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In-office communication about excessive daytime sleepiness associated with treated obstructive sleep apnea: insights from an ethnographic study of physician-patient visits

Christine Won[1,2*], Richard K. Bogan[3,4], Karl Doghramji[5], Joseph Ojile[6], Shay Bujanover[7], Danielle L. Hyman[7], Kathleen A. Hewett[8] and Robert Thomas[9]

Abstract

Background: Excessive daytime sleepiness (EDS), a primary symptom of obstructive sleep apnea (OSA), negatively affects functioning and quality of life (QoL). EDS can persist despite primary airway therapy, and often remains unmanaged, potentially due to inadequate provider-patient communication. Ethnographic research was conducted to assess provider-patient communication about EDS.

Methods: Participating physicians (primary care $n=5$; pulmonologists $n=5$; sleep specialists $n=3$) identified adult patients ($n=33$) diagnosed with OSA who were prescribed positive airway pressure (PAP) therapy $\geq$6 months prior and previously reported EDS. Visits and post-visit interviews were video-recorded and analyzed using standardized, validated sociolinguistic techniques.

Results: Despite 55% of patients (18/33) reporting QoL impacts post-visit, this was discussed during 28% (5/18) of visits. Epworth Sleepiness Scale was administered during 27% (9/33) of visits. Many patients (58% [19/33]) attributed EDS to factors other than OSA. Physicians provided EDS education during 24% of visits (8/33). Prior to the visit, 30% (10/33) of patients were prescribed EDS medication, of which 70% (7/10) reported currently experiencing EDS symptoms.

Conclusions: EDS was minimally discussed and rarely reassessed or treated after PAP therapy initiation in this study. Patients often attributed EDS to factors other than OSA. The findings suggest physicians and patients may benefit from dialogue tools, routine use of screening tools, and patient education.

Keywords: Excessive daytime sleepiness, Hypersomnolence, Physician-patient communication, Obstructive sleep apnea, Qualitative research

Introduction

Obstructive sleep apnea (OSA), defined as an apnea-hypopnea index (AHI) $\geq$5 with associated signs/symptoms, or an AHI $\geq$15 with no associated signs/symptoms, occurs on average in 22% (range, 9–37%) of men and 17% (range, 4–50%) of women (Sateia 2014; Franklin and

*Correspondence: christine.won@yale.edu
[1] Yale School of Medicine, 300 Cedar Street TAC 441, PO Box 208057, New Haven, CT 06520-8057, USA
Full list of author information is available at the end of the article
Shay Bujanover and Danielle L Hyman are former employees of Jazz Pharmaceuticals.

Lindberg 2015). Excessive daytime sleepiness (EDS) is a main symptom of OSA, and is often a primary complaint for patients seeking medical care (Pagel 2009; Dongol and Williams 2016). EDS linked to OSA is associated with a negative impact on patient and public safety (Ward et al. 2013; Lloberes et al. 2000), daily functioning and work productivity (Mulgrew et al. 2007; Omachi et al. 2009), and quality of life (QoL) (Silva et al. 2009). It is also associated with impairments in motivation and mood, including depression and anxiety (Bixler et al. 2005; Gasa et al. 2013; Pepin et al. 2009; Lee et al. 2015), and cognitive function including attention, memory, and higher-order executive functions (Dean et al. 2010; Zhou et al. 2016; Redline et al. 1997; Werli et al. 2016).

Positive airway pressure (PAP) therapy is the standard of care to treat OSA (Epstein et al. 2009; Calik 2016), but 9–22% of patients with OSA experience persistent EDS despite adherence to PAP treatment and AHI normalization (Dongol and Williams 2016; Gasa et al. 2013; Pepin et al. 2009; Weaver et al. 2007; Weaver et al. 2004; Antic et al. 2011; Koutsourelakis et al. 2009; Weaver et al. 2005). There are many potential causes of EDS in patients with OSA, including insufficient sleep, PAP issues (eg, insufficient use, mask leaks), depression, anxiety, hypothyroidism, medication side effects, obesity, and other sleep disorders (Javaheri and Javaheri 2020). While there are effective therapies for EDS in OSA patients, such as modafinil, armodafinil, and solriamfetol, (Chapman et al. 2016; Sukhal et al. 2015; Pack et al. 2001; Rosenberg and Doghramji 2009; Schweitzer et al. 2019) many patients remain symptomatic (Gasa et al. 2013; Pepin et al. 2009). One reason may be that physician-patient dialogue about EDS is limited in OSA patients due to lack of practical objective EDS assessment tools (Chapman et al. 2016; Roth et al. 2010; Reuveni et al. 2004; Chervin et al. 1997), prioritization of PAP adherence (Sukhal et al. 2015; Pack et al. 2001; Pollak 2003), or patient under-recognition and minimization of EDS (Weaver et al. 2004; Engleman et al. 1997).

Fostering more effective communication has been shown to improve health outcomes, physician-patient alignment, and patient understanding and satisfaction (Hahn et al. 2008; Ong et al. 1995). To understand physician-patient communication regarding persistent EDS and its potential role in treatment decisions, we conducted an in-office ethnographic sociolinguistic study of visits.

Materials and methods

Sample selection

Primary care physicians (PCPs), pulmonologists, and sleep specialists ($n = 5073$) in community-based practices and nonacademic sleep centers across the United States were invited to participate in the study. Physicians who were board-certified or board-eligible in their specialty, in practice 2–35 years, and in practice full time, spent a minimum of 75% of time in direct patient care, conducted ≥75% of patient discussions in English and, in a typical month, treated ≥30 patients with OSA who had been prescribed PAP therapy, either continuous positive airway pressure (CPAP) or bilevel positive airway pressure (BiPAP) for ≥6 months, were eligible to participate.

Participating physicians identified eligible adult patients who were previously diagnosed with OSA, fluent in English, not cognitively impaired, and prescribed PAP therapy for ≥6 months prior to the visit and had reported experiencing EDS symptoms to their physician prior to the visit. Patients eligible for enrollment had a significant discussion of OSA during the visit. Participating patients identified eligible care partners who were people with whom they discussed treatment and/or who assisted in making treatment decisions.

Study design

This study was approved by the New England Institutional Review Board (IRB Number: 120170306, Protocol Number: 1233110) and conducted in accordance with the amended Declaration of Helsinki. All recorded participants provided written informed consent. The study methodology is summarized in Fig. 1. This study design emulates other ethnographic studies, such as Rubin et al. (2017).

One to 2 days of research was conducted at each physician's practice by 1 member of a team of trained ethnographic researchers. Patients who met the criteria were invited by office staff to participate in this research upon arrival for their regularly scheduled appointments. Potential patient participants met with the researcher to receive information about the study and provide written informed consent. Participants were informed that they would be part of a communication study and their visits would be audio- and video-recorded. Specific research objectives were not shared with participating physicians, patients, care partners, or research coordinators.

Eligible care partners were invited to participate. Those who were interested in participating and present at the visit provided written informed consent. Patients with a care partner who was not at the visit were provided materials about the research to share with them. These care partners were given the opportunity to participate in a telephone interview (see Additional file 1). Written informed consent was acquired prior to the interview.

Physician-patient interactions were audio- and video-recorded without the researcher present in the exam room. Immediately following each visit, the researcher

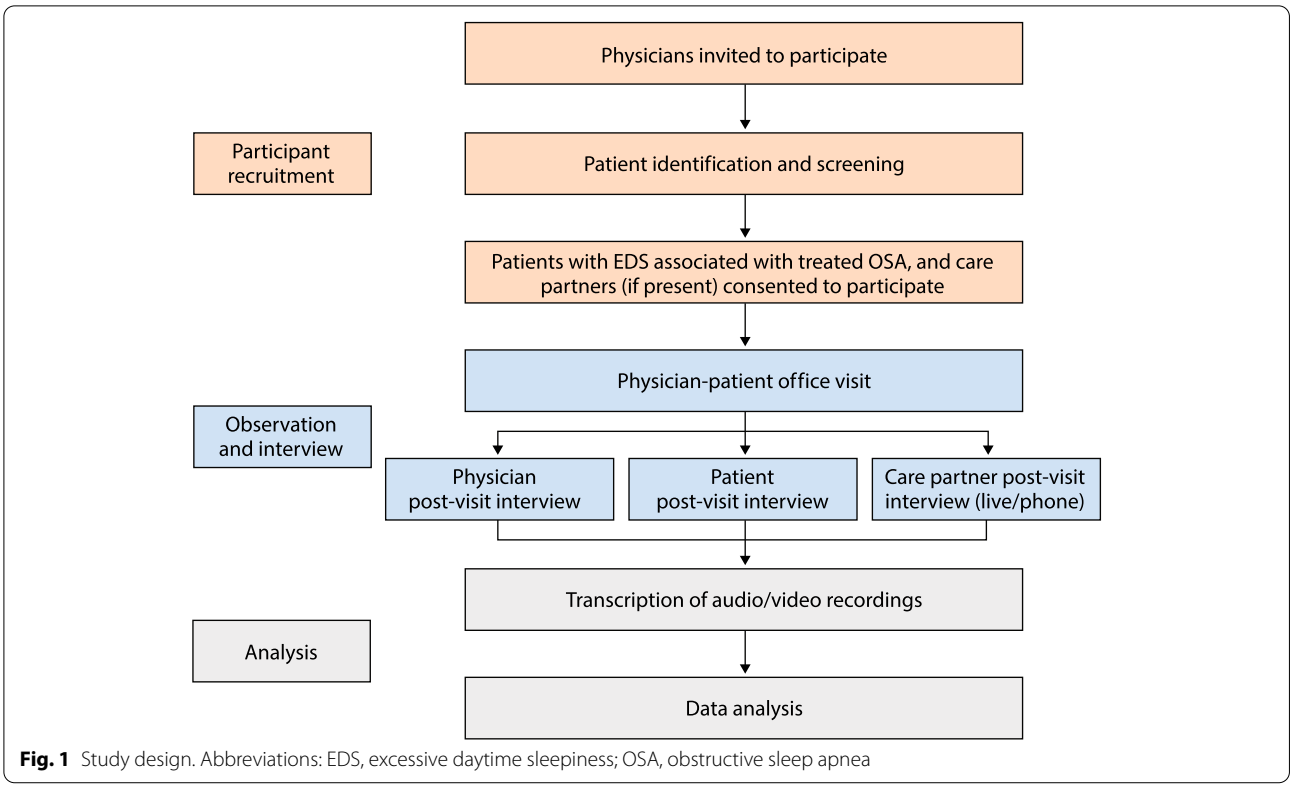

Fig. 1 Study design. Abbreviations: EDS, excessive daytime sleepiness; OSA, obstructive sleep apnea

conducted an interview with the patient (approximate duration, 20 min) (see Additional file 2) and administered a written questionnaire (see Additional file 3). At the end of the day, the researcher conducted an interview with the physician about each patient (approximately 20 min per patient) and his or her general attitudes and treatment practices (10–20 min) (see Additional file 4). The physician was administered written questionnaires about each patient (see Additional file 5). The physician was able to reference patient records; the researcher was not provided access. The physician interviews and questionnaires were completed at the end of the day to minimize disruption of the office environment and typical practices. The interviews and questionnaires were used to gather history, demographics, attitudes, experiences, perceptions about the interaction, and alignment. Participating physicians, patients, care partners, and research coordinators were financially compensated for their participation. Due to the observational nature of this study, data collection only included observing physician and patient interactions and interviews/questionnaires to gather history, demographics, attitudes, experiences, perceptions about the interaction, and alignment. Clinical data on ESS scores, OSA severity, and primary therapy adherence were not collected.

Data analysis

Audio recordings of visits and interviews were transcribed. Video recordings were used as quality control and to reveal nonverbal communication. Transcripts were analyzed using interactional sociolinguistic methods to understand the conversational dynamics of the physician-patient interaction (Gumperz 1999; Hamilton 2004), including detailed analysis and categorization of language at the topic and word level and assessment of speaker roles and alignment. Adherence to PAP therapy was collected through patient and physician reports, rather than clinical measure, to assess alignment. A subset of transcripts was reviewed first to identify trends and develop hypotheses. An analytic plan was developed and executed on the full dataset. A Fisher's exact test was conducted to test for statistical significance comparing proportions from different populations.

Themes were assessed using descriptive statistics, including:

- The number of patients who reported EDS symptoms post-visit, reported EDS symptoms during the visit, related EDS symptoms to other factors, reported current QoL impacts of EDS, and/or had been prescribed medication for EDS prior to the visit
- The number of visits when the following were discussed: QoL impacts of EDS, PAP therapy adherence

and usage data, and/or adherence to medication for EDS
- The number of visits at which physicians asked at least 1 open-ended question related to EDS, asked about QoL impacts of EDS, mentioned treatment options for EDS, and/or prescribed new treatment for EDS
- The number of visits at which physicians and/or their office staff provided education about EDS and/or used the Epworth Sleepiness Scale (ESS) questionnaire
- The percentage of the visit discussion focused on key topics, including EDS and PAP therapy

Results

Sample profile

A total of 19 (0.004%) physicians responded; 13 (0.003%) physicians located across the United States met the criteria and agreed to participate. PCPs ($n=5$), pulmonologists ($n=5$), and sleep specialists ($n=3$) were enrolled.

A total of 39 patients were approached, consented, and recorded. Some of these patients did not meet the eligibility requirements because they were not prescribed PAP therapy for ≥6 months prior to the visit ($n=3$), or there was minimal discussion of OSA during the visit ($n=3$). A total of 33 patients were enrolled in the study. Forty-two percent ($n=14/33$) of enrolled patients were seen by their pulmonologist, 33% ($n=11/33$) by their PCP, and 24% ($n=8/33$) by their sleep specialist.

Twelve care partners were also enrolled, of whom 7 participated in follow-up telephone interviews, 4 were present during the visit and interviewed at the office, and 1 was not present during the visit, but was interviewed at the office. Care partner interviews were not analyzed for this study. The characteristics of the physicians and patients are summarized in Tables 1 and 2.

Table 1 Characteristics of participating physicians

Physician/Clinic Characteristics	
No. of participants	13
Male, No. (%)	10 (76.9)
Years in practice, mean (SD; range)	21 (10.3; 2–35)
Type of practice, No. (%)	
Group	9 (69.2)
Solo	4 (30.8)
Specialty, No. (%)	
Primary care	5 (38.4)
Pulmonology	5 (38.4)
Sleep	3 (23.1)
Location, No. (%)	
California	3 (23.1)
Florida	3 (23.1)
Alabama	1 (7.7)
Arizona	1 (7.7)
Illinois	1 (7.7)
New Jersey	1 (7.7)
North Carolina	1 (7.7)
Ohio	1 (7.7)
West Virginia	1 (7.7)

Notes: Data presented as mean (SD; range) or n (%) as indicated

Table 2 Characteristics of participating patients

Patient Characteristics	
No. of participants	33
Age, mean (range), y	62 (35–80)
Male, No. (%)	25 (75.8)
Length of physician-patient relationship, No. (%)[a]	
< 1 y	4 (12.1)
1–3 y	10 (30.3)
3–5 y	4 (12.1)
> 5 y	15 (45.5)
Duration on PAP therapy, No. (%)[a]	
6–12 mo	1 (3.0)
1–2 y	8 (24.2)
3–4 y	10 (30.3)
5+ y	14 (42.4)
Current medication for EDS (at start of visit), No. (%)[a]	
Wake-promoting agent	7 (21.2)
Stimulant	3 (9.1)
None	23 (69.7)

Notes: [a]According to physician or confirmed during visit discussion

Abbreviations: *EDS* Excessive daytime sleepiness, *PAP* Positive airway pressure

Dialogue characteristics

The average visit length was 14.05 min (SD, ± 5.85). The average percentage of the visit discussion dedicated to key topics is illustrated in Fig. 2. Thirteen percent of the visit dialogue time (mean [SD] 1.83 min [± 1.77]) was related to EDS, including discussion within and outside the context of PAP therapy. EDS was discussed exclusively within the context of PAP therapy during 18% of visits ($n=6/33$), of which 67% ($n=4/6$) were with PCPs and 33% ($n=2/6$) were with pulmonologists. Examples of this and other key characteristics of physician and patient visit dialogue are shown in Table 3.

During 24% ($n=8/33$) of visits, physicians provided some education related to EDS, including information about symptoms, ESS scoring, potential impacts, and/or treatment. During visits with 33% ($n=11/33$) of patients, physicians asked at least 1 open-ended question related to EDS. Of these patients, 45% were

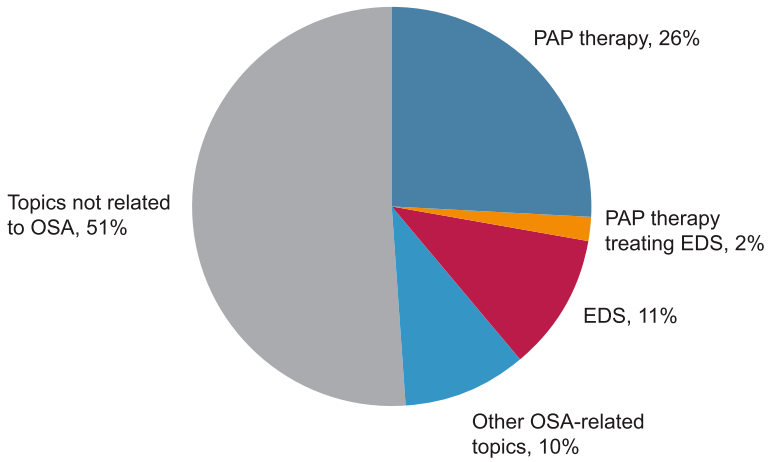

Fig. 2 Average percentage of visit discussion dedicated to key topics. Notes: Visit discussion among all participants, including physicians, patients, visit companions, and other healthcare professionals, if applicable. PAP Therapy: Discussion of PAP therapy (eg, Physician: "And how do you feel like you're doing with your [CPAP] machine?"); PAP Therapy Treating EDS: Discussion of PAP therapy in the context of treating EDS (eg, Physician: "Did the use of the [CPAP] machine make you feel better during the day? Did you have more energy? Were you less sleepy?"); EDS: Discussion of EDS (eg, Physician: "There are medications to help during the daytime if you're really sleepy."); other OSA-related topics: Discussion of other OSA-related topics, such as sleep hygiene, weight, and other symptoms (eg, Physician: "I wouldn't try to nap all over the house. I mean, obviously the bedroom is the place for sleeping."); topics not related to OSA: Discussion of other topics during the visit that are not directly related to OSA (eg, Patient: "I'm allergic to penicillin."). Abbreviations: EDS, excessive daytime sleepiness; OSA, obstructive sleep apnea; PAP, positive airway pressure

Table 3 Examples of physician and patient visit dialogue characteristics

Dialogue Characteristic	Dialogue Example
Physician discussing EDS within the context of PAP therapy	Physician: Did the use of the [CPAP] machine make you feel better during the day? Did you have more energy? Were you less sleepy? —visit with a PCP and a 47-year-old male
Physician providing education related to EDS	Physician: In terms of the daytime, there are medications to help during the daytime if you're really sleepy. —visit with a sleep specialist and a 44-year-old female
Physician asking an open-ended question related to EDS	Physician: How sleepy are you these days? —visit with a sleep specialist and a 55-year-old male
Physician asking about potential impacts of EDS on QoL	Physician: How about drowsy driving? Has that been an issue at all? —visit with a sleep specialist and a 65-year-old male
Patient reporting EDS symptoms during the visit	Physician: And during the day you're not tired or sleepy? Patient: Umm, around 2:00 I do. I get sleepy. —visit with a pulmonologist and a 54-year-old female
Patient reporting EDS symptoms during the visit	Physician: Then, do you end up taking a nap in the daytime, or no? Patient: Yes. Almost… Physician: Every day? Patient: Not every day, but probably 70%. —visit with a PCP and a 73-year-old male
Patient relating EDS symptoms to another factor	Physician: But you peter out during the day sometimes? Patient: But I think people my age [do]. —visit with a pulmonologist and a 79-year-old male

Abbreviations: *CPAP* Continuous positive airway pressure, *EDS* Excessive daytime sleepiness, *PAP* Positive airway pressure, *PCP* Primary care physician, *QoL* Quality of life

attending visits with their sleep specialist ($n=5/11$; 5/8 sleep specialist visits), 36% with their pulmonologist ($n=4/11$; 4/14 pulmonologist visits), and 18% with their PCP ($n=2/11$; 2/11 PCP visits).

Screening and QoL impact

The ESS was administered during 27% of visits ($n=9/33$). It was administered during 50% ($n=7/14$) of pulmonology visits and 25% ($n=2/8$) of sleep specialist visits.

Among the visits that obtained an ESS ($n=9$), physicians discussed the results with their patients 67% of the time ($n=6/9$). During a third ($n=2/6$) of these discussions, physicians segued from dialogue about ESS scores to dialogue about medication for EDS.

Physicians asked 18% ($n=6/33$) of patients about the potential impact of EDS on QoL, despite 55% ($n=18/33$) of patients reporting current QoL impacts of EDS at their post-visit.

Symptoms and treatment

PAP therapy adherence was discussed during all visits. It was augmented by discussion of PAP usage data during 42% ($n=14/33$) of visits (57% [$n=8/14$] with pulmonologists and 43% [$n=6/14$] with sleep specialists).

Prior to the visit, 30% ($n=10/33$) of patients had already been prescribed medication for EDS (4 of whom attended visits with sleep specialists, 4 with pulmonologists, and 2 with PCPs) (Fig. 3). Adherence to medication was discussed during all of these patients' visits. Seventy percent ($n=7/10$) of the patients prescribed medication were asked open-ended questions related to EDS versus 17% ($n=4/23$) of patients who were not prescribed medication ($P<0.01$). During visits, 70% of the patients prescribed medication (n=7/10) reported currently experiencing EDS symptoms.

Among patients not prescribed medication, 78% ($n=18/23$) were currently experiencing symptoms of daytime sleepiness and/or the need to nap during the day, as reported by the patient during the visit and/or post-visit interview. The vast majority (83%; $n=15/18$) of these patients reported these EDS symptoms during the visit. However, treatment options for EDS were discussed in only 27% ($n=4/15$) of cases and led to only one intervention from a sleep specialist for an oral appliance to specifically address EDS symptoms (Fig. 3).

Fifty-eight percent of patients ($n=19/33$) associated their EDS symptoms to factors other than OSA, such as comorbidities, other treatments and medications, work, retirement, age, weight, and sleep habits.

Discussion

Although EDS is a core symptom of OSA and often the impetus for sleep evaluation (Pagel 2009; Dongol and Williams 2016), in this cross-sectional, observational study, EDS was minimally discussed and rarely reassessed or treated after PAP therapy initiation, even when patients were still experiencing EDS symptoms and related QoL impacts. The focus of the visit discussion in this study was on the use of PAP therapy, rather than clinical effectiveness and persistent symptoms. Ongoing assessment of EDS at regular intervals is recommended (Weaver et al. 2007); however, despite this recommendation, the ESS was not universally administered at physician visits in this study and patients were rarely asked at these visits about the impact EDS may have on their QoL. From a patient perspective, despite reporting persistent EDS, many patients attributed it to factors other than OSA, and did not bring up the QoL impacts with their physicians during the visits in this study.

Prior to this study, very little was known about communication between patients and treating physicians regarding EDS associated with OSA. This study was the first to explore the nature of this dialogue, using interactional

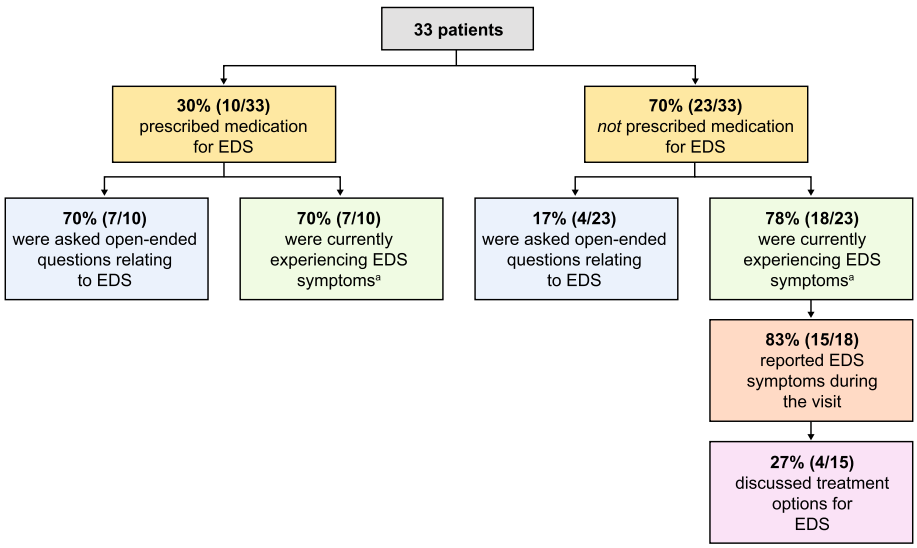

Fig. 3 Patient-physician interactions. Notes: [a]As reported by the patient during the visit and/or post-visit interview

sociolinguistic methods that are standard for this type of observational research, and identify areas for improvement. Studies of physician-patient communication in other disease categories have found that more effective communication, such as the increased use of open-ended questions, has led to improvement in health outcomes, physician-patient alignment, and patient understanding and satisfaction (Ong et al. 1995; Gumperz 1999). EDS is an important target for intervention in patients with OSA because it is associated with significant negative impacts on patient and public safety (Ward et al. 2013; Lloberes et al. 2000), patient daily functioning, work productivity, and QoL (Mulgrew et al. 2007; Omachi et al. 2009; Silva et al. 2009; Bixler et al. 2005; Gasa et al. 2013).

There are parallels between these findings and research in other fields in which routine screening for specific behavioral and mental health issues, such as diet, exercise, smoking, alcohol use, drug use, stress, depression, and anxiety have been shown to improve patient care and satisfaction (Krist et al. 2016; Sharp and Lipsky 2002). Other areas for which standard guidelines are lacking, including pain, domestic abuse, social neglect, and elder abuse, have seen substantial research and interest in developing screening guidelines (Owen et al. 2018; Shavers 2013; Ferreira et al. 2015; Sheehan et al. 2016; Wagenaar et al. 2010), suggesting that routine screening is increasingly recognized as a valuable approach to improve care across a wide range of settings. Thus, an approach may be to include screening for EDS during routine medical evaluation for all patients, even those not diagnosed with OSA. This approach may identify other causes of EDS, including narcolepsy, idiopathic hypersomnia, severe social jet lag, and chronic partial sleep deprivation (Pagel 2009; Lunn et al. 2017). The ESS is a useful tool in clinical practice to evaluate EDS, however, it may not be representative of how patients universally describe and experience their EDS. Using this tool with effective open-ended questioning, or developing a new screening and monitoring tool for EDS in OSA that is more representative of the way current patients speak to their sleepiness, could help optimize the treatment of EDS in OSA (Omobomi and Quan 2018).

This study had some limitations. The participation fraction was small, which was expected due to the observational nature of the research, thus generalization was limited, and the study was not powered to compare specialists and generalists. The rate of response and sample size, including the study of specialty cohorts, were typical of ethnographic sociolinguistic research (Hahn et al. 2008; Rubin et al. 2017; Gumperz 1999; Hamilton 2004). Participants in this research knew they were being recorded; this, along with the level of trust the participant had previously established with the provider, may have affected their behavior. One could postulate that this may have caused participants to communicate more effectively than would be typical, so it is unclear why those who participated would have been unlikely to address EDS. Due to the cross-sectional and observational nature of this study, causal associations, including why EDS was not addressed, could not be determined. Since the majority of patients had been visiting these physicians for years, it is possible that EDS may have been discussed more comprehensively during previous visits, but the single-day design of this study prohibited characterization of the longitudinal relationship between the physician and patient. If this was the case, it could also suggest the need to reevaluate EDS symptoms in patients who may have initially reported resolution of EDS, since many of these patients described EDS symptoms at the time of this study.

Due to the nature of this study, another limitation includes the lack of collection of clinical data on PAP usage, OSA severity, or subjective or objective measures of EDS (eg, Epworth Sleepiness Scale scores, Maintenance of Wakefulness Test mean sleep latency, or Multiple Sleep Latency Test mean sleep latency). It is acknowledged that many clinical factors shape the discussion between patient and physician, and these clinical data may have informed why EDS was not discussed.

This study did not explore possible reasons why EDS is not addressed after PAP therapy initiation ("attitudes to EDS"), including de-prioritization of EDS, and assumption that patients would raise the topic if it is of concern. This research also did not assess why patients attribute persistent EDS to factors other than OSA. However, this research may inform the design of future studies to explore potential areas for intervention.

Conclusions

In this ethnographic sociolinguistic study, during visits between physicians and sleepy patients with OSA treated with PAP therapy, EDS had a minimal role in the dialogue. Symptoms and QoL impacts were often overlooked, and treatment options were rarely discussed or prescribed. Physicians and patients may benefit from improved use of existing screening and monitoring tools for EDS (eg, ESS) and access to dialogue tools (eg, discussion guides) and communication training (eg, to ask open-ended questions). One approach to improved communication about EDS would be to include standardized assessment and research-guided questioning during routine medical evaluation.

Abbreviations

AHI: Apnea-Hypopnea Index; BiPAP: Bilevel Positive Airway Pressure; CPAP: Continuous Positive Airway Pressure; ESS: Epworth Sleepiness Scale; EDS:

Excessive Daytime Sleepiness; IRB: Institutional Review Board; PAP: Positive Airway Pressure; PCP: Primary Care Physicians; OSA: Obstructive Sleep Apnea; QoL: Quality of Life.

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s41606-022-00072-y.

Additional file 1. Care Partner Post-Visit Interview Discussion Guide.

Additional file 2. Patient Post-Visit Interview Discussion Guide.

Additional file 3. Patient Post-Visit Interview Questionnaire.

Additional file 4. Physician Post-Visit Interview Discussion Guide.

Additional file 5. Physician Post-Visit Interview Questionnaire.

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Authors' contributions
KAH was the principal investigator for the study and takes responsibility for the integrity and content of the manuscript, including the data and analysis. CW, RKB, KD, JO, SB, DLH, KAH, and RT contributed to the conception and design of the study, data interpretation, drafting of the submitted article, and critical revision of the manuscript for important intellectual content. KAH contributed to data acquisition and analysis. CW, RKB, KD, JO, SB, DLH, KAH, and RT provided final approval of the version to be published and agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. All authors have reviewed and approved this manuscript.

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Availability of data and materials
All data generated or analyzed during this study are included in this published article and its supplementary information files.

Declarations

Ethics approval and consent to participate
This study was approved by the New England Institutional Review Board (IRB Number: 120170306, Protocol Number: 1233110) and conducted in accordance with the amended Declaration of Helsinki. All recorded participants provided written informed consent.

Consent for publication
Not applicable.

Competing interests
CW and KD are consultants for, and participate in research that is supported by, Jazz Pharmaceuticals. RKB is on the speakers' bureau for Jazz Pharmaceuticals, advisory board and has participated in industry-sponsored research. JO is an employee of the Caduceus Corporation and the Clayton Sleep Institute, LLC; has received research funding from Fisher-Paykel, Jazz Pharmaceuticals, Respironics, and Teva; has served on the speakers' bureaus for AstraZeneca, Boehringer Ingelheim, Merck, and Teva; and serves as a board member for the National Sleep Foundation. SB and DLH are former employees of Jazz Pharmaceuticals who, in the course of their employment, have received stock options exercisable for, and other stock awards of, ordinary shares of Jazz Pharmaceuticals PLC. KAH is an employee of Ogilvy Health and was a paid consultant to Jazz Pharmaceuticals in connection with performing this research and with the development of this publication. RT receives royalty payments from MyCardio, LLC for CG-based sleep and sleep apnea phenotyping software, has consulted for DeVilbiss-Drive for CPAP software development, and is a consultant for GLG Councils and Jazz Pharmaceuticals. He has a patent for a device regulating CO_2 for central/complex apnea treatment.

Author details
[1]Yale School of Medicine, 300 Cedar Street TAC 441, PO Box 208057, New Haven, CT 06520-8057, USA. [2]VA Connecticut Healthcare System, West Haven, CT, USA. [3]SleepMed, Inc., Columbia, SC, USA. [4]University of South Carolina School of Medicine, Columbia, SC, USA. [5]Thomas Jefferson University, Philadelphia, PA, USA. [6]Saint Louis University School of Medicine, Saint Louis, MO, USA. [7]Jazz Pharmaceuticals PLC, Palo Alto, CA, USA. [8]Ogilvy Health, Parsippany, NJ, USA. [9]Beth Israel Deaconess Medical Center, Boston, MA, USA.

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