

SCIENTIFIC INVESTIGATIONS

## Practice patterns of board-certified sleep medicine providers: a national analysis among older adult Medicare beneficiaries

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**Study Objectives:** To examine the proportion of Medicare beneficiaries with sleep disorders who were evaluated by board-certified sleep medicine providers (BCSMPs).

**Methods:** Using a random 5% sample of Medicare administrative claims data (2007–2011), BCSMPs were identified by employing a novel cross-matching approach based on National Provider Identifiers available within the Medicare database. Sleep disorders were included based partially on the *International Classification of Sleep Disorders, Third Edition* (insomnia, sleep-related breathing disorders, hypersomnias, circadian rhythm sleep-wake disorders, parasomnias, and restless legs syndrome), and operationalized as *International Classification of Diseases, Ninth Revision, Clinical Modification* diagnostic codes. The proportion of beneficiaries with each disorder who were seen by BCSMPs and nonspecialists was computed.

**Results:** Among older adult Medicare beneficiaries with sleep disorders, the most common sleep disorder was insomnia (n = 65,033), and the least common sleep disorder was narcolepsy (n = 784). Individuals with central sleep apnea (n = 1,561) were most likely to be treated by a BCSMP (63.9% of beneficiaries with central sleep apnea), and individuals diagnosed with insomnia were least likely to be treated by a BCSMP (16.4% of beneficiaries with insomnia). Most BCSMPs treated beneficiaries with obstructive sleep apnea (84.9% of BCSMPs) and insomnia (75.8% of BCSMPs).

**Conclusions:** BCSMPs are involved in the care of a substantial proportion of Medicare beneficiaries with sleep disorders.

**Keywords:** sleep medicine, board certification, health services, Medicare, older adults

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### BRIEF SUMMARY

**Current Knowledge/Study Rationale:** Specialty medical board certification is increasingly recognized as an important determinant of high-quality and cost-effective health care. A small but growing body of literature has evaluated the impact of board certification in sleep medicine, with promising initial results.

**Study Impact:** This study represents the largest analysis to date of the public health impact of board certification in sleep medicine. Using a nationally representative sample of Medicare administrative claims data, present results demonstrate that board-certified sleep medicine providers are involved in a substantial proportion of sleep medicine specialty care in the United States. Given the known shortage of sleep specialists in the United States, future research should evaluate the impact of board-certified sleep medicine provider status on quality of care as well as health and economic outcomes among Medicare beneficiaries. As part of an American Academy of Sleep Medicine Foundation Strategic Award to the University of Maryland, Baltimore, such studies are currently underway.

### INTRODUCTION

Specialty board certification is increasingly recognized as an important predictor of high-quality and cost-effective health care. Since a seminal meta-analysis reported an overall positive association between board certification and clinical outcomes,<sup>1</sup> similar, generally positive, results have been reported across a range of disease states<sup>2–6</sup>. In sleep medicine, doctoral-level providers including physicians and psychologists were eligible for board certification from 1995–2006, under the aegis of

the American Board of Sleep Medicine (ABSM). Since 2007, physicians who completed a fellowship were invited to sit for a sleep specialty exam administered biannually by the American Board of Medical Specialties (ABMS), with those who passed earning the designation of Board-Certification in Sleep Medicine; with this transition to a formal medical subspecialty restricted to physicians, psychologists were no longer eligible for board certification under the ABMS. A small body of literature has evaluated the importance of board certification in sleep medicine, with most studies supporting the value

of board certification in providing quality care and improving patient outcomes.

The first study to consider the impact of board certification in sleep medicine was a telephone survey and chart review conducted by Scharf and colleagues.<sup>7</sup> Relative to patients with obstructive sleep apnea (OSA) treated by primary care physicians, those treated by board-certified sleep medicine physicians (BCSMPs) in our accredited center experienced reduced time to consultation and demonstrated increased disease awareness, but no differences in positive airway pressure (PAP) adherence were observed in this small sample.<sup>7</sup> Subsequently, a national cross-sectional survey conducted by Parthasarathy and colleagues<sup>8</sup> found that patients treated for OSA in American Academy of Sleep Medicine (AASM)-accredited sleep centers or by BCSMPs were less likely to discontinue PAP therapy and reported higher satisfaction rates than did patients treated in nonaccredited centers or by nonspecialist providers. Similarly, a chart review of patients referred to an AASM-accredited sleep center found that consultation with a BCSMP prior to diagnostic polysomnogram was associated with greater subsequent adherence to PAP therapy.<sup>9</sup> Finally, a prospective comparative effectiveness study found that patients treated in accredited sleep centers and by BCSMPs were provided more timely care and achieved higher rates of PAP adherence than patients treated in nonaccredited centers or by nonspecialist providers.<sup>10</sup>

At the same time, not all studies have supported the positive impact of board certification in sleep medicine. A highly publicized and controversial randomized, controlled, noninferiority, clinical efficacy trial conducted by Chai-Coetzer and colleagues<sup>11</sup> found no significant differences in self-reported sleepiness, patient satisfaction, or PAP adherence between patients with OSA cared for by BCSMPs and primary care physicians. More recently, a systematic review found no differences in quality of care or sleep medicine outcomes between care delivered by non-sleep specialists and sleep specialist providers.<sup>12</sup> Notably, both the study by Chai-Coetzer and colleagues<sup>11</sup> as well as the 4 papers that met inclusion criteria for the systematic review were seriously confounded. In those studies, providers with high levels of sleep medicine training and many years of experience treating patients with sleep disorders could still be considered non-sleep specialists.<sup>13</sup>

Despite these findings, little is known about national practice patterns of BCSMPs and nonspecialists in the evaluation and management of sleep disorders. Findings derived from assessment of such national patterns of practice are an important step to understand the clinical and public health impact of board certification in sleep medicine. To this end, the purpose of the present study was to assess the national patterns of sleep medicine care delivery by BCSMPs. Specifically, we sought to evaluate the workload of BCSMPs and to determine the proportion of older adult Medicare beneficiaries with sleep disorders who are cared for by BCSMPs. We also present detailed methodology regarding identification of BCSMPs in a large, administrative database of nationally representative Medicare administrative claims data. The Medicare population is of particular interest because Medicare is the largest payer for health care services for the elderly in the United States and a leader in the development of federal and private health policy.

## METHODS

### Participants

A 5% sample of Medicare administrative claims for years 2006–2013 was the source of data for this study. The data were obtained from the Center for Medicare and Medicaid Services (CMS) Chronic Condition Data Warehouse (CCW), which represents a random 5% sample of Medicare beneficiaries. Beneficiaries were included in this study if they received 1 or more physician-assigned diagnoses of sleep disorders of interest during a 37-month period with continuous Medicare Parts A and B with no Medicare Part C (Medicare Advantage) coverage. The 37-month period was defined by the first sleep disorder diagnosis received during the study period and required 12 months of continuous coverage prediagnosis and 24 months of continuous coverage postdiagnosis, excluding the month of diagnosis. Beneficiaries who were diagnosed with more than 1 sleep disorder contributed to the denominator of each.

### Sleep disorders

Sleep disorders included insomnia, sleep-related breathing disorders (OSA and central sleep apnea [CSA]), narcolepsy, circadian rhythm sleep-wake disorders, parasomnias, hypersomnia, and restless legs syndrome. These disorders were selected based on expert input and designed to mimic the structure of the *International Classification of Sleep Disorders, Third Edition*.<sup>14</sup> **Table 1** depicts *International Classification of Diseases, Ninth Revision, Clinical Modification* (ICD-9-CM) codes used to operationalize the sleep disorders assessed in this study. This study was approved by the Institutional Review Board at the University of Maryland, Baltimore.

### Identifying provider codes and cleaning data in the CCW

Although the CCW claims files do not include provider names, all beneficiary events and charges (eg, encounters, procedures, prescriptions) are associated with provider identifiers. Prior to June 2007, providers were identified by Unique Physician Identifier Numbers. Beginning in June 2007, providers in the CCW were assigned a National Provider Identifier (NPI). The NPI is a Health Insurance Portability and Accountability Act Administrative Simplification Standard and a publicly available unique identifier for covered health care providers. In order to identify BCSMPs, all events and charges from sleep case beneficiaries during the study period 2006–2013 were considered ( $n = 7,527,178$ ). Events include multiple types of encounters with the health system, including visits, prescription fills, procedures, and so on, aggregated from numerous types of Medicare event files. Ninety-three percent ( $n = 6,993,039$ ) of these events and charges were associated with an NPI; all other events and charges were excluded from further analysis. Following necessary decryption and removal of duplicates,  $n = 203,114$  unique NPIs were identified in the CCW data file. Next, it was necessary to determine which NPIs were associated with BCSMPs. Because BCSMPs have historically been certified by 2 licensing bodies, a 2-prong approach was required.

**Table 1**—Operational definitions of sleep disorders.

Sleep Disorder	ICD-9-CM Codes
Insomnia	307.41, 307.42, 307.49, 327.00, 327.01, 327.09, 780.52, V69.4
Obstructive sleep apnea	327.23, 780.57, 780.51, 780.53
Central sleep apnea	327.21, 327.22, 327.27, 327.29, 768.04
Hypersomnia	307.43, 307.44, 327.10, 327.11, 327.12, 327.13, 327.14, 327.15, 780.54
Narcolepsy	347.0, 347.00, 347.01, 347.1, 347.10, 347.11
Circadian rhythm disorders	307.45, 327.3x, 780.55
Parasomnia	327.40, 307.46, 307.47, 327.4x, 780.56
Restless legs syndrome	333.94

ICD-9-CM, *International Classification of Diseases, Ninth Revision, Clinical Modification*.

### Identifying BCSMPs certified prior to 2007

Prior to 2007, BCSMPs were certified by the ABSM, an independent certifying body. For the purposes of this study, the ABSM provided a limited dataset for research purposes only, which included first name, last name, and basic demographic information of all BCSMPs certified from 1976–2006 (n = 3,444). All information provided was publicly available. Notably, this ABSM diplomate file did not include NPIs. Thus, to determine which of the ABSM BCSMPs were included in the CCW dataset, it was necessary to (1) identify providers included in the CCW and (2) to create a “flag” (ie, yes/no variable) within the CCW data to identify ABSM BCSMPs. A multistep process was followed.

First, NPIs from the CCW were cross-referenced with NPIs included in the February 2018 National Plan and Provider Enumeration System (NPPES) data file; the NPPES is a publicly available file for all US health providers containing detailed contact information, including but not limited to NPI, first name, last name, and basic demographic information. Of the 203,114 unique NPIs identified in the CCW data file, 203,108 (99.99%) were matched successfully. This resulted in an NPPES-enhanced CCW dataset that included more detailed information regarding providers, including not only NPI but also first name, last name, highest degree earned, city, and state.

Next, this newly enhanced CCW file (n = 203,108) was cross-referenced with the ABSM diplomate file (n = 3,444) by using the additional provider details newly available within the CCW file. Following an initial cross-reference for unique fname/lname (first name/last name) combinations, increasingly strict matching criteria (eg, first name/last name/degree/city/state) were applied to those providers where fname/lname was duplicative in either the CCW file or the ABSM diplomate file. Claims associated with the identified ABSM BCSMPs providers were “flagged” within the CCW file, as described above. Additional quality-assurance strategies for providers with fname/lname duplication included calling the telephone number on file (NPPES), if available, and performing confirmatory Internet searches. This method resulted in 2,460 ABSM BCSMPs identified within the CCW data; the remaining 984 were not found to be in the CCW cohort.

### Identifying BCSMPs certified in 2007 and later

Beginning in 2007, BCSMPs were certified by the ABMS. The ABMS is a national nonprofit association that works in collaboration with 24 specialty boards to maintain the standards for physician board certification and maintenance of recertification. Board certification status for individual physicians can be verified online; certification status of multiple physicians can be simultaneously verified through ABMS Solutions, LLC, a partner company of ABMS. In the current project, ABMS Solutions, LLC, was engaged to verify which of the n = 203,108 NPIs from the CCW data file were associated with BCSMPs certified in 2007 and later. This resulted in the identification of n = 2,665 BCSMPs, who were subsequently flagged within the CCW data file as described above. BCSMPs certified prior to 2007 were not found to be recertified after 2007. Thus, we identified a total of 5,125 (ie, 2,460 + 2,665) BCSMPs in our data.

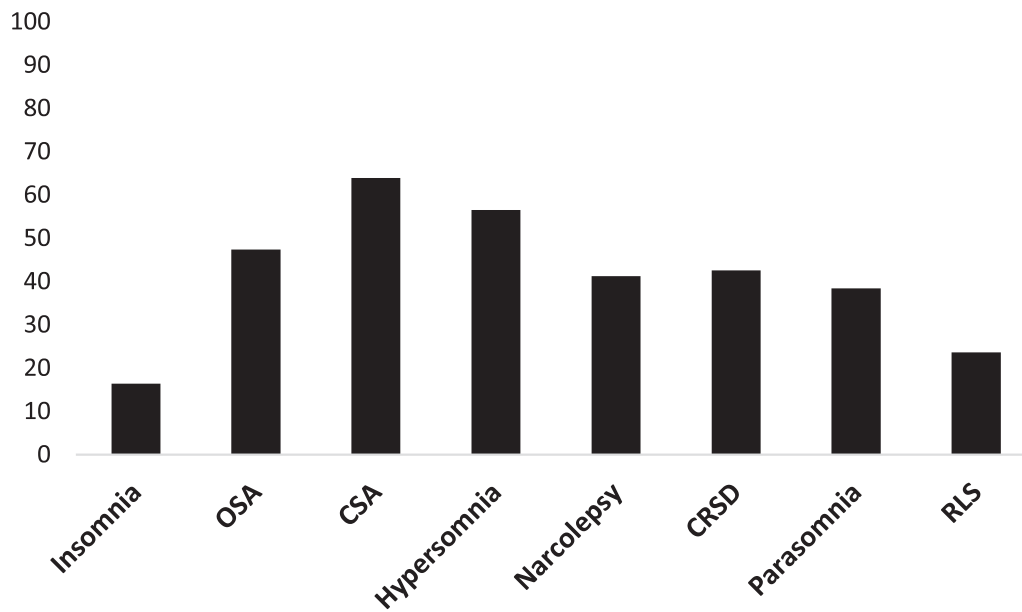
### Analytic plan

In order to evaluate the relationship between BCSMP status and quantity of sleep medicine care, we calculated the proportion of beneficiaries within each sleep disorder category that were treated by a BCSMP at any time during the 24-month continuous coverage period (ie, beginning with diagnosis of the sleep disorder). We also determined the mean number of visits to unique BCSMPs per patient as well as the mean number of visits to any BCSMP per patient. Finally, within each sleep disorder group, we identified the number of unique BCSMPs who provided care.

## RESULTS

### BCSMPs

Of the 5,125 BCSMPs identified in our data, 4,462 (87%) contributed to our final dataset. The remaining encounters with BCSMPs occurred outside of the 24-month continuous coverage period examined in this study. Among Medicare beneficiaries diagnosed with at least 1 of the 7 studied sleep disorders, the range of unique visits to unique BCSMPs was 0–4, with approximately 2% having 1 visit. The remaining

**Figure 1**—Proportion of Medicare beneficiaries diagnosed with sleep disorders in 2007–2011 by BCSMPs over 24 months of follow-up.

Proportions of beneficiaries seen by BCSMPs include insomnia (%), OSA (%), CSA (%), hypersomnia (%), narcolepsy (%), CRSD (%), parasomnia (%), RLS (%), and sleep disturbances (%). BCSMP = board-certified sleep medicine provider; CSA = central sleep apnea; CRSD = circadian rhythm sleep-wake disorder; OSA = obstructive sleep apnea; RLS = restless legs syndrome.

**Table 2**—Treatment of Medicare beneficiaries diagnosed with sleep disorders in 2007–2011 by BCSMPs over 24 months of follow-up.

Sleep Disorder	n	Treated by BCSMP, n (%)	Number of BCSMPs Involved (Total n = 5,125), n (%)
Insomnia	65,033	10,640 (16.4)	3,885 (75.8)
Obstructive sleep apnea	42,864	20,325 (47.4)	4,352 (84.9)
Central sleep apnea	1,561	998 (63.9)	1,040 (20.3)
Hypersomnia	7,369	4,169 (56.6)	2,363 (46.1)
Narcolepsy	784	323 (41.2)	378 (7.4)
Circadian rhythm disorders	1,354	577 (42.6)	615 (12.0)
Parasomnia	3,185	1,219 (38.3)	1,099 (21.4)
Restless legs syndrome	13,267	3,135 (23.6)	2,209 (43.1)

BCSMP = board-certified sleep medicine provider.

beneficiaries with more than 1 visit to a BCSMP comprised less than 0.03% of the sample.

### Proportion of beneficiaries with sleep disorders treated by BCSMPs

The proportions of beneficiaries diagnosed with each sleep disorder who were treated by a BCSMP during the 24-month follow-up are presented in **Figure 1** and **Table 2**, along with the total number of BCSMPs who provided treatment. Individuals diagnosed with insomnia (n = 65,033) were least likely to be treated by a BCSMP (16.4% of beneficiaries with insomnia), while those with CSA were most likely to be treated by a BCSMP (63.9% of beneficiaries with CSA). Large proportions of the total number of BCSMPs in the sample treated

beneficiaries with OSA (84.9% of BCSMPs) and insomnia (75.8% of BCSMPs).

### DISCUSSION

To our knowledge, this is the first study to assess national patterns of sleep specialist–delivered health care among Medicare beneficiaries. Using a national database of Medicare administrative claims, we found that BCSMPs are involved in caring for a substantial proportion of Medicare beneficiaries diagnosed with sleep disorders. This important finding builds upon past literature among convenience samples that demonstrate the positive impact of board certification in



sleep medicine<sup>7,8,10</sup> and is an important step to understand if CMS objectives for high-quality specialty care are realized in Medicare beneficiaries.

Our findings suggest that BCSMPs are heavily involved in sleep disorders management among older adults in the United States. In terms of specific sleep disorders, sleep-related breathing disorders including OSA and CSA demonstrated the highest proportion of evaluation and management by a BCSMP, while insomnia demonstrated the lowest proportion of evaluation and management by a BCSMP. OSA and insomnia are the most common sleep disorders among adults.<sup>15</sup> OSA requires objective diagnostic testing, and the most common treatments (ie, PAP and oral appliance therapies) require durable medical equipment and careful specialist oversight. Conversely, insomnia is most often managed via medication therapies prescribed by nonspecialists. However, cognitive behavioral therapy for insomnia is recognized as first-line treatment for insomnia,<sup>16–19</sup> and there is a well-recognized shortage of certified behavioral sleep medicine specialists in the United States.<sup>20</sup> Thus, our results regarding insomnia medication usage raise important questions about assessment and treatment of insomnia by nonspecialists.

It is also interesting to consider our results in the context of sleep medicine training. Evidence from fellowship matching programs indicates that, while the number of sleep medicine trainees is increasing, each year sleep medicine fellowship slots remain unfilled.<sup>21</sup> Although the reasons are complex, the uncertain perceived value of sleep medicine to medical trainees as well as payers are clear influences. Under the leadership of several professional societies and other organizations, the sleep medicine community has launched multiple efforts to increase the number of sleep medicine trainees, with promising early success.

Results of this study demonstrate that BCSMPs provide a substantial quantity of care for sleep disorders among older adults in the United States. However, from a policy perspective, quantity of care is necessary but insufficient to demonstrate the public health value of board certification in sleep medicine. Future studies should consider the association between BCSMP status and quality of care as well as health and economic outcomes among older adults with sleep disorders.

This study possesses strengths. First, we utilized a large, national database derived via random procedures.<sup>22</sup> Second, the CCW includes actual administrative claims directly reflecting the payer perspective. Third, we included a broad range of sleep disorders, including the most common sleep disorders seen in clinical practice. Finally, we employed a novel, rigorous, and highly innovative methodology to identify BCSMPs based on publicly available information.

At the same time, our administrative methodology has limitations. Most important, although our operational definition of sleep disorders was based on physician-assigned diagnoses, there are currently no validated algorithms to identify sleep disorders in claims data. Similarly, our administrative database does not permit analysis of objective sleep parameters, sleep disorders symptoms, or other clinical variables of interest. Nonetheless, we believe that our data provide important, novel insight into the scope of clinical care provided by BCSMPs

at a national population level. Finally, despite the large size of our sample, it is unknown how well this randomly generated 5% sample generalizes to all older adults, or to adults in Medicare advantage plans.

In conclusion, using a national database of Medicare administrative claims, BCSMPs were involved in a great proportion of sleep medicine care to US older adults. To explore further the value of board certification in sleep medicine, future studies should evaluate the impact of BCSMP status on quality of care as well as health and economic outcomes. Such analyses are currently underway.

## ABBREVIATIONS

AASM, American Academy of Sleep Medicine  
 ABMS, American Board of Medical Specialties  
 ABSM, American Board of Sleep Medicine  
 BCSMP, board-certified sleep medicine provider  
 CCW, Chronic Conditions Warehouse  
 CMS, Centers for Medicare and Medicaid Services  
 ICD-9-CM, *International Classification of Diseases, Ninth Revision, Clinical Modification*  
 NPI, National Provider Identifier  
 NPPES, National Plan and Provider Enumeration System  
 OSA, obstructive sleep apnea  
 PAP, positive airway pressure

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## DISCLOSURE STATEMENT

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