hypnotic medications used in the different studies. Adding additional benzodiazepines as well as other medications that may be used to promote sleep, such as tricyclic antidepressants and barbiturates, greatly increases the number of such prescriptions. We selected 10 hypnotic

medications that have an approved FDA indication for insomnia. However, many more medications have sedative properties and may be prescribed by physicians to help their patients sleep better. When we expanded the medications to include additional benzodiazepines (alprazolam, chlordiazepoxide, clonazepam, clorazepate, diazepam, flunitrazepam, halazepam, lorazepam, prazepam, and quazepam), the estimated number of prescriptions in 2010 rose to 61.4 million. However, many of these prescriptions were likely issued for reasons other than insomnia. Furthermore, given a choice of medications for a particular treatment, physicians may select a medication with sedative properties for use at bedtime. Therefore, our estimates of prescriptions for hypnotics may represent only one facet of prescribing practices for sleep difficulties.

Several additional limitations to our study are worth noting. The sample sizes proved inadequate for presenting estimates for detailed patient reasons for visits and physicians' diagnoses as well as for allowing stratification by other covariates in many instances. By having to collapse codes for reasons for visit and diagnoses, potentially important information could not be examined. Race designations were missing from sizable percentages of records, which led us to use a variable containing imputed race designations. Even after aggregating data into 4-y periods, the stability of some of the estimates remained suboptimal. The surveys do not allow differentiation of prescriptions into new prescriptions or renewals.

Depending on the definition of insomnia the prevalence of insomnia ranges from 6% to about 33%.⁴⁵ Consequently, the percentage of office visits listing insomnia as a reason for visit may appear low in comparison. Explanations may include the possibility that only a fraction of people with insomnia seek medical help and that medical providers may not record insomnia in the medical record.

In conclusion, the number and percentage of office visits for sleeping difficulties increased greatly from 1999-2010. This increase coincided with a large increase in the number and relative increase in the percentage of office visits during which patients were given a prescription for a sleeping medication. Because our analyses cannot address the rationale underlying these trends, further research is warranted. Unless prescribing trends for hypnotic medications change, increasing numbers of adults in the United States will be treated for sleep related conditions with hypnotics. Given the potential harm associated with even intermittent use of hypnotic medication, alternative approaches to treating insomnia such as cognitive behavioral therapy merit consideration.^{46,47}

DISCLOSURE STATEMENT

This was not an industry supported study. The authors have indicated no financial conflicts of interest. The findings and conclusions in this article are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

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