## INTRODUCTION
Disturbed sleep affects 50 to 70 million Americans [1], and excessive sleepiness (ES) is reported by 21% of women and 30% of men in the United States [2]. Common causes of ES include insufficient time allocated for sleep, sedating medications, sleep-wake disorders, and medical and psychiatric comorbidities [3]. The psychological, cognitive, and physiological consequences of sleep loss are significant, with considerable health, safety, social, and economic implications, including increased mortality risk, elevated body mass index (BMI), endocrine changes, cardiovascular disease, increased inflammatory response, and altered immune response [4-7]. In addition, ES is associated with reduced cognitive performance, increased risk of motor vehicle accidents and occupational injury, and increased risk of errors on the job [8-12]. In fact, the impact of ES on ability to sustain attention is substantive and actually impairs performance as much as alcohol use [13]. Furthermore, like alcohol, those experiencing ES-related impairment frequently underestimate its risk and impact [14]. Despite its high prevalence, ES is underdetected, and the underlying cause is often not identified and appropriately treated [14-16]. Such suboptimal clinician performance is related to a number of patient- and clinician-associated barriers and gaps. Patients often view ES as a normal variant and therefore generally do not proactively report it unless there has been a related adverse consequence. Furthermore, even when they do report ES, they often use nonspecific language that does not “cue” clinicians to pursue sleep-wake disorders [15].
Regarding clinician-related gaps, failure to systematically screen patients for sleep-related complaints is common. In an annual sleep survey, 86% of respondents reported that their primary care provider (PCP) had never raised the issue of sleep, with 60% of PCPs citing lack of time to do so and 90% of PCPs rating their knowledge of sleep disorders as poor [17,18]. As a second part of this gap, it appears that even when ES is detected, clinicians often do little to probe for and identify the underlying cause. This is likely related to the fact that even though validated diagnostic tools exist for sleep-wake disorders, their use is not routinely implemented into practice. Finally, evidence supports that treatment strategies are often not effectively implemented; nor do many PCPs respect, value, or refer to sleep specialists [19-25]. These gaps and challenges in the screening, diagnosis, and treatment of sleep-wake disorders have led the Institute of Medicine to call for expanded awareness of sleep disorders among healthcare professionals through education and training [1].

In this article, we report on an educational activity that was designed, implemented, and sponsored by CME Outfitters using commercial support via an educational grant from Cephalon. CME Outfitters, LLC, is accredited by the Accreditation Council for Continuing Medical Education to provide continuing medical education (CME) for physicians. CME Outfitters is a provider with accreditation with commendation. The qualitative assessment was independently conducted by AXDEV Group to evaluate the educational impact of the activity with respect to change in knowledge, attitude, and practice, and moreover, to provide direction for improvements and educational opportunities. The CME activity was designed to address the above-described gaps and to achieve the following 3 learning objectives:

1. Increase the percentage of patient visits during which sleep-wake function is evaluated with a screening tool to improve the recognition of sleep-wake disorder symptoms.

2. Utilize diagnostic tools and instruments to improve the accuracy of differential diagnosis of comorbid sleep-wake disorders including obstructive sleep apnea and circadian rhythm sleep disorders such as shift work sleep disorder and jet lag disorder in patients.

3. Integrate primary care providers and sleep specialists into patient care to improve ongoing communication among providers regarding the optimal management of patients with sleep-wake disorders.

Design of the format considered many factors. Expertise in managing sleep disorders, readiness to change, occupational demographics, and ability to segment learners were each weighed and applied to the development of appropriate formats with the goal of affecting a positive shift in knowledge, skills, attitude, and performance. The selection and design of the activity was based on adult learning principles first advanced by Knowles. The activity was a certified 60-minute live and interactive broadcast delivered via satellite TV, webstream, and audio-conference bridge and a supplemental 30-minute question-and-answer session called “After the Show.” The format was a faculty panel presentation in which 3 faculty experts representing various specialties with an interest in sleep medicine (ie, sleep specialist, primary care clinician) discussed clinically relevant, evidence-based topics and focused on translation of evidence into practice. Interactivity was achieved via a question-and-answer segment during which the faculty panel responded to audience comments, questions, and case challenges posed via e-mail, fax, or telephone. Internet polling allowed participants the opportunity to provide real-time feedback regarding issues clinicians face in practice. The “Clinical Connections” were used to summarize the clinical presentations and translate them into 3 to 4 actionable strategies for clinical practice. The additional 30-minute “After the Show” segment permitted the faculty to answer additional participant questions, address challenging cases, and continue to focus on translating the evidence to opportunities to improve the care of patients.

Content for the activity was developed via a 2-day educational needs roundtable involving 6 faculty members and was aligned to the aforementioned learning objectives. For learning objective #1, content focused on the prevalence, causes, and consequences of ES. The faculty incorporated the use of clinical tools to evaluate sleep complaints, and they provided information regarding useful and reliable websites for healthcare providers. For learning objective #2, the presentation focused on the prevalence, consequences, and practical assessment of 3 circadian rhythm disorders that often present with ES. For learning objective #3, the faculty focused on treatment of these disorders, indications for referral, and how to optimize collaboration between primary care physicians and sleep specialists. This live activity took place on September 2, 2009, from noon to 1pm ET and had 1871 registrants and 1186 participants. It should be noted that it was just 1 of several certified activities in a larger educational initiative on improving outcomes for patients with sleep-wake disorders.

**METHODS**

A mixed-methods (quantitative and qualitative) evaluation was conducted to assess the following and to ensure up to and including Level 5 outcomes assessment [26-30]:

1. Change in awareness and recognition of sleep disorders and knowledge of their differential diagnoses and comorbid conditions.

2. Change in clinical reasoning, demonstrating enhancement of the factors and variables incorporated into an optimal assessment, diagnosis, and treatment plan.

3. Change in attitude, indicating increased motivation, interest, and value in the importance of proactively addressing sleep-wake disorders.
The quantitative evaluation consisted of an immediate post-activity questionnaire and a 2-week post-activity questionnaire. The immediate post-activity questionnaire used multiple choice and true/false items to measure activity satisfaction and knowledge change. The 2-week post-activity questionnaire targeted intent to change practice, utilizing Likert rating scales statements. The qualitative component of the evaluation was conducted independently and anonymously by AXDEV Group to ensure conflict-of-interest-free evaluation, and it was approved of by an Institutional Review Board (IRB Service, Boca Raton, Florida). Participants were independently recruited and interviewed prior to the activity and 2 months following the activity to assess impact on knowledge, confidence, and practice behavior change [31-33]. Semi-structured interviews (approximately 45 minutes in length) including presentations of actual clinical practice behaviors were developed based on best practice in identifying, diagnosing, and treating sleep-wake disorders and conducted by experts in qualitative interviewing. Financial compensation was provided to participants in the qualitative evaluation only, as per the parameters of IRB approved research.

Data Collection
During activity registration (prior to September 2, 2009), physicians who registered for the live activity (n = 1871) were invited to be candidates for the qualitative evaluation through an independent opt-in procedure. This pool of opt-in registrants was then selectively sampled, and 14 clinicians were identified to take part in a pre-activity and post-activity interview. Qualitative interview data were collected from August to November 2009. All participants in the CME activity (n = 1186) were invited to participate in the quantitative evaluation only, as per the parameters of IRB approved research.

Data Analysis
Quantitative data were analyzed using means and frequencies. Qualitative data were analyzed with open coding, reviewing the data in detail based on the conceptual framework and research questions identified above [34]. Coding categories were then grouped into related themes and sub-themes, such as Knowledge: lack of knowledge of diagnostic tools, and Attitude: lack of prioritization of sleep-wake disorders. Selective coding was then conducted, whereby data were systematically coded with respect to core concepts identified in literature review and analysis of interview data [34]. Findings of the qualitative and quantitative data were then triangulated [27-31]. Specifically, the quantitative data measured what (ie, what were the educational outcomes that were achieved most/least optimally), whereas qualitative data posits the causal explanation or the why (ie, what causal factors best explain the quantitative results).

RESULTS
Respondents
Of 1186 activity participants, 824 completed a post-test and 534 submitted an activity evaluation form. From the pool of registrants, 14 participants were selectively sampled and participated in the in-depth qualitative interviews.

Activity Value
Collectively, quantitative and qualitative data revealed that the activity helped learners validate knowledge and practice behaviors for physicians experienced in sleep-wake medicine. Novice professionals gained value in learning, increased their confidence, and were able to share information with colleagues. Participants who completed an evaluation form rated learning objectives as having been met with scores from 4.40 to 4.43 out of 5.00.

Activity Format
The interactive discussion of the multi-disciplinary panel presented multiple perspectives, was dynamic, and was not too “research oriented.” The extended question-and-answer period after the session was relevant to clinical practice and noted as very useful by physician participants. The broadcast was of high technical quality, and participants were highly satisfied with the format and presentation of the activity (Figure), rating the overall quality as 4.55 out of 5.00.
Seventy-two percent of participants planned to change their clinical behavior following the activity.

**Activity Impact on Assessment**

In the 2-month post-activity interviews, respondents reported increased awareness of triggers for assessment of sleep-wake disorders (especially cardiovascular comorbidities), increased knowledge of the potential health impact of sleep-wake disorders (especially cardiovascular disease), and most importantly, increased frequency in proactively assessing patients for sleep-wake disorders, and increased knowledge of appropriate assessment questions to ask patients. As stated by this family physician:

“You can be dragging for hours interviewing patients, and it’s not going to be as efficient . . . So they said for history, to rule out any sleep disorders, you just ask 3 questions . . . This was a validated clinical tool I can use.”

In the immediate post-activity questionnaire, items related to assessment were answered correctly by more than 90% of respondents (Table 1). In the 2-week post-activity questionnaire, 59% reported objectively evaluating patients who reported snoring (current = 3.22 out of 5); 63% expressed the intent to do so, with the average score increasing (intended = 3.56 out of 5).

**Activity Impact on Diagnosis**

Two months following the activity, respondents demonstrated suboptimal knowledge and skill in differentially diagnosing sleep-wake disorders, still relying largely on the patient history as evaluated via patient case vignette. Participants described ongoing confusion about overlapping symptoms between circadian rhythm disorders and other comorbidities such as depression. Some physicians also admitted to not using validated tools for diagnosis of sleep-wake disorders, being uncertain of which scale to use, being uncertain that there is any additional value in quantifying sleep problems, and characterizing tools as being more research oriented than useful in clinical practice. There was an increase in the intent to implement use of evaluation tools in the future, particularly the Epworth Sleepiness Scale (ESS), which was seen as an important objective measure of ES and useful for documentation purpose. Most participants did not remember other tools presented, and this was reinforced by scores on the immediate post-activity survey (Table 2), in which 99.5% correctly identified the ESS, but 56% were not able to identify the Insomnia Severity Index. In the 2-week post-activity questionnaire, 56% expressed the intent to use at least 2 of the formal, standardized assessment tools presented in the activity (intended = 3.30 out of 5).

**Activity Impact on Team Management**

Following the activity, most physicians did not report any substantive change in when, how, and to whom they refer patients with sleep-wake disorders. They reported seeing limited value in referring patients and limited guidance as to when they should refer to a sleep specialist. As stated by this psychiatrist:

“The neurologist is the only one in town that will treat difficult insomnia. The rest of them are extremely disappointing; if it’s outside of restless leg, sleep apnea, or narcolepsy, they’re pretty clueless.”

Understanding of roles and responsibilities of team members continued to be a challenge, with lack of clarity as to who should follow-up when a patient is referred. Lack of communication and coordination between healthcare professionals was an ongoing barrier, with the patient becoming the only source of information. Of the 27 participants who completed the post-activity after two weeks, 33% reported consulting with a local sleep specialist or a colleague regarding barriers to optimal continuous positive airway pressure (CPAP) utilization in patients with obstructive sleep apnea (OSA) (current = 2.96), but 55% expressed an increase in their intent to do so (intended = 3.52).

**DISCUSSION**

Sleep-wake disorders negatively impact overall health and quality of life, yet gaps

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**Table 1. Responses Related to Screening and Assessment for Sleep-Wake Disorders on the Immediate Post-Activity Questionnaire**

<table>
<thead>
<tr>
<th>Question</th>
<th>Number of Right Answers (n = 824)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Common causes of excessive sleepiness</td>
<td>752 (91.2%)</td>
</tr>
<tr>
<td>Common complaints from patients that clinicians should consider evaluating for excessive sleepiness</td>
<td>822 (99.8%)</td>
</tr>
<tr>
<td>Impact of sex and body mass index [BMI] on risk of obstructive sleep apnea</td>
<td>801 (97.1%)</td>
</tr>
</tbody>
</table>

**Table 2. Responses Related to Diagnostic Testing for Sleep-Wake Disorders on the Immediate Post-Activity Questionnaire**

<table>
<thead>
<tr>
<th>Question</th>
<th>Number of Right Answers (n = 824)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description and use of the Epworth Sleepiness Scale</td>
<td>820 (99.5%)</td>
</tr>
<tr>
<td>Interpretation of the Epworth Sleepiness Scale</td>
<td>815 (98.9%)</td>
</tr>
<tr>
<td>Interpretation of the Fatigue Severity Scale</td>
<td>791 (95.9%)</td>
</tr>
<tr>
<td>Description and use of the Insomnia Severity Index</td>
<td>462 (56.1%)</td>
</tr>
<tr>
<td>Indications for full-night in-laboratory polysomnography</td>
<td>800 (97.1%)</td>
</tr>
</tbody>
</table>
exist in the care received by these patients [1]. A multifaceted CME satellite TV broadcast, webcast, and audio-conference was developed to address identified gaps in clinical practice. The live component of the activity was evaluated using both qualitative and quantitative methods. The evaluation showed satisfaction with the format and content of the activity and increases in intent to change practice related to ES and sleep-wake disorders. Participants reported that the activity was relevant to their clinical practice and that the panel discussion with extended question-and-answer format provided multiple perspectives that were clinically useful. Increased awareness of sleep-wake disorders and its assessment were demonstrated. Participants registered agreement that the learning objectives were met and reported increased frequency in proactively assessing patients for sleep-wake disorders. Despite clinical reminders and tools for diagnosis that were also presented in the activity, fewer participants reported using validated diagnostic tools during the 2-month follow-up interviews, citing several reasons including under-appreciation of value offered by clinical tools and uncertainty about which scale to use and interpretation of findings. Many physicians did report that they would ask their patients about the quality of their sleep. Limited improvement was seen in referral rates of patients with sleep-wake disorders to sleep specialists; many physicians reported having no clear guidelines as to when they should refer and why. It should be noted that some participants did indicate increased interest in becoming more familiar with professionals at their local/regional sleep center(s). Change in team-based processes is based not only on knowledge, but also on relationships and systems issues such as availability of specialists; this was beyond the scope to the activity and may explain the minimal impact seen regarding team processes. Though online resources have the potential to serve admirably in identifying local resources such as specialists and sleep clinics and can initiate such connections through interactive forums, they are less well suited to addressing relationship and system challenges. The positive impact of this activity on knowledge and awareness of identification, diagnosis, and management of sleep-wake disorders suggests overall effectiveness of the activity. The value of the opportunity for asynchronous discussion was demonstrated and can promote change in practice as well as provide ongoing stimulus for eventual translation of knowledge into practice [35-39].

Limitations
The participants of the mixed-methods evaluation research were volunteers, and such a self-selected sample may have differed from those who chose not to participate. Participants of the qualitative interviews were limited to physicians, reducing the generalizability of the findings to other types of healthcare professionals. The results in attitude and practice are based on self-report and self-assessment, which may not always translate to clinical performance. In addition, the questionnaire data was collected after the activity only, without a pre-activity baseline; however, a baseline was obtained for the qualitative interviews, and triangulation of findings across interview and questionnaire data supports the strength of the findings [27,28]. Finally, this assessment was based on a single CME activity, and significant change in practice often demands multiple educational interventions, which was outside the scope of this evaluation.

CONCLUSIONS
Providing optimal patient care for any disorder begins with recognition of its associated signs and symptoms. This is a particularly germane point to consider regarding the symptom of ES. The CME activity described in this article aimed to address known gaps in recognition and screening for ES and associated sleep-wake disorders (ie, OSA, shift work disorder, and jetlag disorder). The evaluation results indicate that this activity contributed to important improvements in clinician knowledge and performance, most prominently in the area of screening and identification. Future educational initiatives need to extend this education to more learners and to provide additional education regarding the need to use objective tools and the value of referral and improved collaboration between primary care providers and sleep specialists. Optimal patient care is on a continuum, and constant assessment and improvement of clinician knowledge and skills is warranted as new evidence becomes available that helps clinicians individualize care for patients with sleep-wake disorders.

REFERENCES
8. Ayas NT, Barger LK, Cade BE, et al.


