JCSM
Journal of Clinical Sleep Medicine

REVIEW ARTICLES

Impact of Obstructive Sleep Apnea and Its Treatments on Partners: A Literature Review

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Study Objectives: Many adults sleep with a significant other; thus, sleep disorder symptoms and treatments of one partner are likely to impact the other partner's health. A literature review was conducted to examine the impact of obstructive sleep apnea (OSA) and OSA treatments on partner-assessed sleep and daytime functioning and partner involvement in OSA treatment.

Methods: MEDLINE, EMBASE, and CINAHL searches yielded 38 pertinent quantitative and qualitative studies that described sleep and/or daytime functioning assessed in partners of patients with untreated OSA, sleep and/or daytime functioning assessed in partners who were referred for OSA treatment, including continuous positive airway pressure (CPAP) therapy, oral appliance (OA), or surgery, and/or associations between partner involvement and OSA treatment use.

Results: The majority of studies found untreated OSA to have a negative impact on partners' objective and subjective sleep and daytime functioning, in particular mood, quality of life, and relationship quality. Improvements in partner-assessed sleep quality were reported for CPAP, OA, and surgery. Conflicting results were reported for partners' mood, quality of life, daytime sleepiness, and relationship quality. Perceived partner support was associated with greater CPAP use.

Conclusions: Symptoms associated with OSA can negatively impact partners' sleep and daytime functioning. Treatment of OSA with CPAP, OA, or surgery can have health benefits for not only patients but also partners. Collaborative partner involvement may be a useful strategy for interventions promoting CPAP adherence.

Keywords: continuous positive airway pressure, obstructive sleep apnea, oral appliance, partner, spouse

Citation: Luyster FS. Impact of obstructive sleep apnea and its treatments on partners: a literature review. *J Clin Sleep Med.* 2017;13(3):467–477.

INTRODUCTION

Obstructive sleep apnea (OSA) is an exceedingly common sleep disorder characterized by snoring, repetitive apneas, sleep disruption due to frequent arousals, and, for some, daytime sleepiness. Untreated OSA is associated with adverse health outcomes, including decreased quality of life, psychological symptoms, insulin resistance, and increased risk for cardiovascular disease and mortality.[1–4] Continuous positive airway pressure (CPAP) therapy is the first-line treatment for OSA, and mounting evidence suggests that CPAP can reduce breathing disturbances and daytime sleepiness and improve sleep quality, quality of life, and blood pressure.[5,6] Alternative treatment options, including oral appliances (OA) and upper airway surgery, are available to patients for whom CPAP therapy is not well tolerated, who are unresponsive to CPAP, or who are not appropriate candidates for CPAP. Adherence to treatment is critical for achieving optimal therapeutic benefit, yet adherence is problematic particularly for individuals undergoing CPAP.[7]

Sleep is often a shared experience for many adults.[8] Because the hallmark symptoms of OSA (i.e., snoring, apneas) occur during the night, spouses and partners are likely to experience sleep disturbance that may contribute to daytime impairments and relationship problems. OSA treatment may also benefit partners as patients experience reductions in snoring, apneas, and daytime sleepiness. The nature of partner interaction during OSA treatment initiation may vary and is likely to have important implications for patients' continued use of treatment. The purpose of this review is to summarize the existing research on (1) the impact of OSA on partner-assessed sleep and daytime functioning, (2) the impact of OSA treatments on partner-assessed sleep and daytime functioning, and (3) partner involvement in OSA treatment.

METHODS

A literature search was conducted using MEDLINE, EMBASE, and CINAHL to identify English-language studies examining the effect of OSA and OSA treatments on partners' assessed sleep and daytime functioning and partner involvement in OSA treatments. Additionally, reference lists of all identified relevant articles were searched. The keywords used to search for articles included sleep apnea, sleep-disordered breathing, spouse, partner, wives, positive airway pressure, oral appliance, and surgery. Different combinations of these search terms yielded between 1 (wives and oral appliance) and 143 (partner and sleep apnea) articles that were considered for review. Studies were included in the review if (1) they reported data from an original study (i.e., no review articles or case reports), (2) patients had objective documentation of OSA

such as laboratory or in-home polysomnography (PSG) and/or were receiving OSA treatment, and (3) described (a) sleep and/or daytime functioning (e.g., mood, daytime sleepiness, cognitive function, quality of life, work performance, relationship quality) assessed in spouses or partners of patients with untreated OSA; (b) sleep and/or daytime functioning (e.g., mood, daytime sleepiness, cognitive function, quality of life, work performance, relationship quality) assessed in spouses or partners of OSA patients who were referred for OSA treatment, including CPAP, OA, or surgery; and/or (c) associations between spouses or partners and use of OSA treatments. Both quantitative and qualitative research studies were included in this review as hearing patients' and partners' perspectives about their experiences and concerns regarding OSA and its treatment can provide a richer understanding of these phenomenon which are unlikely to be fully captured by questionnaires. Articles were excluded if, for inclusion criterion a or b, partner outcomes were reported by the patient. In total, 38 studies were included in the current review.

REVIEW OF FINDINGS

Effects of Untreated OSA on Partners' Sleep and Daytime Functioning

Most research examining the impact of untreated OSA on partners have found negative daytime and nighttime consequences (**Table 1**). As compared to spouses from the general population, spouses of patients with heavy snoring and OSA are three times more likely to report insomnia symptoms, including difficulty initiating and maintaining sleep and unrefreshing sleep, and twice as likely to report fatigue and daytime sleepiness even after controlling for age, body mass index (BMI), number of children younger than 18 y, work time, own snoring, and use of sleep medications.[9] Symptoms associated with OSA are major causes of sleep disturbance among partners. Among 37 partners of patients suspected of having OSA, 55% reported that patients' snoring disturbed their sleep every night or almost every night.[10] Baseline assessments from 46 partners of patients with OSA in a crossover trial of CPAP versus placebo found significant numbers who reported moderate to severe sleep disturbance because of snoring (69%), apneas (54%), and restlessness (55%), and 66% who were "poor" sleepers (i.e., Pittsburgh Sleep Quality Index score > 5).[11] Qualitative data reveal that partners are distressed by witnessing patients' apneas and feel a need to monitor the patient's breathing during the night to ensure he/she continues to breathe.[12,13]

Studies utilizing PSG to assess sleep among partners of patients with untreated OSA also have found significant sleep disturbances.[14–16] In an early study, 10 wives of husbands undergoing PSG for suspected OSA underwent concurrent PSG in the same bed as their husbands.[14] Wives had a median PSG-assessed sleep efficiency of 74% and an arousal index of 21, with up to 32% having an arousal within 1 to 3 sec of a snore by the patient. A case-control study of 17 wives who regularly shared a bed with a spouse with untreated OSA found more wake after sleep onset, a higher percentage of stage 1 sleep, and alpha power during slow wave sleep during in-laboratory PSG without a shared bed compared to wives of healthy sleepers even after adjustment for age and menopausal status.[16] In a cross-sectional study examining sleep of bed partners of individuals with OSA, 110 couples underwent in-home PSG and were classified according to OSA status into 1 of 3 groups: neither partner had OSA, one of the partners had OSA, or both had OSA.[15] Comparison of sleep architecture and PSG-assessed sleep onset latency, total sleep time, and sleep efficiency between partners without OSA sleeping with OSA partners and partners sleeping with non-OSA partners showed no differences, suggesting that having a bed partner with OSA is not associated with worse sleep quality. In contrast to the previous studies that included clinic populations, this study included a community-based sample in which patients were not seeking treatment and had on average mild to moderate OSA severity.

In order to mitigate the disturbed sleep caused by the patients' OSA symptoms, partners report using ear plugs and/or sleeping medication and alternating their sleep schedule with the patient.[10,13] For some couples, patients' snoring and its interference with partners' sleep lead to sleeping in separate rooms.[12,13,17] Others may insist on maintaining bed sharing despite disturbed sleep in order to avoid social stigma and to maintain the feeling of a "healthy" relationship.[12] Partners' sleep loss often resulted in frustration, exhaustion, interference with work, and a strained relationship.[13] In an early study, marital dissatisfaction, in particular conflict over childrearing, was reported by wives of OSA patients.[17] Virkkula et al. found 35% of partners of men with suspected OSA (n = 37) reported relationship problems due to snoring.[10] Although husbands' snoring was not associated with marital satisfaction among 45 wives of men with untreated OSA, they were 2.9 times more likely to sleep apart as compared to wives of men who did not snore frequently.[18]

Untreated OSA can negatively affect partners' quality of life.[11,19] General health-related quality of life (mean 36-item Short Form Health Survey (SF-36) physical component summary score = 40.5 ± 14.2; mean SF-36 mental component summary score = 45.5 ± 11.3) was significantly worse among partners of patients with untreated OSA compared to the general population.[11] Similarly, Doherty et al. found lower SF-36 scores among 55 partners of patients with OSA prior to initiation of CPAP therapy as compared to age- and sex-matched normative values, indicating impaired quality of life.[19] More than 50% of partners reported anxiety symptoms and 18% reported depressive symptoms before CPAP treatment initiation. Conversely, a study of 122 partners of patients with untreated OSA found quality of life on the SF-36 to be similar to age- and sex-adjusted normative values.[20] Parish and Lyng also found no significant difference in pretreatment quality of life between bed partners and national norms except for in the SF-36 domain of bodily pain.[21] It is important to note that the aforementioned studies only included patients and partners who regularly shared a bed. Partners of patients who do not share a bed have been found to have worse quality of life and depression and anxiety symptoms than partners who share a bed with a patient with untreated OSA.[19]

Table 1—Effect of obstructive sleep apnea on partner-assessed outcomes.

Authors	Patient OSA Severity	Partners			Results
		n	Age, y	% Female	
Ulfberg et al. (2000)[9]	100% heavy snoring, 32% diagnosed OSA	304	30–64 [a]	100	• ↑ Insomnia symptoms, daytime fatigue, and sleepiness
Luyster et al. (2016)[13]	Self-reported moderate to severe OSA: 71%	12	54 (17)	72	Focus groups: • Distressed by witnessing apneas • Disturbed sleep and lead to frustration, irritation, exhaustion, interference at work, strained relationship • Used sleeping pills, ear plugs; alternated sleep schedule; slept in separate rooms
Henry and Rosenthal (2013)[12]	AHI: 57 (42)	12	48 (14)	58	Interviews: • 3 spouses stayed up at night monitoring patients' breathing • Tense conversations about spouse's disturbed sleep and concerns about patients' health • Relationship problems • 4 couples slept in separate rooms; 8 couples insisted on maintaining bed sharing
Virkkula et al. (2005)[10]	AHI: 14 (16)	37			• Disturbed sleep and relationship problems due to snoring • Sleep in separate rooms
Beninati et al. (1999)[14]	AHI: 26 (3–75) [b]	10		100	• Disturbed sleep based on in-laboratory PSG
McArdle et al. (2001)[11]	AHI: 41 (28–60) [b]	46			• Poor sleep quality and quality of life
Smith et al. (2009)[16]	AHI: > 15	17	52 (6)	100	• Disturbed sleep based on in-laboratory PSG
Sharief et al. (2008)[15]	RDI: 18 (10–68) [c]	42	36 (47–74) [c]	83	• PSG-sleep similar to partners of individuals without OSA
Doherty et al. (2003)[19]	AHI: 32 (21–57) [b]	45	47 (38–55) [b]	98	• Anxiety and depression symptoms • Impaired quality of life
Breugelmans et al. (2004)[20]	AHI: 43 (26)	122	49 (10)	72	• Quality of life similar to age- and sex-matched normative values
Parish and Lyng (2003)[21]	AHI: 48 (33)	54	56	87	• Quality of life similar to age- and sex-matched normative values
Cartwright and Knight (1987)[17]	AHI: 56 (38)	10		100	• Disturbed sleep due to snoring • Sleep in separate rooms • Marital dissatisfaction
Billman and Ware (2002)[18]	AHI: ≤ 20 vs. > 20	45		100	• Patients' snoring not associated with marital satisfaction • Sleep in separate rooms
Stålkrantz et al. (2012)[22]	AHI: 44 (17)	12	49 (14)	75	Interviews: • Managed living with patient with OSA by sacrificing, controlling, changing, or understanding

AHI and age presented as mean (standard deviation) unless otherwise noted: [a] = range, [b] = median (interquartile range), [c] = mean (minimum-maximum).
AHI = apnea-hypopnea index, OSA = obstructive sleep apnea, PSG = polysomnography, RDI = respiratory disturbance index.

Interviews with 12 spouses were conducted to learn about how they managed living with a patient with untreated OSA.[22] Spouses expressed sacrificing their social activities and interactions in order to take on more of the household workload due to patients' tiredness. This often led to relationship problems and feeling like more of a caregiver than a spouse. Taking control was another way of managing the everyday life for the partner. Spouses thought it was their responsibility to help the patient by sharing the bedroom despite disturbed sleep to ensure the patient was breathing and making sure the patient received help and treatment for his or her symptoms, which lead to feeling like more of a parent than a spouse. Making changes to diet and lifestyle was also a means to dealing with their life situation. Spouses reported providing support to the patient and also engaging in these changes. Finally, spouses dealt with their life situation by feeling empathic toward the patient and consequently adapting daytime activities to the patient's tiredness and making the best of the situation.

Effect of OSA Treatments on Partners' Sleep and Daytime Functioning

CPAP Treatment

The majority of studies have found CPAP treatment in patients with OSA to have positive effects on their partners' physical and mental health, with improvements noted immediately and sustained up to 1 y (**Table 2**). Immediate increases in PSG-assessed sleep efficiency and percentage of rapid eye movement (REM) sleep and decreases in number of arousals and percentage of non-rapid eye movement sleep were noted in spouses when patients were treated with CPAP during an overnight diagnostic PSG study.[14] No change in PSG-assessed total sleep time was found. In a cross-over study of CPAP versus placebo pill in 22 patients with OSA, partners of patients treated with CPAP had better sleep quality and less sleep disturbance at 1 mo compared to partners of patients treated with placebo.[11] However, six partners reported moderate to severe sleep disturbance related to CPAP use, mainly from noise or cold air. No differences in daytime sleepiness, self-reported health, or marital satisfaction were found between partners of patients in the two treatment groups. Conversely, partners of male patients with moderate-severe OSA randomized to CPAP (n = 51) reported greater improvements in sleep quality, daytime alertness, mood, quality of life, and personal relationship with the patient (assessed by the Dublin Bed Partner's Assessment) at 4-w follow-up as compared to partners of patients randomized to sham CPAP (n = 51).[23] These improvements have been found to be maintained up to 12 mo.[24] Partners of 45 patients with OSA treated with CPAP for 6 w had less daytime sleepiness, anxiety symptoms, and better quality of life in the SF-36 domains of role-physical, role-emotion, social functioning, mental health, and vitality compared to before CPAP treatment.[19] No changes in depressive symptoms nor the SF-36 domains of physical functioning, pain, and general health perception were found. Quality of life measured by the SF-36 and Sleep Apnea Quality of Life Index (SAQLI) were assessed in 54 partners of patients with OSA before and after 6 w of CPAP treatment.[21] Significant improvements were found for daytime sleepiness, the SAQLI, and the role-physical, vitality, social functioning, and mental health domains of the SF-36, but the SF-36 domains of physical functioning, bodily pain, and role-emotional did not change from baseline. Following 12 w of CPAP treatment in 21 men with OSA, their female partners reported significant improvements in depression symptoms and overall sexual functioning assessed by the Female Sexual Function Index (FSFI) and within all 6 domains of the Female Sexual Function Index, including lubrication, orgasmic function, sexual desire, intercourse satisfaction, arousal, and pain.[25] During focus groups conducted with spouses of patients with OSA managed with CPAP, partners described the experience of not hearing their partner snore during the first few nights with CPAP as alarming; however, after adjusting to this new occurrence, partners noted being able to fall asleep faster, having more energy, being happier, and resuming bed sharing.[13]

Studies examining the effect of CPAP treatment on marital satisfaction based on partners' report yield conflicting results. In a prospective trial of CPAP treatment versus conservative treatment (i.e., weight loss, sleeping posture, and avoidance of alcohol in the evening), 44 partners completed questionnaires about marital satisfaction before and 3 mo after treatment initiation.[26] Partners of patients treated with CPAP had significantly greater improvements in marital satisfaction and less disagreements in the past week as compared to partners of patients treated conservatively. However, no difference in number of times per week of bed sharing were found between the groups. In contrast, Baron et al. did not find significant improvements in partners' reports of relationship quality, daytime sleepiness, depression, or functional impairment with 3 mo of CPAP treatment among their bed partners with OSA.[27] It was noted that daytime sleepiness, depression, and functional impairment were at normal levels at baseline; thus, a floor effect could have contributed to the nonsignificant results.

Oral Appliances

In a study of 144 patients with OSA treated with an OA, partners of patients who reported continued use of their OA at a median 7 mo after fitting had greater improvement in sleep quality as compared to partners of patients who had discontinued OA use.[28] Increased bed sharing was reported by partners of OA users, but no change in marital satisfaction was reported. Partners of non-OA users did not report changes in bed sharing frequency nor marital satisfaction. Another study of OA treatment among 121 patients with OSA found 64% of partners to report improvement in their sleep after 3 mo of treatment.[29]

Among 62 partners who share a bedroom with patients with OSA treated with an OA, more than half reported improvements in their general well-being, mental energy, and sleep quality and less daytime sleepiness and disturbed sleep after 1 y of treatment.[30] In a comparative study of two OAs, 94% of partners (n = 16) reported improved sleep quality, quality of life, and personal relationship with the patient at 3-mo follow-up and these improvements were maintained at 2.5- to 4.5-y follow-up (n = 14).[31,32]

No improvements in quality of life assessed by the SAQLI were reported among 32 partners of patients with mild to moderate OSA participating in a randomized controlled crossover study of OA treatment versus a control device.[33] The short study time period of 1-w acclimatization followed by a 1-w washout could account for these results.

Surgery

Changes in anxiety, depression, and daytime sleepiness were assessed in 36 partners of snoring and/or patients with OSA before and after patients received two sessions of radiofrequency tissue ablation treatment (RFTA).[34] Significant reductions in anxiety and depression symptoms were found among partners of patients with OSA treated with RFTA, whereas no reduction in anxiety was found among partners of simple snoring patients treated with RFTA. No change in daytime sleepiness was detected for either group of partners.

Partner Involvement in OSA Treatment Adherence

Presence of Spouse or Live-In Partner

Limited data suggest that having a spouse or live-in partner can influence patients' acceptance and adherence to OSA

Table 2—Effects of obstructive sleep apnea treatment on partner-assessed outcomes.

Authors	OSA Treatment	Partners			Results
		n	Age, y	% Female	
Beninati et al. (1999)[14]	CPAP	10		100	• ↑ PSG-assessed SE, REM sleep • ↓ PSG-assessed ArI, NREM sleep • No change in PSG-assessed TST
McArdle et al. (2001)[11]	CPAP	23	51 (10)	93	• ↑ Sleep quality • ↓ Sleep disturbance • No change in daytime sleepiness, SF-36 physical and mental summary scores, or marital satisfaction
Siccoli et al. (2008)[23]	CPAP	102			• ↑ Sleep quality, daytime alertness, mood, quality of life, and personal relationship with patient
Kiely and McNicholas (1997)[24]	CPAP	55			• ↑ Sleep quality, daytime alertness, mood, quality of life, and personal relationship with patient
Doherty et al. (2003)[19]	CPAP	45	47 (38–55) [a]	98	• ↑ SF-36: role-physical, role-emotional, social functioning, mental health, energy/vitality • ↓ ESS, HADS anxiety • No change in HADS depression, SF-36: physical functioning, pain, general health perception
Parish and Lyng (2003)[21]	CPAP	54	56	87	• ↑ SAQLI, SF-36: role-physical, social functioning, energy/vitality, mental health • ↓ ESS • No change in SF-36: physical functioning, role-emotional, pain, general health perception
Acar et al. (2016)[25]	CPAP	21	42 (8)	100	• ↑ Sexual functioning • ↓ BDI depression
Luyster et al. (2016)[13]	CPAP	12	54 (17)	72	Focus groups: • Initial concern about not hearing patients' snoring • ↑ Sleep, energy, activities, mood, marital quality, bed sharing
McFadyen et al. (2001)[26]	CPAP	69			• ↑ ENRICH marital satisfaction • ↓ Disagreements • No change in nights of bed sharing
Baron et al. (2009)[27]	CPAP	17	43 (12)	100	• No change in relationship quality, ESS, CES-D depression, FOSQ
Izci et al. (2005)[28]	OA	144			• ↑ Sleep quality, nights of bed sharing • No change in ENRICH marital satisfaction
Bates and McDonald (2006)[29]	OA	53			• ↑ Sleep
Tegelberg et al. (2011)[30]	OA	85	56 (10)	82	• ↑ Well-being, sleep quality, mental energy • ↓ Daytime sleepiness, disturbed sleep
Gauthier et al. (2009)[31]	OA	16			• ↑ Personal relationship with patient, sleep quality, quality of life
Gauthier et al. (2011)[32]	OA	14			• ↑ Personal relationship with patient, sleep quality, quality of life
Dort and Brant (2008)[33]	OA	32			• No change in SAQLI
Uloza et al. (2010)[34]	Surgery	32	41 (11)	84	• ↓ STAI anxiety, BDI depression and no change in ESS among partners of OSA patients • ↓ BDI depression and no change in STAI anxiety or ESS among partners of simple snoring patients

Age presented as mean (standard deviation) unless otherwise noted: [a] = median (interquartile range). ArI = arousal index, BDI = Beck Depression Inventory, CES-D = Center for Epidemiologic Studies Depression Scale, CPAP = continuous positive airway pressure therapy, ENRICH = Evaluation and Nurturing Relationship Issues, Communication, and Happiness (ENRICH) Marital Satisfaction Scale, ESS = Epworth Sleepiness Scale, FOSQ = Functional Outcomes of Sleep Questionnaire, HADS = Hospital Anxiety and Depression Scale, NREM = non-rapid eye movement, OA = oral appliance, OSA = obstructive sleep apnea, PSG = polysomnography, REM = rapid eye movement, SAQLI = Sleep Apnea Quality of Life Index, SE = sleep efficiency, SF-36 = 36-item Short Form Health Survey, STAI = State-Trait Anxiety Inventory, TST = total sleep time.

treatment and that frequency of bed sharing may also have important implications for adherence (**Table 3**). Living with a partner was associated with CPAP acceptance among patients with OSA with average or high income, but was not a predictor of CPAP acceptance for low-income patients.[35] Patients with a new diagnosis of OSA who reported living alone had significantly less CPAP use over the first month of treatment as compared to those living with a partner (3.6 h versus 5.0 h, respectively).[36] Gagnadoux and colleagues found those who were married or living with a partner had a 1.5-fold increased likelihood of being adherent to CPAP (i.e., mean nightly hours of use ≥ 4 h) an average of 504 days after CPAP initiation among 1,141 patients with OSA.[37] Conversely, a retrospective chart review of 33 older male patients with OSA found no significant difference in percentage of patients who had a spouse or live-in partner between those adherent (i.e., mean nightly hours of use ≥ 5 h) and not adherent to CPAP during a 6-mo period.[38] In multivariate analysis controlling for age, BMI, daytime sleepiness, and apnea-hypopnea index (AHI), having a partner who sleeps in a separate room quadrupled the odds (odds ratio = 4.3, 95% confidence interval = 4.1–13.3) of purchasing a CPAP machine.[39] Cartwright examined the association between bed sharing and CPAP adherence during the first 2 w of treatment.[40] A greater number of nights the couple slept together based on wives' sleep log was significantly associated with higher average hours of CPAP use during the initial 2-w treatment period. Partners' reports of increased bed sharing since initiation of OA was associated with self-reported use of OA at a median 7 mo after fitting.[28] Additionally, lower marital satisfaction before starting OA as reported by the partner was associated with continued OA use.

Partner Involvement

To date, studies assessing partner involvement in patients' use of his or her OSA treatment has focused solely on CPAP therapy. The majority of quantitative studies investigating the role of partners in patients' CPAP initiation and adherence have not obtained the partners' perspective but rather relied on patient assessment. Among patients with OSA who were recommended for CPAP therapy, 38% to 53% of patients who purchased CPAP reported receiving encouragement from their partner.[39,41] In a prospective study of 23 married, male patients with OSA, marital conflict, in particular negative emotions such as anger, upset feelings, and criticism, reported by the patient was associated with lower CPAP adherence over the first 3 mo of treatment.[27] Marital support reported by the patient was not associated with CPAP adherence.

To assess spousal involvement (i.e., pressure, collaboration, support) in CPAP therapy during the initial treatment phase, 31 male patients completed a daily questionnaire for a 10-day period starting within 1 w of receiving the CPAP machine in their home.[42] The majority of patients (94%) expressed feeling supported by their spouse to use CPAP at least 1 day during the 10-day assessment period, whereas 13% did not report any spousal involvement. Perceptions of spouses' support predicted increased next-day self-reported CPAP use among patients with higher AHI. Following nights with decreased adherence, patients reported increased collaboration (e.g., helped with the machine) from their spouses the next day. Patients reporting low marital conflict reported greater increases in next-day collaboration following nights with CPAP problems (e.g., mask leaks, stuffy nose). Perceived pressure from spouses to use CPAP did not predict next-day adherence. A closer assessment of spousal involvement (i.e., collaborative, one-sided, positive, and negative) during the first 3 mo of CPAP treatment in 23 male patients with OSA revealed both positive (e.g., changed something at work or home to get me to use CPAP) and negative (e.g., tried to make me scared of the consequences of not using CPAP) involvement of wives approximately one to two times during the first week of treatment.[43] Frequency of perceived spousal involvement remained the same at 3-mo follow-up except for negative involvement, which had decreased. Perceived collaborative spousal involvement was associated with greater CPAP adherence at 3 mo. One-sided, positive, and negative spousal involvement were not associated with 3-mo adherence.

Qualitative studies have captured both patients' and partners' perspectives of partners' involvement in the patients' use of CPAP. Semistructured interviews conducted with 23 CPAP-treated patients with OSA identified engagement of partners in education provided during diagnostic procedures and treatment initiation and in providing practical support (e.g., mask adjustments during the night) as facilitators for CPAP adherence.[44] However, insufficient emotional and practical support from their partner was identified as a barrier for CPAP adherence. Similarly, partners identified providing emotional support (e.g., encouragement) and instrumental support (e.g., verbal reminders, help with putting on mask) as motivators for the patient to use CPAP during focus group discussions.[13] During semistructured interviews with patients with OSA, unmarried patients described an absence of support, less belief in their ability to use CPAP, and fewer positive experiences with CPAP after the first week of treatment compared to married patients.[45]

Elfström et al. conducted semistructured interviews with 25 partners of patients with CPAP-treated OSA to learn about situations influencing partners' support to patients and strategies for managing these situations during the initial phase of CPAP treatment.[46] Partners mentioned sounds from the mask or device that disturbed their sleep along with patients experiencing physical problems (e.g., mask leakage) or practical problems (e.g., traveling, limited sleeping positions) with the CPAP equipment as factors negatively affecting their willingness to support the patients' use of CPAP. Additionally, patients' shame, interference with closeness, and partners' limited presence were identified as situations negatively influencing support. Partners described an understanding of the consequences of OSA, positive treatment effects, patients' positive attitude about CPAP, and receiving support from family, friends, and healthcare professionals as motivators for providing support. Three management strategies used by the partners were identified: letting the patient handle the treatment themselves with little to no assistance from the partner; handling the treatment together with emotional and practical support provided by the partner; and taking over the treatment by supervising and controlling all practical aspects of the treatment, including giving

Table 3—Partner involvement in obstructive sleep apnea treatment.

Patient-Assessed Partner Involvement					
	Patients				
Authors	**n**	**Age, y**	**% Male**	**Partner Involvement**	**OSA Treatment Outcome**
Tarasiuk et al. (2012)[35]	Average/high income			• Living with partner	• ↑ Acceptance of CPAP
	145	50 (10)	86		
Lewis et al. (2004)[36]	82	51 (10)	94	• Living with partner	• ↑ Nightly hours of CPAP use during first month
Gagnadoux et al. (2011)[37]	CPAP adherent			• Being married or living with partner	• ↑ Odds of CPAP adherence an average of 504 days after initiation
	674	23% ≥ 65 y	74		
	CPAP nonadherent				
	467	22% ≥ 65 y	71		
Russo-Magno et al. (2001)[38]	CPAP Adherent			• Having spouse or partner	• No difference between adherent vs. nonadherent patients during 6-mo period
	20	72	100		
	CPAP nonadherent				
	13	74	100		
Brin et al. (2005)[41]	Purchase CPAP			• Encouragement from partner	• ↑ Likelihood to purchase CPAP
	128	54 (10)	83		
	Did not purchase CPAP				
	272	54 (11)	83		
Simon-Tuval et al. (2009)[39]	162	55 (12)	75	• Encouragement from partner • Partner sleeping in separate room	• ↑ Acceptance of CPAP
Baron et al. (2009)[27]	23	49 (11)	100	• Relationship conflict • Negative emotions	• ↓ Nightly hours of CPAP use during first 3 mo
Baron et al. (2011)[42]	31	49 (11)	100	• Spousal support	• ↑ Nightly hours of self-reported CPAP use during first 10 days
Baron et al. (2012)[43]	16	47 (11)	100	• Collaborative spousal involvement	• ↑ Nightly hours of CPAP use during first 3 mo
Broström et al. (2010)[44]	23	33–74 [a]	56	• Engagement from partner in educational and practical situations regarding OSA and CPAP	• Facilitators of CPAP adherence
Sawyer et al. (2010)[45]	15	54 (13)	87	• Married	• Positive belief in ability to use CPAP
Partner-Assessed Partner Involvement					
	Partners				
Authors	**n**	**Age, y**	**% Female**	**Partner Involvement**	**Results**
Cartwright (2008)[40]	10	42 (11)	100	• ↑ Nights of bed sharing	• ↑ Nightly CPAP use during first 2 w
Izci et al. (2005)[28]	144			• ↑ Nights of bed sharing • Low marital satisfaction before starting OA	• ↑ Self-reported OA use at median 7 mo • Low marital satisfaction before starting OA as reported by partner was associated with continued OA use
Elfström et al. (2012)[46]	25		72	• Strategies for managing the OSA patient: little to no assistance; taking over; collaboration	• Initial CPAP treatment phase
Luyster et al. (2016)[13]	12	54 (17)	72	• Encouragement • Assistance with equipment	• Facilitators for CPAP adherence

Age presented as mean (standard deviation) unless otherwise noted: [a] = range. CPAP = continuous positive airway pressure therapy, OA = oral appliance, OSA = obstructive sleep apnea.

out directives and ultimatums. From the patient perspective as expressed in the study by Broström et al.,[44] a lack of emotional and practical support from a partner can deter adherence to CPAP therapy, thus a "hands-off" approach may not be the most effective strategy for partners during the CPAP initiation period.

CONCLUSIONS AND DIRECTIONS FOR FUTURE RESEARCH

Many adults sleep with a significant other, thus in the context of a sleep disorder such as OSA, its symptoms and treatments are likely to have profound effects on the well partners' sleep and daytime functioning. A growing body of literature suggests that OSA is a shared problem not only affecting patients but also partners, and that OSA treatments may also have beneficial effects for partners. Additionally, partners can positively and negatively influence patients' adoption and use of OSA treatments. This reviews highlights the importance of taking a dyadic (pairing of two individuals) perspective to the diagnosis and management of OSA.

Recent investigations have identified associations between patients' chronic illness symptoms (e.g., pain, physical limitations) and impairments in spouses' sleep and well-being.[47–49] In the context of OSA, snoring contributes to partners' objective and subjective sleep disturbance. Qualitative studies suggest that partners' sleep may also be disturbed by monitoring the patients' breathing throughout the night due to witnessing apneas. It could be hypothesized that long-term exposure to untreated OSA could increase the risk of insomnia in bed-sharing partners, thus leading to both individuals having a sleep disorder. More detailed longitudinal studies are necessary to explore this possibility.

In a large population-based study of couples, both spouses' sleep problems (insomnia symptoms) and the partners' own sleep problems were associated with partners' poorer physical and mental health, well-being, social involvement, and marital quality.[50] This finding suggests that the relationship problems, daytime sleepiness, anxiety and depression symptoms, and impaired quality of life reported by partners of patients with OSA could not only be the result of their own disturbed sleep but also the disturbed sleep of their OSA partner. Partners also reported frequently eliminating bed sharing. Sex differences in couples' sleep when co-sleeping and the interaction between sleep and relationship functioning have been identified in studies of healthy couples.[51–54] Womens' objective and subjective sleep has been found to be disturbed by the presence of their male partner, whereas mens' subjective sleep improved with a woman's presence.[54] An early study by Monroe found women to have significantly increased stage 4 sleep, greater total sleep time, and fewer awakenings than males when sleeping alone.[52] Despite objective sleep disturbances experienced more frequently by women, they prefer to sleep with their partner.[52,53] Among healthy co-sleeping couples, lower sleep efficiency predicted more negative perceptions of partner interactions the following day among males, whereas more negative perceptions of partner interactions predicted lower sleep efficiency that night for females.[51] These findings suggest that sex of the partner is an important variable that needs to be considered in future studies examining the effects of OSA and its treatments on partners' sleep and daytime functioning. Sex differences were not examined in the studies included in this review. Although some of the studies did not report the demographics (e.g., sex) of the partners, those that did included a majority of women, which could have precluded the examination of sex differences.

OSA treatments, including CPAP, OA, and surgery, consistently were associated with improvements in partners' sleep. Discrepant results were reported for daytime sleepiness, quality of life, mood, and marital quality. Variation in assessments between studies and normal baseline levels of these variables could have accounted for the inconsistencies. Generally, patients' improvements in sleep and daytime functioning tracked with partners' improvements, although patients tended to have greater improvements than partners possibly because they were more impaired prior to treatment. Future research needs to examine cross-partner effects of OSA treatments on outcomes as improvements in patients' OSA symptoms, sleep, and well-being are likely to be associated with improvements in partners' sleep and well-being and *vice versa*. Adherence to OSA treatment also needs to be taken into consideration in future studies as improvements in patients' symptoms is dependent on consistent use, and thus partners' outcomes may be influenced by whether the patient is using his or her treatment. Interestingly, only one study of surgical treatment for OSA was identified that assessed partner outcomes.[34] Most surgical trials obtained partners' assessment of patients' snoring without evaluation of how the partner was affected by the treatment. The scarcity of partner-assessed outcomes in OSA treatment studies, particularly surgical OSA treatment trials, raises the question of whether partner outcomes should be considered a standard outcome assessment in trials of OSA treatments.

An expansive body of literature demonstrates that partners can influence patients' health behaviors, with positive partner involvement (encouragement, collaborative approach) leading to greater patient engagement in the desired behavior, whereas negative partner involvement (criticizing, nagging) may backfire and have opposite effects.[55–62] Partners can positively and negatively affect all phases of CPAP therapy, from purchase to initiation and early and later use. Patients are frequently prompted by their partners to seek treatment in the first place, which can have potentially adverse consequences for CPAP adherence over time,[63] particularly if participation is viewed by the patient as coercive. Partners can approach patients' initiation of CPAP differently, from being uninvolved to taking over all aspects to working together. These approaches can have a profound effect on patients' motivation to use CPAP. Limited studies suggest partner involvement that is collaborative and supportive is an important facilitator of CPAP use.[42–44] Other than two qualitative studies,[13,46] assessment of partner involvement has primarily been from the patients' perspective. Future research needs to take into consideration the dyadic nature of partner involvement and measure spousal involvement independently in both patients and partners as actual and perceived

involvement may be incongruent. Other potentially important factors such as relationship quality, sex of the couple, and partners' knowledge and attitude toward OSA and CPAP should be considered when examining the association between partner involvement and CPAP adherence.[64]

A meta-analyses of couple-oriented interventions for chronic illnesses including cardiovascular disease, cancer, osteoarthritis, chronic pain, rheumatoid arthritis, human immunodeficiency virus, and type 2 diabetes found small but significant improvements in patient depressive symptoms, marital functioning, and pain.[65] Additionally, couple-oriented interventions led to improvements in partners' psychological and marital functioning. It has been suggested that targeting partners' concerns and well-being and addressing communication and actions by the partner that can influence patients' health behaviors may strengthen the effects of couple-oriented interventions on patients' and partners' outcomes.[65] A couple-oriented intervention aimed at improving CPAP adherence has not been developed. Two previous CPAP adherence intervention studies did mention the presence of partners during the intervention sessions, although these interventions were not couple-based.[63,66] Focus group data from both OSA patients and their partners suggest that inclusion of partners in a new CPAP user program would be a key component.[13] Partners expressed interest in participating in this type of program in order to obtain education about consequences of OSA and benefits of CPAP. Inclusion of partners throughout the diagnosis and treatment phases of OSA could help partners to feel more empowered to support the patient as he or she undertakes a challenging new treatment. Adoption of a collaborative approach to improving CPAP adherence may be a beneficial strategy for interventions promoting CPAP adherence.[42,43]

This review reveals the many opportunities for developing future studies to better understand the impact of OSA and OSA treatments on partners and partners' role in OSA treatment adherence. Longitudinal studies with assessments from both patients and partners will enable evaluation of interactive effects of health outcomes associated with OSA and its treatments. Greater insight into partners' perspectives of their involvement in CPAP treatment adherence and factors that affect their involvement could help guide the development of CPAP adherence interventions that are couple-based. Emphasis should be placed on clinician engagement of partners in discussions of negative health effects of OSA and benefits of OSA treatments for both patients and partners.

ABBREVIATIONS

AHI, apnea-hypopnea index
BMI, body mass index
CPAP, continuous positive airway pressure
FSFI, Female Sexual Function Index
OA, oral appliance
OSA, obstructive sleep apnea
PSG, polysomnography
REM, rapid eye movement
RFTA, radio-frequency tissue ablation
SAQLI, Sleep Apnea Quality of Life Index
SF-36, 36-item Short Form Health Survey

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Submitted for publication September 22, 2016
Submitted in final revised form December 15, 2016
Accepted for publication December 19, 2016
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DISCLOSURE STATEMENT

This was not an industry supported study. Support for Dr. Luyster was provided by the National Heart, Lung, and Blood Institute (NHLBI) K23 HL105887. Dr. Luyster has indicated no financial conflicts of interest.