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Obstructive Sleep Apnea (OSA) in Pregnancy - An American College of Chest Physicians Clinical Practice Guideline

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COI statement: See **e-Appendix 2**

Key Words: Obstructive sleep apnea; sleep disordered breathing; pregnancy; screening; treatment; positive airway pressure

Authors' roles: Dr. D'Ambrosio and Dr. Bourjeily are Co-Chairs of the Committee.
All authors have contributed to the data screening and collection, data interpretation, consensus process and manuscript writing and critical review.

Abbreviations: AHI=Apnea-Hypopnea Index, APAP=Auto-titrating Positive Airway Pressure, CPAP=Continuous Positive Airway Pressure, ESS: Epworth Sleepiness Scale, GDM: Gestational Diabetes Mellitus, HST: Home Sleep test, MAS: Mandibular advancement splint, OSA = Obstructive Sleep Apnea, PAP: positive airway pressure, PSG: Polysomnogram, RCT: Randomized controlled trial, REI=Respiratory Event Index, RR: Relative risk, SDB: Sleep Disordered Breathing, STOP BANG: (snoring, tired, observed, pressure, BMI, Age, Neck, Gender).

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ABSTRACT

Background: Obstructive sleep apnea (OSA) is associated with significant morbidity in pregnancy. There is minimal guidance available on how best to screen, diagnose, treat, and re-evaluate for OSA in pregnant patients.

Considering the potentially adverse consequences of OSA in pregnancy if left untreated, we assembled a panel of experts to methodologically review the available literature and make evidence-based recommendations.

Methods: Rigorous methodology was applied to provide a trustworthy evidence-based guideline and expert panel report. Panelists developed key clinical questions utilizing the PICO (population, intervention, comparator, and outcome) format, addressing specific topics in OSA in pregnant individuals. MEDLINE (via PubMed) and the Cochrane Library were systematically searched for relevant literature and supplemented by manual searches. References were screened with study evaluation tools to assess for inclusion, extract meaningful data, and grade the level of evidence to support each recommendation or suggestion.

Results: PICO questions related to screening, diagnosis, treatment, and follow up of OSA in pregnant patients resulted in nine conditional recommendations, made with the evidence available and with consensus of the expert panel. We recommend screening pregnant patients for OSA, either with a pregnancy specific screening questionnaire or a standard tool. For those at risk of OSA based on screening, either a home sleep test (HST) or in laboratory polysomnogram (PSG) is recommended for diagnosis. We recommend treatment for those with an apnea-hypopnea index (AHI) of 5-15 who have symptoms/sequelae or comorbidities, or those with an

AHI ≥ 15 regardless of symptoms or comorbidities, preferably with auto-titrating positive airway pressure (APAP). Additionally, scheduled naps may be beneficial as an initial step in alleviating residual symptoms. Reassessment of OSA in the postpartum period is recommended in some patients.

Conclusion: Due to low level of certainty, nine conditional recommendations were made in the screening, testing, and treatment of OSA in pregnancy.

BACKGROUND

Sleep disordered breathing (SDB) is a spectrum of disorders characterized by reduced airflow during sleep associatedwith oxygen desaturations and / or arousals, and encompasses many disorders including obstructive sleep apnea (OSA). In the pregnant population, the bulk of epidemiologic data have focused on snoring t and OSA. This manuscript focuses on guidance for the screening and management of OSA.

Objectively defined OSA impacts about 9% of the general pregnant population and is significantly more common in complicated pregnancies.[1] OSA is associated with perinatal outcomes including hypertensive disorders of pregnancy, gestational diabetes, severe cardiovascular morbidity, and risk for ICU admissions.[1-4] An increased risk for maternal mortality has been described in some studies but not others.[1-3,5,6]

Furthermore, maternal OSA or measures of OSA have been associated with adverse fetal growth outcomes, a higher risk of admission to the neonatal intensive care unit at birth, a longer hospital stay, congenital anomalies, and preterm birth.[6-11]

While these associations have been demonstrated repeatedly, specific guidance for treatment is lacking. A recent guideline was developed by the Society of Anesthesia and Sleep Medicine and the Society for Obstetric Anesthesia and Perinatology to provide recommendations for screening, and treatment decisions targeting an audience of obstetricians and anesthesiologists.[12] This guideline was developed to address the need for more specific guidance for sleep clinicians and pulmonologists for issues around OSA in pregnancy that are addressed by these clinicians.

METHODS

A multidisciplinary international expert panel conducted a systematic review addressing nine questions developed using the population, intervention, comparator, and outcome (PICO) format (e-**Appendix 1**, **e-Table 1**). The population of interest is the pregnant population. The panel employed the GRADE (Grading of Recommendations, Assessment, Development, and Evaluations) approach for assessing the certainty of evidence and formulating and grading clinical recommendations. For detailed methodology, see **e-Appendix 1**. Studies utilized and cited in this document are listed in each question in the supplemental material.

RESULTS

Results from the literature search including PRISMA diagram in Supplement (**e-Figure 1**). Summary of available evidence/studies from literature search can be found in **e-Tables 2-10 and the table of contents guides readers to the supplemental content**. A summary of the recommendations is listed in **Table 1**.

Question 1: Should pregnant individuals on continuous positive airway pressure (CPAP) for OSA prior to pregnancy be switched to auto-titrating positive airway pressure (APAP) or continue CPAP during pregnancy?

CHEST Recommendation: In pregnant individuals on CPAP for OSA prior to pregnancy, we suggest APAP be used rather than continued CPAP. (Conditional recommendation, very low certainty of evidence).

Remarks: This recommendation would be applicable as long as APAP is available and would not result in additional financial burden or accessibility challenges.

Justification: There is minimal data on the optimal management of sleep apnea in pregnancy. Current management has resulted from extrapolation of guidelines in the nonpregnant adult population and applied to the care of pregnant populations. Pregnancy poses a nuanced challenge. Pregnancy-related airway changes and weight gain may worsen sleep apnea severity and increase therapeutic pressure requirements across gestation.[13,14] Further, with widespread challenges in access, APAP would most likely assure timeliness of effective treatment. Based on experience with non-pregnant individuals, use of APAP over CPAP is feasible and acceptable, does not impact equity, is anticipated to be cost-effective, and has minimal undesirable effects for pregnant individuals. In the United States, most reproductive age individuals on CPAP will have APAP-capable machines, and therefore, switching to APAP would not incur significant resources or treatment delay. This may differ in other countries. There was no available evidence on maternal-fetal outcomes, symptoms, or treatment adherence to guide these recommendations.

Question 2: Should screening for Obstructive Sleep Apnea (OSA) versus no screening for OSA be used for pregnant individuals?

CHEST Recommendation: In pregnant individuals, we suggest screening for OSA. (Conditional recommendation, very low certainty of evidence).

Remarks: We suggest that screening is important in certain populations, particularly high-risk pregnancies complicated by obesity, a history of hypertensive disorders or diabetes, or family history of OSA. As demographics and social determinants of health may impact the prevalence

and severity of OSA as well as access to screening and care for OSA, those should be carefully considered to avoid care disparities.[15-18]

Justification: Commonly assessed screening tools in pregnancy literature include the Epworth Sleepiness Scale (ESS), the Berlin Questionnaire, the STOP and the STOP-Bang.[19-21] No direct evidence supports that screening for OSA in pregnancy improves perinatal outcomes. Howeverwe can evaluate whether screening tools lead to more streamlined diagnostic pathways and effective treatment of OSA, in order to provide symptomatic relief and potentially ameliorate health outcomes.

The ability of the ESS[22-26] and Berlin questionnaire to predict OSA in pregnancy is limited.[23,25-27] STOP questionnaire was associated with low sensitivity but high specificity in predicting perinatal outcomes,[28] limiting its utility as a stand-alone screening tool. Trimester of pregnancy may also play a role in screening. Another model that included age, BMI and tongue enlargement had high area under the curve for screening for OSA.[29] A limitation of the current literature on screening for OSA in pregnancy is that positive and negative predictive values vary by populations studied, impacting the utility of the existing data and further demonstrating the need for more research in this area.

Screening may improve the ability for definitive testing, and fast-track diagnosis and treatment to avoid negative health outcomes. The utility of screening tests is particularly dependent on the person's access to resources for further testing and the priority placed on sleep health compared to other pregnancy complications. Unanticipated or undesirable effects of screening may include anxiety over the diagnosis, additional testing, and cost of additional testing, particularly if false positives are identified. tThere is currently no data evaluating the cost effectiveness of screening for OSA in pregnancy to reduce healthcare utilization.

The benefit of screening for OSA may vary across populations including in those with high pretest probability such as those with extreme obesity. While more research is needed, we favor screening in populations with obesity, hypertension, or diabetes. Screening tools are easily implemented and may not add significant burden to patients and their caregivers.

Question 3: Should pregnant individuals be screened for OSA using a pregnancy-specific screening tool or standard OSA screening tool?

CHEST Recommendation: In pregnant individuals being screened for OSA, we suggest screening using either a pregnancy-specific tool or a standard screening tool. (Conditional recommendation, very low certainty of evidence).

Remarks: Awareness of limitations of various tools is important. Pregnancy specific tools still need external validation, and standard OSA screening tools do not perform well in most studies. However, various tools may perform better on sensitivity or specificity, or vice versa (see below and Figure 1).

Justification: Screening tools developed in the general population, such as the Berlin questionnaire and the STOP-Bang[20,21] were validated in non-pregnant, predominantly male, middle aged, and elderly populations.

The Facco et al.[30] screening tool which incorporates frequent snoring, chronic hypertension, age, and body mass index (BMI),[30] demonstrated a sensitivity of 0.86 and a specificity of 0.74 in development and internal validation.[30] However, when used in pregnant women with extreme obesity or metabolic complications its sensitivity was 0.93-1.00, but its specificity decreased to 0.21-0.37, owing to many false positive results.[25,31] Another model developed in pregnant

168 women consisting of BMI, age, and the presence or absence of tongue enlargement showed
169 promise with an AUC of 0.87, but this model has not been further validated.[32]
170
171 Sensitivity and specificity of the Berlin questionnaire varied extensively, for a pooled sensitivity
172 of 0.66 and pooled specificity of 0.65.[21,25,27,30,33,34] The wide confidence intervals for the STOP-
173 Bang resulted from small sample sizes, with a pooled sensitivity of 0.58 and pooled specificity of
174 0.82 (Figure 1).[25,27,31,34] When compared to the Berlin questionnaire and the STOP-Bang, the
175 Facco tool was more sensitive and less likely to miss cases of OSA, but showed poorer
176 specificity by falsely identifying women as having OSA.
177
178 The certainty of evidence for this recommendation was very low due to serious inconsistencies
179 and imprecisions resulting from the lack of overlap and wide sensitivity/specificity CIs of the
180 analyzed studies, as well as variations in the populations in which tools were developed.
181
182 The predictive value of both pregnancy-specific and general screening tools for OSA in
183 pregnancy is suboptimal. Despite this, we suggest screening for OSA during pregnancy with
184 either type of tools, as it is preferred to expedite further investigation for pregnant individuals in
185 a timely manner where possible. Incorporating a quick screening tool in clinical practice should
186 be associated with negligible costs and it should be feasible with appropriate training.
187
188 When screening for OSA in pregnancy, awareness of individual tools' limitations and their
189 global context of use is required. A screening tool with reduced specificity could lead to the
190 unnecessary psychological burden of requiring further testing for OSA. Moreover, screening

tools yielding high false positive testing place a larger burden on the healthcare system. On the other hand, using less sensitive tests such as the Berlin questionnaire and STOP-Bang may lead to underdiagnosis of OSA.

Question 4: In pregnant individuals undergoing evaluation for OSA, should an at-home sleep test or an in laboratory polysomnogram be used for diagnosis?

CHEST Recommendation: In pregnant individuals undergoing evaluation for OSA, we suggest either at home diagnostic devices or lab-based diagnostics be used (Conditional recommendation, very low certainty of evidence).

Remarks: PSGs are the gold standard diagnostic test and provide a more comprehensive evaluation of sleep; however, they may not be readily available, are costly, and inconvenient. Hence, if there are no barriers to in-laboratory testing, they can be used as first line diagnostic testing. However, in our experience, the majority of pregnant women have in-home diagnostic testing due to the above limitations.

Justification: The committee found limited evidence on this question, so the recommendation is largely based on expert opinion. The potential benefits of at-home diagnostics compared to in-lab diagnostics were significant, with minimal undesirable effects. However, the committee did not recommend one over the other, for various reasons.

At-home diagnostics are more accessible than in-lab testing, the latter being complicated by long wait times for appointments, a deterrent that is particularly relevant during pregnancy. While in-lab testing might be considered the gold standard, it requires overnight stays in medical facilities, posing feasibility and comfort challenges for pregnant patients. In lab testing may also require

additional resources. Consequently, the committee noted that more patients might be tested and treated promptly with at-home testing. Validation studies for at-home diagnostics against polysomnography are complicated by variations in methodological practices such as the definition of pathology, cut off chosen (AHI>5, or >10, or >15 e.g. events per hour), or obstructive event definition.[35,36] In the general population, the sensitivity of at-home testing may be lower in milder forms of OSA. This is particularly relevant to the pregnant population, especially in early gestation, where the vast majority of pregnant patients have mild disease. Given that at-home testing may underestimate the AHI compared to PSG, a negative at-home test in a patient with high clinical suspicion of OSA might require an in-lab PSG to make the diagnosis of OSA. However, two recent studies demonstrated an area under the curve ROC of 0.94 (CI 0.87-1.0) and 0.95 (CI 0.86-1.0) for home level II and III devices when compared to PSG in early to mid-pregnancy.[31,37]

At-home diagnostics require patient education on proper device placement and use. Device failure rates may be impacted by older age, chronic conditions and/or comorbidities, or cognitive challenges,[37] factors that are less relevant in the perinatal population. The committee also believed that at-home diagnostics could increase equity by overcoming some of the previously mentioned barriers and be more cost-effective for the healthcare system (depending on insurance coverage), although no studies in pregnant individuals have confirmed this.

Question 5: Should pregnant individuals diagnosed with OSA during pregnancy undergo treatment based only on the apnea-hypopnea index or a combination of AHIwith clinical comorbidities and symptoms?

CHEST Recommendation: In pregnant individuals diagnosed with OSA during pregnancy, we suggest that treatment be offered for those with an AHI of 5-15 when accompanied by symptoms, sequelae, or comorbidities/ additional risk factors (e.g. hypertension, diabetes, stroke). For AHI >15, PAP therapy is recommended regardless of symptoms or comorbidities. (Conditional recommendation, very low certainty of evidence).

Remarks: This recommendation emulates recommendations in the non-pregnant population due to the lack of guiding pregnancy specific data. An individualized approach that incorporates AHI, symptoms, and comorbidities should guide treatment decisions. Given limited evidence that treatment improves perinatal outcomes in OSA, therapy primarily targets symptom relief and prevention of progression.

Justification: Available observational studies comparing mild vs. moderate–severe OSA show trends toward worse outcomes with higher AHI, though these data lack stratification by symptom burden or comorbidities.[24,26] Existing studies are limited by low numbers of included participants with severe OSA and lack of data comparing symptoms, quality of life, or treatment outcomes between mild and moderate-severe OSA groups (e-Table 6).

A treatment algorithm for mild OSA is illustrated in **Figure 2.** We recommend assessing symptoms and comorbidities in patients with mild OSA while deciding on management strategies. Important caveats are that OSA is associated with adverse maternal-fetal outcomes[1,11,41,42] and OSA severity and related symptoms can worsen throughout pregnancy. Therefore, it is possible that early treatment may prevent progression to more severe OSA.[13,39,43]

Hence, monitoring throughout pregnancy is critical and can help guide decisions in patients without initial symptoms or comorbidities.

Specific populations: Pregnant individuals with hypertension or diabetes may have greater benefit from treatment, even with mild OSA, though data are quite limited. Obesity alone should not be interpreted as a mandatory criterion for treating mild OSA but rather a risk enhancing factor to be considered in individualized treatment decisions.

Need for monitoring: OSA severity may progress throughout pregnancy and may influence the decision to initiate therapy. Symptoms should be monitored alongside objective sleep measures.

Question 6: Should pregnant individuals diagnosed with OSA during pregnancy be treated with PAP?

CHEST Recommendation: In pregnant individuals diagnosed with OSA during pregnancy in whom treatment is recommended, we suggest that any form of PAP treatment be used over no treatment. (Conditional recommendation, very low certainty of evidence).

Remarks: The favorable effects of PAP therapy on sleep symptoms and the cost-effectiveness of PAP therapy extrapolated from the non-pregnant population, combined with the committee's opinion of low risk associated with PAP therapy, led to the conditional recommendation in the face of minimal evidence. This recommendation is conditional on availability of treatment.

Justification: OSA affects both maternal and fetal health, extending past the post-delivery period. Even small improvements in outcomes are significant due to their impact on both populations. Two randomized controlled trials (RCTs) and one observational study examined the impact of PAP therapy on maternal health. A RCT randomized 340 pregnant participants with SDB to PAP

or usual care and performed a modified intention to treat analysis. Primary outcomes were clinic blood pressures, with incidence of hypertensive disorders of pregnancy serving as a secondary outcome. Pregnant individuals with SDB randomized to PAP therapy had lower blood pressure measures and lower rates of hypertensive disorders of pregnancy compared to usual care.[44] A small RCT in women with OSA and gestational diabetes mellitus (N=36) showed no difference in glycemic control.[45] A small observational study demonstrated a significant association between OSA and impaired fetal growth, but in women who were adherent to PAP therapy, there was no association between PAP therapy and impaired fetal growth (N=14) after adjusting for covariates.[46] The existing literature highlights that further studies are needed to examine the effect of PAP therapy on key perinatal outcomes. However, committee members believed that given the low anticipated risk of PAP therapy in this population, and the fact that PAP improves respiratory parameters during sleep and symptoms of OSA, PAP therapy may offer benefit to symptomatic individuals and those at risk as discussed above.[47]

Another important consideration is the low adherence to PAP therapy reported in pregnancy.[44,48-50] This is thought to be related to a multitude of factors, some that are similar to those in the general population, others that are unique to this population, as well as factors that relate to the prioritization (or lack of) of sleep interventions in the prenatal population. Hence, focused efforts to identify and address barriers to PAP therapy in this population are needed and may include focused desensitization or behavioral interventions.

Need for monitoring: Monitor PAP use adherence, side effects, and the impact of therapy on sleep quality and daytime function.

Question 7: Should pregnant individuals diagnosed with OSA during pregnancy be treated with alternatives to PAP vs PAP?

CHEST Recommendation: In pregnant individuals diagnosed with OSA during pregnancy for whom treatment is recommended, we suggest using PAP therapy rather than alternative therapies. (Conditional recommendation, very low certainty of evidence)

Remarks: Some evidence supports that treatment of OSA may improve outcomes during pregnancy. The gold standard therapy is PAP. For this reason, we suggest considering PAP as first-line treatment, before considering alternative therapies.

Justification: Comparative studies of therapeutic interventions in OSA in pregnancy are scarce. Huynh et al. (2022), studied 17 women with mild to moderate OSA treated with mandibular advancement splint treatment (MAS) during pregnancy and up to 6 months postpartum.[51] The MAS reduced AHI and snoring; however, adherence was only 57 % during pregnancy and 24.8% postpartum. Maxwell et al. (2022), noted that the use of nasal dilator strips during pregnancy did not improve respiratory event indices or pulse transit time, and suggested that nasal dilator strips would be an adequate placebo intervention.[52] Reid et al. (2013) explored whether treating nocturnal airflow limitation with PAP or MAS + nasal strips could improve gestational hypertension.[53] PAP was more effective at reducing SDB than MAS, but neither strategy significantly lowered blood pressure after a single night. In an observational study, Stajic et al. (2022) investigated the effect of PAP therapy on hypertensive disorders of pregnancy in high risk pregnancies in women with OSA and daytime sleepiness, comparing women who were adherent to auto-titrating PAP (Group 1) to those who declined PAP therapy (Group 2) and controls without OSA.[54] Group 1 and 2 were offered conservative management that included psychological support, postural advice, medical management of comorbidities, advice to reduce

alcohol and smoking use. PAP treatment significantly reduced the incidence of severe hypertension and improved oxygen saturation compared to conservative management. The literature remains quite limited in examining appropriate alternatives to PAP therapy and the recommendation is mainly based on the fact that more studies have reported on the use of PAP therapy than any other alternative *(See **Table 2** regarding knowledge gaps and research recommendations).* Despite MAD being effective in treating mild OSA in the general population and potential applicability of this device in pregnancy, feasibility, efficacy, and safety data on the use of MAD in this population remain very limited. Data on pharmacological or neuromodulation interventions in pregnancy are lacking.

Question 8: Should pregnant individuals with residual sleepiness after treatment with PAP be treated with stimulants or scheduled naps?

CHEST Recommendation: In pregnant individuals with residual sleepiness currently on PAP therapy for OSA, we suggest using scheduled naps whenever possible, and only using stimulants on an as-needed basis after failure of scheduled naps. (Conditional recommendation, very low certainty of evidence)

Remarks: This recommendation was based on a very low level of evidence and was reached following review of guidance on the treatment of residual sleepiness while on PAP treatment in the general population, as well as review of available data regarding the safety profile and the risk of teratogenicity of drugs approved for the treatment of the condition. The recommendation applies for individuals who have the ability to take scheduled naps during waking hours.

Justification: The committee felt that the first step in addressing residual sleepiness, despite being on PAP treatment, should be optimizing PAP therapy and sleep duration, assessing, screening, and treating other sleep disorders, encouraging good sleep hygiene and regular physical activity, and considering cognitive-behavioral therapy for co-morbid insomnia. In patients with persistent sleepiness despite the lack of other treatable conditions and in whom PAP prescription and usage is optimized, additional measures to address sleepiness would need to be initiated (**Figure 3**). Scheduled strategic naps can help improve alertness and cognitive function, providing temporary relief from residual sleepiness. Napping generally has minimal side effects compared to stimulant use. However, napping may not address the underlying cause of residual sleepiness, could potentially disrupt nighttime sleep, and may be logistically difficult due to personal or professional obligations. On the other hand, stimulants can provide short-term improvements in alertness and wakefulness, which may enhance daytime functioning in pregnant individuals with residual sleepiness. As daytime sleepiness can impact daytime functioning, quality of life, and may place an individual at risk for physical harm such as from motor vehicle accidents, risk of the untreated condition and the drug and the benefit of treatment should be weighed carefully.[55] Stimulants can have adverse effects on both the mother and the developing fetus. Possible adverse reactions [56,57] include increased heart rate and blood pressure, disruption of sleep architecture and decreased sleep quality. There is also a potential for worsening sleepiness in the long term and possible tolerance and dependence, as seen in the general population. Pregnancy specific risk exists as well (see **Table 3**) and the decision to start pharmacologic treatment should be done through shared decision making and in partnership with the healthcare provider managing the pregnancy.

Need for monitoring: Given that sleep and sleep disorders evolve and change during the different stages of pregnancy, periodic monitoring of residual sleepiness is warranted with re-evaluation of confounding factors related to sleep quality and quantity, emerging sleep disorders that contribute to sleep disruption, and the control of OSA on current PAP therapy. Monitoring of pregnant women who are treated with stimulants is also indicated as per the general guidelines for the specific agent used.

Question 9: Should reassessment for OSA vs. no reassessment be used after delivery in individuals previously diagnosed with OSA during pregnancy?

CHEST Recommendation: In individuals previously diagnosed with OSA during pregnancy, we suggest reassessment for OSA after delivery (conditional recommendation, very low certainty of evidence).

Remarks: In pregnant individuals who were diagnosed with OSA prior to pregnancy, retesting after pregnancy may not be necessary and therapy should be continued. Women with severe disease diagnosed during pregnancy are probably less likely to have full resolution postpartum and continuing therapy without repeating testing may be justified, especially if symptoms persist.

Justification: The postpartum period is associated with changes in the sleep pattern, metabolism, hormonal and musculoskeletal systems.[75,76] Up to 75% of people in the United States, at one year after childbirth, have a higher BMI compared to pre-pregnancy and up to 20% of people experience excessive postpartum weight retention.[77-79] These factors can affect the resolution of OSA diagnosed in pregnancy.[80]

The panel identified three studies addressing this question.[51,80,81] Street et al. revealed that 16 (66.7%) of 24 women who were diagnosed with OSA (REI≥5) during the third trimester had persistent OSA at 6-8 months postpartum.[80] Huyhn et al. studied 17 women with mild-moderate OSA at an average of 22 weeks' gestation (AHI 10-29, diagnosed by level 2 polysomnography). Only 2 participants (11.8%) had normalization of AHI (≤10 events/h) around 4 months postpartum, while 47%, 36% and 6% of participants had persistent mild, moderate and severe OSA, respectively.[51] The NuMOM2B cohort followed nulliparous pregnant women (N=1,964) after delivery and had repeat sleep studies at 2-7 years.[81] Though this study examined women later than the period intended for this PICO question, the sample size is the largest of existing studies and warrants mention. A total of 9.3% had AHI≥5 either at early or mid-pregnancy sleep assessment. A repeated sleep study was performed 2-7 years after delivery in a subset of women. The results showed that 84.1% of the women had no OSA at all time points, 5.8% had OSA during pregnancy that persisted at follow-up, 2.6% had OSA in pregnancy that resolved at follow-up and 7.5% had new-onset OSA that was discovered at follow-up. OSA at 2-7 year follow up is linked to hypertension, metabolic syndrome, and impaired glucose tolerance (aRR 2.3-3.8).[81,82] Although the repeated sleep study was performed years after an index pregnancy, and not immediately after, the information highlights the adverse metabolic health effects of OSA, either persistence from pregnancy or new onset, in women of childbearing age. As data is lacking regarding specific risk factors that predispose to the persistence of OSA postpartum, we believe that failure to test postpartum may result in unwarranted long-term therapy.

Cost: In non-pregnant people with moderate to severe OSA and at high risk for cardiovascular diseases, PAP is cost-effective after the second year of treatment.[83] Whether screening and treating OSA in the postpartum period is cost-effective remains to be explored.

Equity: Reassessment for OSA after delivery could be influenced by access to health care. Half of birthing individuals in the US do not receive routine postpartum healthcare. Further, some pregnant patients who qualified for states' medical insurance during pregnancy lose their coverage after delivery, which may disproportionately impact populations with existing health disparities.[84-87] These are important considerations as it is known that the severity of OSA differs across racial/ethnic groups, being higher in racial/ethnic minorities.[88]

DISCUSSION AND SUMMARY

This manuscript aims to provide an evidence-based approach to the detection and management of OSA during and after pregnancy. It is important to note that all questions addressed had a very low degree of certainty and hence, were addressed with available evidence and expert consensus from the authors. Our review has identified several aspects of care for pregnant patients with, or at risk for, OSA that remain to be explored highlighting the need for more investigation into how best to approach OSA during and after pregnancy.

Given the prevalence of OSA during pregnancy estimated at >9%,with significantly higher prevalence in complicated pregnancies, and the established association with adverse outcomes, it was important to evaluate the current data and present guidance on management strategies. As most of the guidance is based on low level of evidence in regard to screening and treatment of

437 OSA in pregnancy, many knowledge gaps remain and call for future research in this area. Some
438 research priorities have been highlighted in **Table 2**.
439

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FIGURE LEGENDS

Figure 1: Sensitivity and specificity of the STOP-BANG questionnaire, the Facco tool, and the Berlin questionnaire in pregnancy

Figure 2. Treating mild OSA (AHI 5-15) during pregnancy

Figure 2 legend: This flowchart outlines treatment strategies for pregnant individuals diagnosed with OSA. For AHI >15, PAP therapy is recommended regardless of symptoms or comorbidities. For AHI 5–15, management is guided by symptom severity and comorbidities: high-risk individuals (e.g., BMI >30, hypertension, diabetes, preeclampsia) should be considered for PAP therapy, while those with mild symptoms or no symptoms may benefit from lifestyle modifications and close monitoring. Postpartum reassessment is essential to determine persistence and treatment needs.

PS: This figure does not consider the timing of diagnosis of OSA and is based on strategies utilized outside of pregnancy. Of note, even mild OSA is associated with adverse perinatal outcomes and there are no studies to guide strategies based on phenotyping by symptoms or risks that are available in this population.

OSA: obstructive sleep apnea; PAP: positive airway pressure; AHI: apnea-hypopnea index

Figure 3: Stepwise approach to treating pregnant individuals with residual sleepiness after PAP therapy.

PAP: positive airway pressure

Table 1: Summary of recommendations

1. In pregnant individuals on CPAP for OSA prior to pregnancy, we suggest APAP be used rather than continued CPAP. (Conditional recommendation, very low certainty of evidence)
2. In pregnant individuals, we suggest screening for sleep disordered breathing. (Conditional recommendation, very low certainty of evidence)
3. In pregnant individuals being screened for sleep disordered breathing, we suggest screening using either a pregnancy-specific tool or a standard screening tool. (Conditional recommendation, very low certainty of evidence)
4. In pregnant individuals undergoing evaluation for OSA, we suggest either at-home diagnostic devices or lab-based diagnostics be used. (Conditional recommendation, very low certainty of evidence)
5. In pregnant individuals diagnosed with OSA during pregnancy, we suggest that treatment be offered to those with an AHI 5-15 when accompanied by symptoms sequelae or comorbidities / additional risk factors. For AHI > 15PAP therapy is recommended regardless of symptoms or comorbidities. (Conditional recommendation, very low certainty of evidence)
6. In pregnant individuals diagnosed with OSA during pregnancy for whom treatment is recommended, we suggest that any form of PAP treatment be used rather than no treatment. (Conditional recommendation, very low certainty of evidence)
7. In pregnant individuals diagnosed with OSA during pregnancy for whom treatment is recommended, we suggest using PAP therapy rather than alternatives to PAP therapy. (Conditional recommendation, very low certainty of evidence)
8. In pregnant individuals currently on PAP therapy for OSA diagnosed during pregnancy and with residual sleepiness, we suggest using scheduled naps whenever possible, and only using stimulants on an as-needed basis after failure of scheduled naps. (Conditional recommendation, very low certainty of evidence)
9. In post-partum individuals previously diagnosed with OSA during pregnancy, we suggest reassessment for SDB. (Conditional recommendation, very low certainty of evidence)

OSA: obstructive sleep apnea; CPAP: continuous positive airway pressure; APAP: auto-adjusting positive airway pressure; AHI: apnea-hypopnea index; SDB: sleep disordered breathing; PAP: Positive airway pressure.

Table 2: Research priorities and knowledge gaps in screening and treatment of OSA in pregnancy

Screening for OSA in pregnant individuals	-Development and validation of screening tools for pregnant individuals at various levels of risk for SDB - Implementation of screening in perinatal care - Educational strategies for the public and the medical community about OSA in pregnancy
Treatment of OSA in pregnant individuals	-Impact of treatment on OSA symptoms as well as on perinatal outcomes -Timing of screening and treatment in the perinatal period for optimal outcomes -Addressing PAP adherence in this population -Effectiveness, adherence, and implementation of alternative therapy to PAP -Education of perinatal providers regarding treatment -OSA phenotypes relevant to treatment. Safety, pharmacokinetic and pharmacodynamic data of pharmacotherapy
OSA postpartum	-Natural history and predictors of persistent OSA - Timing, implementation and acceptability of postpartum testing

SDB: sleep disordered breathing; OSA: obstructive sleep apnea; PAP: positive airway pressure

Table 3: Safety data of stimulants in pregnancy and lactation.

	Pregnancy considerations	Lactation
Amphetamines	Neurodevelopmental issues in experimental animal studies and decreased fetal growth. Human studies suggest an increased risk for hypertensive disorders of pregnancy and preterm birth, and severe maternal illness.[56,57] Fetal growth delays have been described with abuse of the drug. A pregnancy registry exists.[58]	Excreted in breast milk. May not adversely affect nursing infants if used at dosages prescribed for medical indications. The American Academy of Pediatrics and the American College of Obstetricians and Gynecologists recommend against breastfeeding in women actively abusing amphetamines.[59,60]
Methylphenidate	Demonstrated in animal fetal brain after intraperitoneal dosing with increased compulsivity, impulsivity, and reward seeking behavior.[61] Conflicting data regarding an association with cardiovascular malformations. A 2023 meta-analysis of human studies with 1st trimester exposure demonstrated a significant increase in risk for cardiac malformations but without exclusion of potential confounders.[58,62]	Levels are low in breast milk and not detectable in infant serum.[63]
Modafinil and Armodafinil	Safety concerns regarding major malformations. European Health Ministry and Health Canada advise against their use due to reports of major malformations.[64-66] A pregnancy registry collected data on malformations.[57]	Excreted in breast mild at about 5% of maternal dose.[67,68] However, this may be underestimated due to measuring only R-enantiomer of modafinil.[69,70] No reports of impact on neonates.
Pitolisant	Decreased embryofetal viability in animal studies. No human studies found.	Excreted in breast milk in rats; no human data on possible effects in the nursing infant were found.[71,72]

Solriamfetol	Fetal and maternal toxicity. Associated with increased risk of "alterations" rather than malformations, according to FDA determination.[71,73]	Excreted in breast milk at 5.5% of the weight adjusted maternal dose; no reports of impact on neonates.

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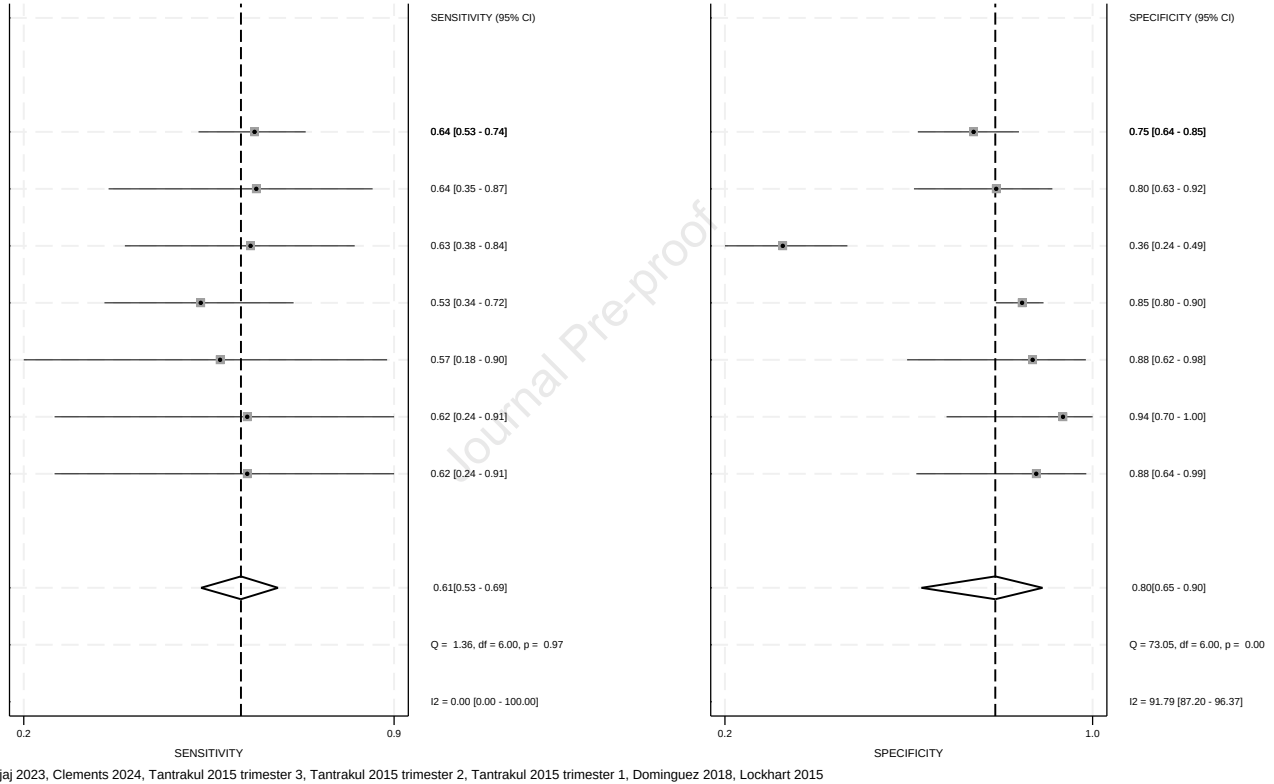
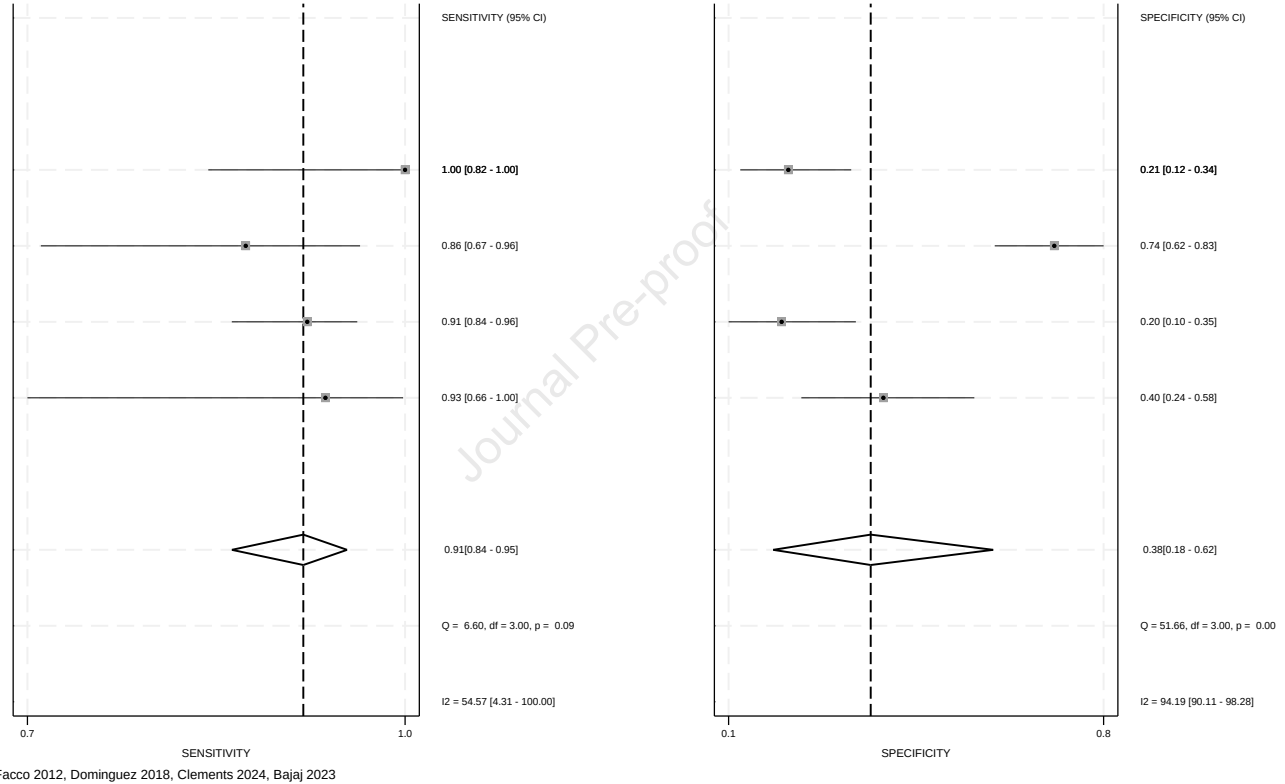


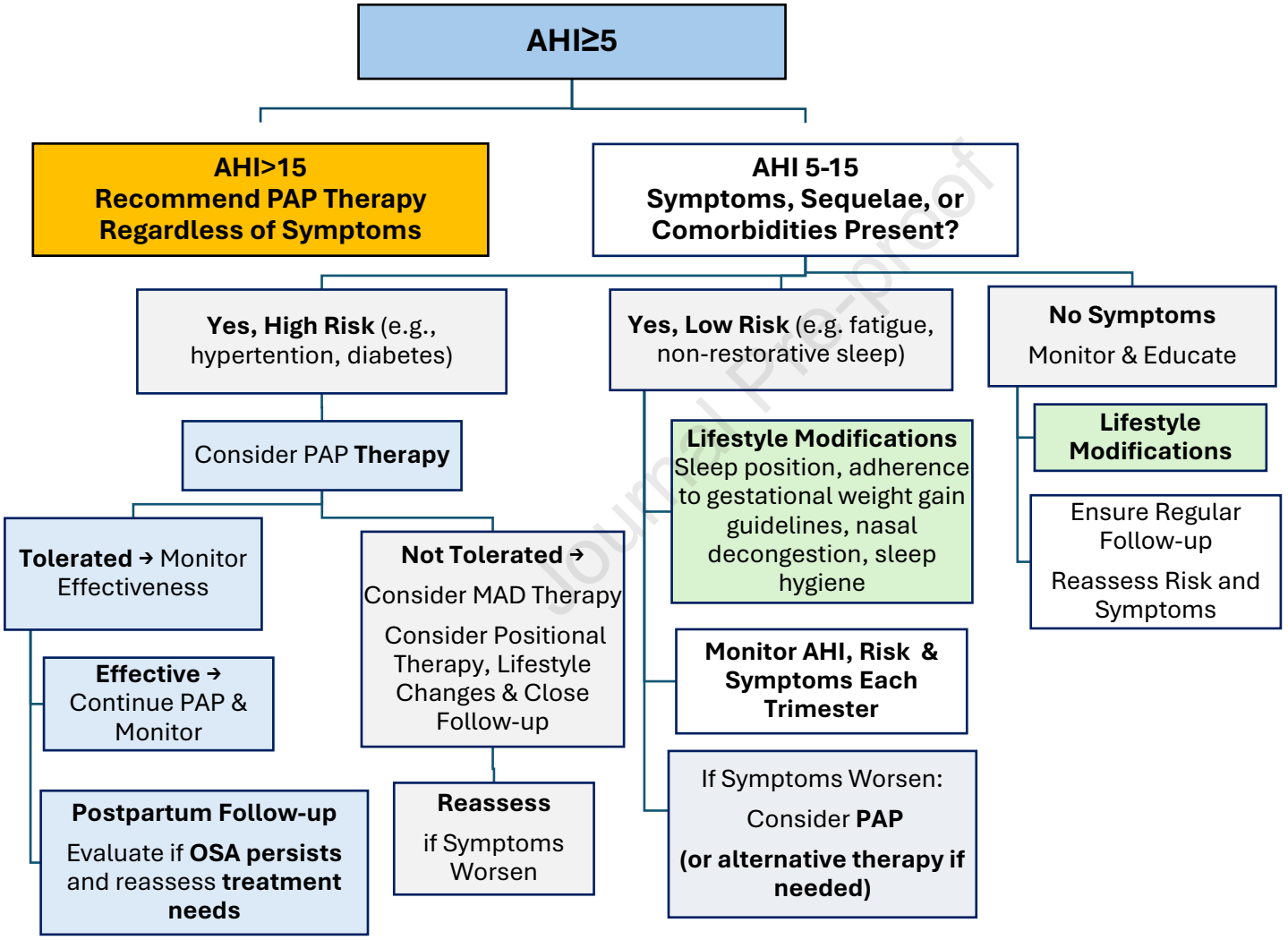
Top to bottom - Bajaj 2023, Clements 2024, Tantrakul 2015 trimester 3, Tantrakul 2015 trimester 2, Tantrakul 2015 trimester 1, Dominguez 2018, Lockhart 2015



Top to bottom - Facco 2012, Dominguez 2018, Clements 2024, Bajaj 2023

Figure 2. Treating Mild OSA (AHI 5-15) During Pregnancy

OSA: obstructive sleep apnea; PAP: continuous positive airway pressure; AHI: apnea-hypopnea index



This flowchart outlines treatment strategies for pregnant individuals diagnosed with OSA. For AHI >15, PAP therapy is recommended regardless of symptoms or comorbidities. For AHI 5–15, management is guided by symptom severity and comorbidities: high-risk individuals (e.g., BMI >30, hypertension, diabetes, preeclampsia) should be considered for PAP therapy, while those with mild symptoms or no symptoms may benefit from lifestyle modifications and close monitoring. Postpartum reassessment is essential to determine persistence and treatment needs.

PS: This figure does not consider the timing of diagnosis of OSA and is based on strategies utilized outside of pregnancy. Of note, even mild OSA is associated with adverse perinatal outcomes and there are no studies to guide strategies based on phenotyping by symptoms or risk that are available in this population.

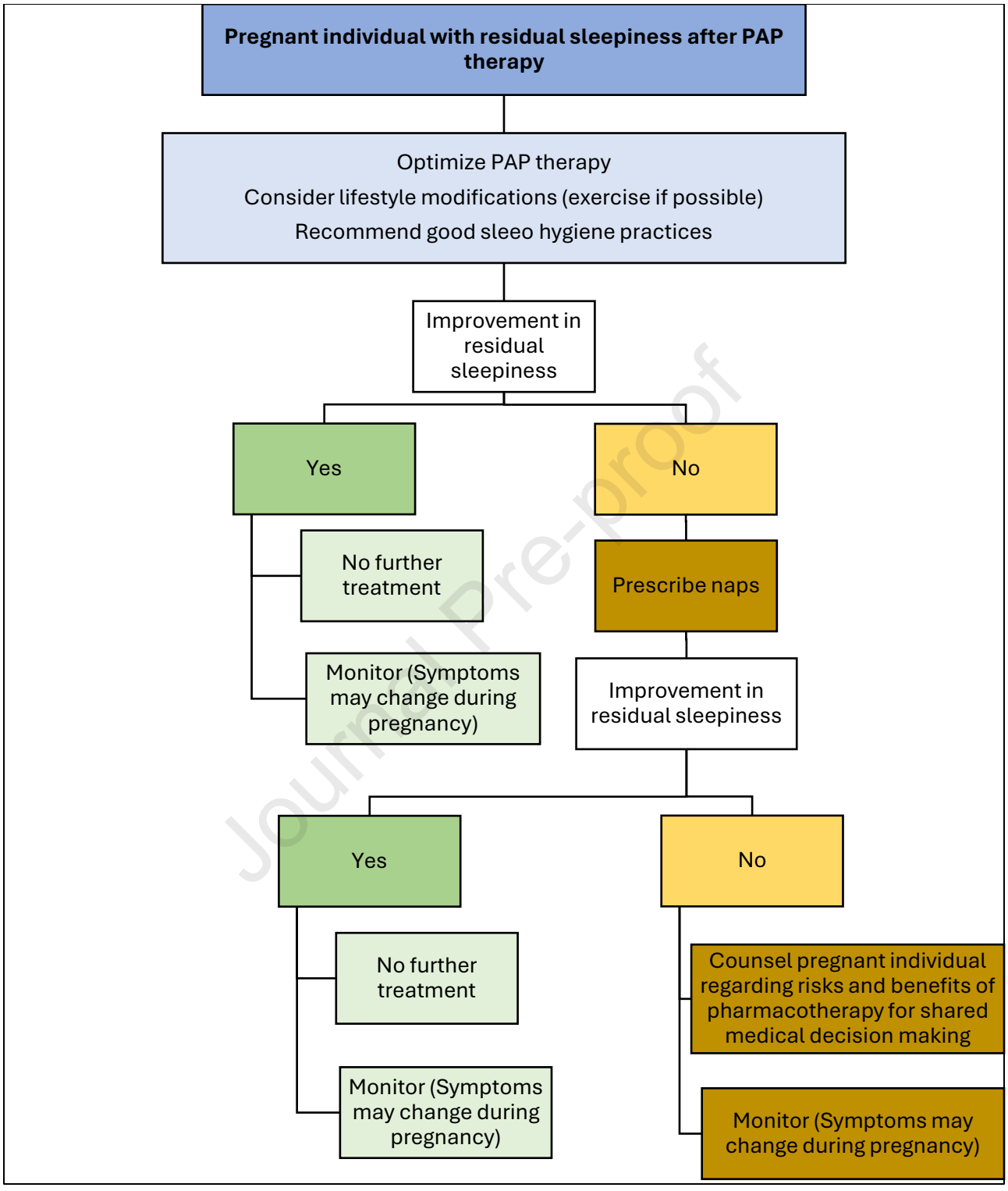

Pregnant individual with residual sleepiness after PAP therapy
Optimize PAP therapy
Consider lifestyle modifications (exercise if possible)
Recommend good sleeo hygiene practices
Improvement in residual sleepiness
Yes
No
No further treatment
Monitor (Symptoms may change during pregnancy)
Prescribe naps
Improvement in residual sleepiness
Yes
No
No further treatment
Monitor (Symptoms may change during pregnancy)
Counsel pregnant individual regarding risks and benefits of pharmacotherapy for shared medical decision making
Monitor (Symptoms may change during pregnancy)

Figure 3

Supplement

e-Appendix 1. Methods (in full)

Expert Panel Composition
The Chairs of the panel (CD and GB) were reviewed for potential conflicts of interest (COIs) and approved by CHEST's Professional Standards Committee. An international panel was nominated by the Chairs based on their expertise relative to potential guideline questions. The final panel consisted of the guideline chair(s), 11 panelists (JD, AH, BIB, JL, ML, IM, SR, LS, FS, DW, CW), representing four countries, a methodologist (CED), and an additional panelist (JV) serving as a liaison to CHEST's Guidelines Oversight Committee. This multidisciplinary panel includes experts in obstructive sleep apnea during pregnancy, sleep, pulmonology, obstetrics and high-risk obstetrics, obstetric anesthesia, nursing, endocrinology, and obstetric medicine. A literature search for qualitative research on patients' views regarding the acceptability of diagnostic and therapeutic questions was conducted to incorporate the patient perspective.

Conflicts of Interest
All panelists were reviewed for their potential conflicts of interest (COI) by the CHEST Professional Standards Committee. Nominees without any significant COIs were approved and those with potential intellectual and/or financial COIs that were manageable were "approved with management." Panelists "approved with management" did not participate in discussions and did not vote on recommendations for which they had COIs. A grid used to track COIs was created for each key clinical question and used during voting to ensure management terms were observed. Panelists' COIs are detailed in a COI grid (**e-Appendix 2**).

Question Development and Literature Search
The co-chairs and core panelists developed a total of nine key clinical questions using the Population, Intervention, Comparator, and Outcome (PICO) format (**e-Table 1**). Outcomes were discussed by the panel, and a survey was performed asking panelists to rate outcomes for each PICO question on a scale of 1 to 9. Outcomes with a mean ranking of 1-3 were considered of limited importance, 4-6 were considered important but not critical, and 7-9 were considered critical. Only critical outcomes were used in the primary analysis for each question and in grading the overall certainty of evidence.

e-Table 1: PICO Questions

Question 1	Should pregnant persons on CPAP for OSA prior to pregnancy be switched to APAP or continue CPAP during pregnancy?
Question 2	Should pregnant persons be screened for OSA in pregnancy?
Question 3	Should pregnant persons be screened for OSA using a pregnancy-specific screening tool or standard OSA screening tool?
Question 4	In pregnant persons undergoing evaluation for OSA, should at-home in-clinic devices be used for diagnosis?
Question 5	Should pregnant persons diagnosed with OSA during pregnancy undergo treatment based only on the AHI or a

	combination of AHI and clinical history and symptoms?
Question 6	Should pregnant persons diagnosed with OSA during pregnancy be treated with CPAP?
Question 7	Should pregnant persons diagnosed with OSA during pregnancy be treated with alternatives to CPAP vs CPAP?
Question 8	Should pregnant persons with residual sleepiness after treatment with PAP be treated with stimulants or scheduled naps?
Question 9	Should postpartum persons diagnosed with OSA during pregnancy be reassessed for OSA severity in the (approximate) 12-month period after giving birth?

With the help of the methodologist, the panel reviewed the PICO questions to identify and finalize search terms, inclusion and exclusion criteria, and databases to be searched. A comprehensive search using MEDLINE via PubMed, Embase, and the Cochrane library was performed to identify evidence that could inform clinical decision-making. The search was conducted using a combination of the National Library of Medicine's Medical Subject Headings and keywords (**e-Appendix 3**) in October 2022. A pragmatic search update was conducted in January 2025 to identify relevant studies published after the original literature search.
The inclusion criteria limited study designs to systematic reviews, randomized controlled trials, prospective and retrospective cohort studies, and case-control studies. Case reports, case series, narrative reviews, expert opinions, conference abstracts, observational studies without a control group, and single-arm studies were excluded. Searches were limited to English language results. Reference lists of retrieved studies were also reviewed, and additional studies were manually added to the search results.

Study Selection and Data Extraction
Studies identified during the literature search were reviewed for relevance using pre-defined inclusion and exclusion criteria based on the PICO components of the key questions over two rounds of study selection. In the initial round, titles and abstracts of each citation were reviewed by two individuals from the panel. References that were considered potentially relevant were further reviewed during full-text screening, after which a final inclusion was made. Inclusion decisions were made independently and in parallel for both rounds of screening. Disagreements were resolved by discussion to reach consensus and if not possible, a third reviewer made a final inclusion or exclusion decision. Study selection is detailed in **e-Figure 1** (PRISMA diagram).

Structured data tables were used to extract relevant data from all studies included after the second round of screening. The methodologist performed data extraction, and subsequently, the data was independently reviewed by a panelist for accuracy. Relevant studies were summarized to inform recommendations for each PICO question.

Risk of Bias Assessment
The methodologist assessed the risk of bias in all included studies using the following assessment tools, as appropriate, based on study design: Cochrane Risk of Bias tool for randomized controlled trials, the Cochrane Bias Methods Group Tool to Assess Risk of Bias in Cohort Studies, and the Documentation and Appraisal Review Tool for systematic reviews. (Diekemper R.L. IBK, Merz

LR. Development of the documentation and appraisal review tool for systematic reviews. World J Meta-Anal.2015;3:142-150.
Boutron et al. Cochrane Handbook for Systematic Reviews of Interventions. Version 6.3, 2022. Chapter 7: Considering bias and conflicts of interest among the included studies. https://training.cochrane.org/handbook/current/chapter-07. Accessed November, 2022.
Higgins et al. Cochrane Handbook for Systematic Reviews of Interventions. Version 6.3, 2022. Chapter 8: Assessing risk of bias in a randomized trial. https://training.cochrane.org/handbook/current/chapter-08. Accessed November, 2022)

Meta-analysis

After completion of the quality assessment and data extraction, meta-analyses were performed when data was homogeneous using a random effects model Review Manager version 5.4. Risk or odds ratios were used to report the results for dichotomous outcomes and mean difference for continuous outcomes with accompanying 95% CIs. Statistical heterogeneity was assessed using the Higgins I^2 value and the χ^2 test. (Higgins JP, Thompson SG. Quantifying heterogeneity in a metanalysis. Stat Med. 2002;21(11):1539-1558.) A Higgins' I^2 value $\geq$ 50% and P values < 0.05 were considered to represent significant heterogeneity.

Assessing the Overall Quality of the Body of Evidence

The overall certainty (quality) of the evidence was assessed for each outcome of interest using the Grading of Recommendations, Assessment, Development, and Evaluation (GRADE) approach. (Balshem H, Helfand M, Schunemann HJ, et al. GRADE guidelines: 3. Rating the quality of evidence. J Clin Epidemiol. 2011;64(4):401-406.) Evidence profiles (**e-Tables 2-10**) were created using the GRADEPro Guideline Development Tool, which categorized the overall certainty of the evidence for each outcome as either high, moderate, low, or very low. Each certainty rating represents the confidence in the estimated effects for an outcome.

Recommendation Drafting

The panel drafted recommendations based on the evidence that addressed the key clinical questions. Recommendations were drafted based on panel discussion and decisions made in the evidence-to-decision framework for each question (**e-Tables 11-19**). (Alonso-Coello P, Schünemann HJ, Moberg J, et al. GRADE evidence to decision (EtD)
frameworks: a systematic and transparent approach to making well-informed healthcare
choices. 1: introduction. BMJ. 2016;353:i2016.) Recommendations were drafted using the GRADE approach, with strength of recommendation considered strong or conditional. Recommendations were accordingly worded such that "We recommend" corresponded to a strong recommendation and "We suggest" corresponded to a conditional recommendation. In areas where there was low or very low certainty of evidence, it was determined *a priori* that a "strong recommendation" could only be considered if there was unanimous agreement amongst the panel for a strong recommendation AND if there was an acceptable paradigmatic situation to justify a strong recommendation. (Andrew, et al. J Clin Epidemiol. 2013;66:719-25.
Andrews, et al. J Clin Epidemiol. 2013;66:726-735.)

Method for Achieving Consensus

Results from the literature search and study summary were discussed among panel members during a video conference. Every panel member had the opportunity to provide comments and suggestions

for the direction and wording of recommendations for each question to be incorporated in the initial round of a modified Delphi survey.

Each panel member voted on the direction and strength of the recommendation using a Likert scale (strong recommendation for the intervention, conditional recommendation for the intervention, conditional recommendation for either the intervention or comparison, conditional recommendation against the intervention, strong recommendation against the intervention). (Jaeschke R, Guyatt GH, Dellinger P, et al. Use of GRADE grid to reach decisions on clinical practice guidelines when consensus is elusive. BMJ (Clinical research ed.) 2008;337:a744). The survey was distributed via SurveyMonkey. COI grids were included with the voting survey, and panelists with COIs related to individual recommendations were not permitted to vote on those statements in accordance with their management terms. As per CHEST policy, consensus was achieved through up to three rounds of anonymous voting or until 80% agreement in directionality was reached for each recommendation with at least 75% of the panel participating. Any recommendation or suggestion that did not meet these criteria was revised by the panel based on the feedback provided, and a new voting survey that incorporated suggested changes was disseminated and completed.

The guideline was reviewed and approved by the CHEST Guidelines Oversight Committee and the CHEST President.

e-Appendix 2. Conflict of Interest Table

COI Table

Name	Relationship*	Decision per CHEST COI Policy**
Bilgay Izci-Balserak, PhD	1. 2022 Grant from NIMHD with funds to institution	1. Permissible
Ghada Bourjeily, MD, FCCP	1. 2021 Grants from NHLBI with funds to institution 2. 2021 Grant from NICHD with funds to institution 3. 2021 Grant from NICCH with funds to institution 4. 2021 Grant from NIGMS with funds to institution 5. 2022 Grant from Dreem, Inc with devices to institution 6. 2021 Royalties from Springer/Humana with funds received 7. 2022 Royalties from Dynamed/Ebsco with funds received 8. 2023 NIH Grants with funds to institution	1-8. Permissible
Carolyn D'Ambrosio, MD, MS, FCCP	1. 2022 Grant from Amazon with funds to institution 2. 2023 Medical Expert/Legal Assistance with funds received 3. Patent Holder – Circadian Programming Device with no funds received	1-2. Permissible 3.Permissible – unrelated to guideline content.
Jennifer Dominguez, MD	Nothing to disclose	
Ashraf Habib, MBBCH, MSc, MHSc	1. 2021 Industry-sponsored advisory boards with Heron Therapeutics and MDoloris with funds received 2. 2022 Heron Therapeutics Advisory Board with funds received 3. 2023 Educational Consultancy with Vertex Therapeutics with funds received 4. 2023 Merck Advisory Board with funds received 5. 2022 grants sponsored by Pacira Biosciences, Avanos Inc, and Haisco USA with funds to institution. 6. 2023 Medical Expert/Legal Assistance with funds received	1-4. Permissible – unrelated to guideline content. 5-6. Permissible
Gayle Olson Koutrouvelis, MD, MPH	1. 2022 patent related to fetal heart monitoring	1. Permissible – unrelated to guideline content.
Judette Louis, MD, MPH	1. 2021 consultancies for Roche, American Board of OB/GYN, Elsevier, Cytyc Prenatal Products, and Hologic with funds received. 2. 2021 consultancy for March of Dimes with no funds received. 3. 2021 - Legal assistance as medical expert 4. 2021-2025 – Publication with Wolters-Kluwer with funds received	1. Permissible – unrelated to guideline content 2-4. Permissible
Mariam Louis,	Nothing to disclose	

MSc, MD, FCCP		
Isabelle Malhame, MD, MSc, FRCPC	1. Grants disclosed in 2022 sponsored by Canadian Institutes of Health Research and Canadian Foundation for Women's Health with funds to institution.	1. Permissible
Sirimon Reutrakul, MD	1. Grants disclosed in 2022 sponsored by National Eye Institute, NHLBI, and NIDDK with funds to institution. 2. Speaking activity for Cardio Metabolic Congress with funds to institution 3. 2024 – Speaking Activity for Christiana Care with funds received.	1-3. Permissible
Laura Sanapo, MD, MSHS	1. Grant disclosed in 2022 sponsored by The Rhode Island Foundation with funds to institution. 2. Grant disclosed in 2023 sponsored by the Women's Medicine Collaborative at Brown University Health with funds to institution.	1-2. Permissible
Fidaa Shaib, MD	1. Grant disclosed in 2022 sponsored by Medical Technology Enterprise Consortium with funds to institution.	1. Permissible
Janine Vintch, MD, FCCP	1. 2022 Consultancy with iSchemaView, Inc with funds received. 2. 2023 Data Safely Monitoring Board with funds to institution.	1. Permissible – unrelated to guideline content 2. Permissible
Danielle Wilson, BSc, MSc, PhD	1. 2022 Grants sponsored by Norman Beischer Medical Research Foundation and Austin Medical Research Foundation with funds to institution. 2. 2023 sponsored by Metro North Health with funds to institution.	1-2. Permissible
Christine Won, MD	1. 2021-2023 consultancy for Flo Health with funds received. 2. 2021-2023 article reviews for Dynamed with funds received.	1. Permissible - unrelated to guideline content 2. Permissible

***** This table represents disclosures from 12 months prior to the start of the guideline, which was June 1, 2022, per the CHEST COI Policy for Guidelines.
******Evaluated per CHEST COI Policy for Guidelines in effect at the time of disclosure.

e-Appendix 3. Search Strategies

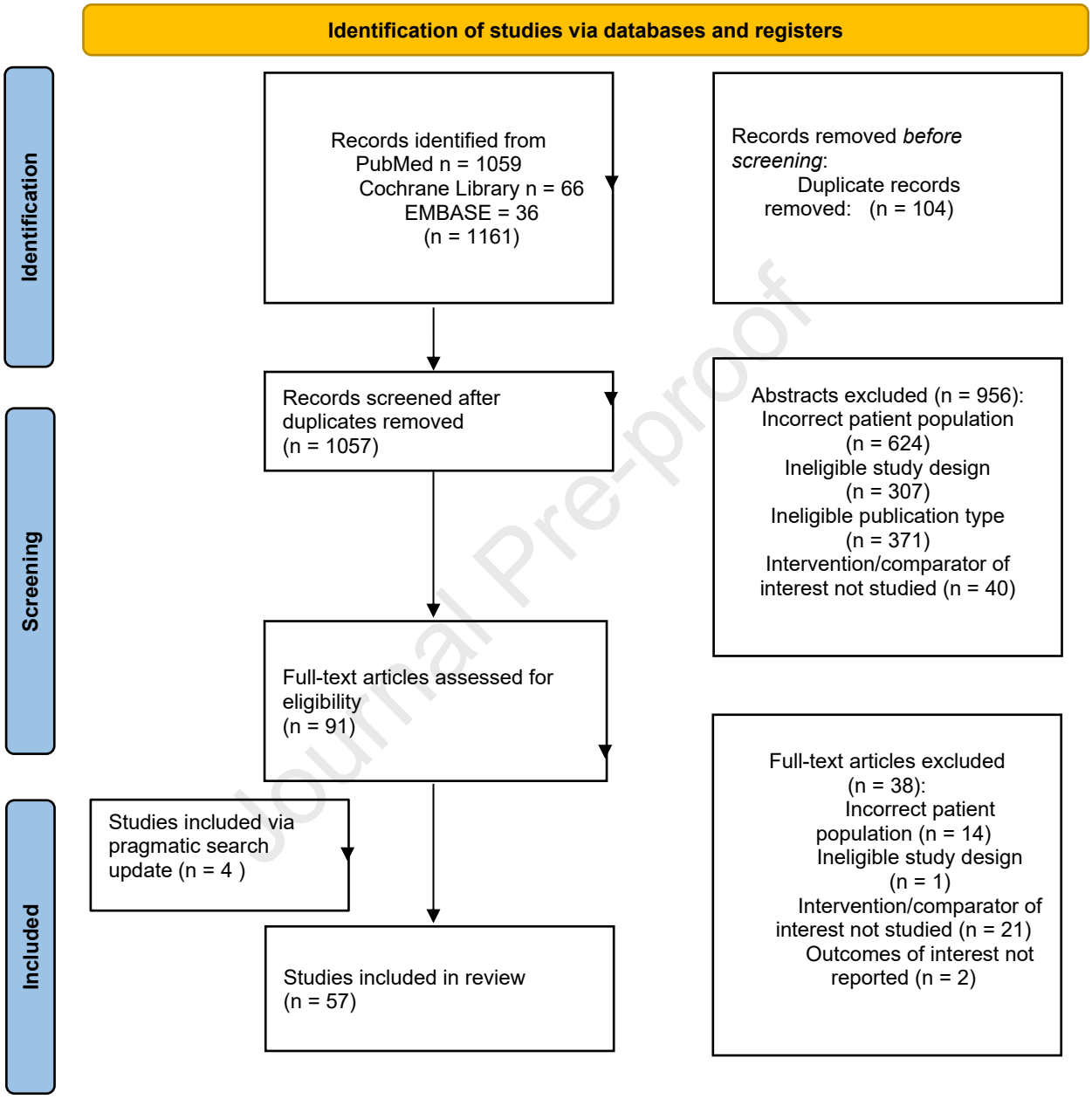
OSA in Pregnancy Cochrane Search

ID	Search Hits
#1	(obstructive):ti,ab,kw 27680
#2	(sleep):ti,ab,kw 44955
#3	(apnea):ti,ab,kw 10492
#4	#1 AND #2 AND #3 6261
#5	MeSH descriptor: [Sleep Apnea Syndromes] explode all trees 3023
#6	("sleep-disordered breathing"):ti,ab,kw 3221
#7	(hypopnea):ti,ab,kw 2963
#8	MeSH descriptor: [Sleep Apnea, Obstructive] explode all trees 2303
#9	#5 OR #6 OR #7 OR #8 6364
#10	#9 OR #4 7868
#11	(pregnancy):ti,ab,kw 66682
#12	(pregnant):ti,ab,kw 25620
#13	(maternal):ti,ab,kw 24609
#14	#11 OR #12 OR #13 83388
#15	MeSH descriptor: [Pregnancy] explode all trees 24875
#16	MeSH descriptor: [Pregnant Women] explode all trees 505
#17	#15 OR #16 24889
#18	#14 OR #17 83653
#19	MeSH descriptor: [Postpartum Period] explode all trees 1930
#20	MeSH descriptor: [Postnatal Care] explode all trees 453
#21	MeSH descriptor: [Prenatal Care] explode all trees 1688
#22	MeSH descriptor: [Pregnancy Trimesters] explode all trees 1869
#23	MeSH descriptor: [Pregnancy Complications] explode all trees 13291
#24	MeSH descriptor: [Pregnancy Outcome] explode all trees 3988
#25	#19 OR #20 OR #21 OR #21 OR #22 OR #23 OR #24 18090
#26	#25 OR #18 85874
#27	#26 AND #10 100

OSA in Pregnancy PubMed Search

((((((((((pregnancy) OR (pregnant)) OR (maternal)) OR (pregnant women)) OR (postpartum)) OR (postnatal)) OR (postnatal care)) OR (prenatal)) OR (prenatal care)) OR (pregnancy trimesters)) OR (pregnancy complications)) OR (pregnancy outcomes)) AND ((((obstructive sleep apnea) OR (sleep apnea syndromes)) OR (sleep-disordered breathing)) OR (hypopnea))

e-Figure 1. Study Selection Process



e-Table 2

Question 1: APAP compared to continued CPAP for pregnant persons on CPAP for OSA prior to pregnancy

Certainty assessment							№ of patients		Effect		Certainty	Importance
№ of studies	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	APAP	continued CPAP	Relative (95% CI)	Absolute (95% CI)		
Sleepiness score - not reported												
-	-	-	-	-	-	-	-	-	-	-	-	IMPORTANT
Snoring - not reported												
-	-	-	-	-	-	-	-	-	-	-	-	IMPORTANT
Maternal complications composite - not reported												
-	-	-	-	-	-	-	-	-	-	-	-	CRITICAL
Fatigue - not reported												
-	-	-	-	-	-	-	-	-	-	-	-	CRITICAL
Breathing discomfort ("respiratory difficulties while on CPAP" and/or "mask-interface issues") - not reported												
-	-	-	-	-	-	-	-	-	-	-	-	CRITICAL
Adherence to treatment - not reported												
-	-	-	-	-	-	-	-	-	-	-	-	CRITICAL
Fetal/neonatal complications composite - not reported												
-	-	-	-	-	-	-	-	-	-	-	-	CRITICAL

CI: confidence interval

e-Table 3

Question 2: Screening for sleep disordered breathing compared to no screening for sleep disordered breathing in pregnant persons

Certainty assessment							№ of patients		Effect		Certainty	Importance
№ of studies	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	screening for sleep disordered breathing	no screening for sleep disordered breathing	Relative (95% CI)	Absolute (95% CI)		
Screening results (assessed with: Epworth sleepiness scale score)												
3[1,3,4]	non-randomised studies	not serious	not serious	serious[a]	serious[c]	none	43	136	-	MD **0.59 higher** (0.66 lower to 1.85 higher)	⨁◯◯◯ Very low	CRITICAL
Screening results (assessed with: Epworth sleepiness scale score (median(IQR)))												
2[2,7]	non-randomised studies	not serious	not serious	serious[a]	serious[e]	none	**Dominguez 2018** reports in a total of n = 19 OSA+ participants, ● median (IQR) = 2 (2,5) and in a total of n = 61 OSA- participants, ● median (IQR) = 3 (2, 5) **Wanitcharoenkul 2017** reports in a total of n = 43 OSA+ participants, ● median (IQR) = 6 (3, 9) and in a total of n = 39 OSA- participants, ● median (IQR) = 6 (3, 9)				⨁◯◯◯ Very low	CRITICAL
Diagnostic performance (assessed with: high risk screening results)												
4[2,3,6,7]	non-randomised studies	not serious	serious[b]	not serious	serious[c]	none	40/98 (40.8%)	87/189 (46.0%)	**OR 1.70** (0.62 to 4.63)	**132 more per 1,000** (from 114 fewer to 338 more)	⨁◯◯◯ Very low[1,2]	CRITICAL
Diagnostic performance (assessed with: Positive screening test performance for perinatal outcomes.)												

Certainty assessment							№ of patients		Effect		Certainty	Importance
№ of studies	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	screening for sleep disordered breathing	no screening for sleep disordered breathing	Relative (95% CI)	Absolute (95% CI)		
1[5]	non-randomised studies	not serious	not serious	not serious	serious[d]	none	**Table 1.** Positive screening test performance for perinatal outcomes.				⨁◯◯◯ Very low	CRITICAL

Outcome	Sensitivity (%) (95% CI)	Specificity (%) (95% CI)	PPV (%) (95% CI)	NPV (%) (95% CI)
Preeclampsia	16.7 (13.2–20.1)	85.6 (82.3–88.9)	4.7 (0.2–9.2)	96.0 (91.8–100)
FGR	8.7 (6.1–11.3)	85.2 (81.9–88.5)	3.1(–0.6–6.8)	94.4 (89.5–99.4)
Cesarean	13.5 (10.4–16.7)	85.0 (81.7–88.3)	32.8 (22.8–42.8)	64.6 (52.4–76.7)
Preterm	28.3 (24.1–32.5)	87.4 (84.3–90.5)	23.4 (14.6–32.3)	89.9 (83.4–96.5)
LBW	25.0 (21.0–29.0)	86.9 (83.8–90.1)	20.3 (11.9–28.8)	89.7 (83.0–96.4)
NICU	27.3 (23.1–31.4)	86.6 (83.4–89.7)	14.1 (6.7–21.4)	93.7 (88.4–98.9)

PPV: positive predictive value; NPV: negative predictive value; CI: confidence interval; FGR: fetal growth restriction; LBW: low birth weight; NICU: neonatal intensive care unit.

CI: confidence interval; **MD:** mean difference; **OR:** odds ration

Explanations

a. Unable to identify extractable evidence regarding the original critical outcome, "percent positive leading to treatment"
b. Tantrakul 2015 reports a very different BQ performance than all other included studies.
c. The calculated CI is quite large and spans across the null value.
d. The calculated CIs for diagnostic performance are very wide.
e. The sample size is very small here, indicating the potential for serious imprecision.

References

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e-Table 4a.

Question 3a: Should pregnancy specific SDB screening tool (Facco) vs. standard SDB screening tool (BQ) be used to screen for OSA in pregnant persons?
Patient or population: pregnant persons
Setting: During pregnancy
New test: Facco et al tool
Reference test: standard SDB screening tool (BQ)
Range of sensitivities pregnancy-specific SDB screening tool (Facco): 0.86 to 1.00 | **Range of specificities pregnancy-specific SDB screening tool (Facco)**: 0.21 to 0.74
Range of sensitivities standard SDB screening tool (BQ): 0.29 to 1.00| **Range of specificities standard SDB screening tool (BQ)**: 0.20 to 1.00

Test result	Number of results per 1,000 patients tested (95% CI)						Number of participants (studies)	Certainty of the Evidence (GRADE)
	Prevalence5% Typically seen in adult pregnant persons with low-risk pregnancies.		**Prevalence25%** Typically seen in obese to extremely obese adult pregnant persons.		**Prevalence40%** Typically seen in adult pregnant persons with high-risk pregnancies.			
	pregnancy specific SDB screening tool (Facco)	standard SDB screening tool (BQ)	pregnancy specific SDB screening tool (Facco)	standard SDB screening tool (BQ)	pregnancy specific SDB screening tool (Facco)	standard SDB screening tool (BQ)		
True positives	43 to 50	14 to 50	215 to 250	73 to 250	344 to 400	116 to 400	180 (2)	⨁⨁◯◯ **Low**[1,2,a,b]
	29 more to 0 fewer TP in pregnancy specific SDB screening tool (Facco)		**142 more to 0 fewer TP in pregnancy specific SDB screening tool (Facco)**		**228 more to 0 fewer TP in pregnancy specific SDB screening tool (Facco)**			
False negatives	0 to 7	0 to 36	0 to 35	0 to 177	0 to 56	0 to 284		
	29 fewer to 0 fewer FN in pregnancy specific SDB screening tool (Facco)		**142 fewer to 0 fewer FN in pregnancy specific SDB screening tool (Facco)**		**228 fewer to 0 fewer FN in pregnancy specific SDB screening tool (Facco)**			
True negatives	199 to 703	190 to 950	158 to 555	150 to 750	126 to 444	120 to 600	230 (5)	⨁⨁◯◯ **Low**[1,2,3,4,5,b,c]
	9 more to 247 fewer TN in pregnancy specific SDB screening tool (Facco)		**8 more to 195 fewer TN in pregnancy specific SDB screening tool (Facco)**		**6 more to 156 fewer TN in pregnancy specific SDB screening tool (Facco)**			
False positives	247 to 751	0 to 760	195 to 592	0 to 600	156 to 474	0 to 480		
	9 fewer to 247 more FP in pregnancy specific SDB screening tool (Facco)		**8 fewer to 195 more FP in pregnancy specific SDB screening tool (Facco)**		**6 fewer to 156 more FP in pregnancy specific SDB screening tool (Facco)**			

CI: confidence interval

Explanations

a. Dominguez 2018 and Facco 2012 have significantly different estimates of specificity.
b. Serious imprecision due to wide sensitivity / specificity CIs in analyzed studies.
c. Multiple studies included in analysis have significantly different estimates of specificity.

References

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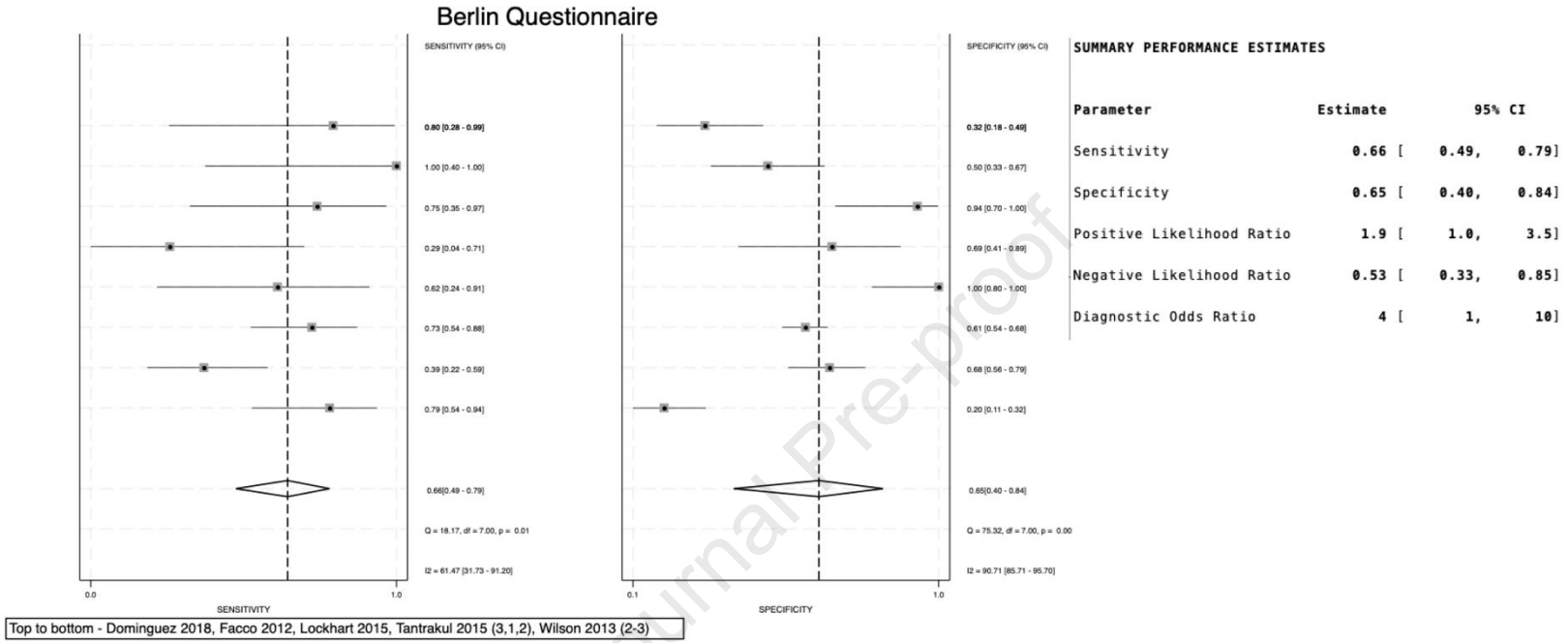
Additional Information



Top to bottom - Dominguez 2018, Facco 2012, Lockhart 2015, Tantrakul 2015 (3,1,2), Wilson 2013 (2-3)

SUMMARY DATA AND PERFORMANCE ESTIMATES

Number of studies = **8**

Reference-positive Units = **109**

Reference-negative Units = **476**

Pretest Prob of Disease = **0.19**

Deviance = **91.0**

AIC = **101.0**

BIC = **104.9**

BICdiff = **48.7**

Correlation (Mixed Model)= **-0.49**

Proportion of heterogeneity likely due to threshold effect = **0.24**

Interstudy variation in Sensitivity: ICC_SEN = **0.12**, 95% CI = [**0.00**- **0.32**]

Interstudy variation in Sensitivity: MED_SEN = **0.65**, 95% CI = [**0.56**- **0.84**]

Interstudy variation in Specificity: ICC_SPE = **0.35**, 95% CI = [**0.05**- **0.66**]

Interstudy variation in Specificity: MED_SPE = **0.78**, 95% CI = [**0.66**- **0.93**]

ROC Area, AUROC = **0.69 [0.65 - 0.73]**

Heterogeneity (Chi-square): LRT_Q = **32.307**, df =**2.00**, LRT_p =**0.000**

Inconsistency (I-square): LRT_I2 = **94**, 95% CI = [**88**- **99**]

Parameter	Estimate	95% CI	
Sensitivity	**0.66**	[**0.49**,	**0.79**]
Specificity	**0.65**	[**0.40**,	**0.84**]
Positive Likelihood Ratio	**1.9**	[**1.0**,	**3.5**]
Negative Likelihood Ratio	**0.53**	[**0.33**,	**0.85**]
Diagnostic Odds Ratio	**4**	[**1**,	**10**]

Facco et al

Study	TP	FP	FN	TN	Sensitivity (95% CI)	Specificity (95% CI)
Dominguez 2018	19	48	0	13	1.00 [0.82, 1.00]	0.21 [0.12, 0.34]
Facco 2012	24	19	4	53	0.86 [0.67, 0.96]	0.74 [0.62, 0.83]

e-Table 4b.

Question 3b: Should pregnancy specific SDB screening tool (Facco) vs. standard SDB screening tool (STBA) be used to screen for OSA in pregnant persons?

Patient or population: pregnant persons
Setting: During pregnancy
New test: Facco et al tool
Reference test: standard SDB screening tool – STOP-BANG (STBA)
Range of sensitivities pregnancy-specific SDB screening tool (Facco): 0.86 to 1.00 | **Range of specificities pregnancy-specific SDB screening tool (Facco)**: 0.21 to 0.74
Range of sensitivities standard SDB screening tool (STBA): 0.53 to 0.63 | **Range of specificities standard SDB screening tool (STBA)**: 0.36 to 0.94

Test result	Number of results per 1,000 patients tested (95% CI)						Number of participants (studies)	Certainty of the Evidence (GRADE)
	Prevalence5% Typically seen in adult pregnant persons with low-risk pregnancies.		**Prevalence25%** Typically seen in obese to extremely obese adult pregnant persons.		**Prevalence40%** Typically seen in adult pregnant persons with high-risk pregnancies.			
	pregnancy specific SDB screening tool (Facco)	standard SDB screening tool (STBA)	pregnancy specific SDB screening tool (Facco)	standard SDB screening tool (STBA)	pregnancy specific SDB screening tool (Facco)	standard SDB screening tool (STBA)		
True positives	43 to 50	27 to 32	215 to 250	133 to 158	344 to 400	212 to 252	180 (2)	⨁⨁◯◯ **Low**[1,2,a,b]
	16 more to 18 more TP in pregnancy specific SDB screening tool (Facco)		**82 more to 92 more TP in pregnancy specific SDB screening tool (Facco)**		**132 more to 148 more TP in pregnancy specific SDB screening tool (Facco)**			
False negatives	0 to 7	18 to 23	0 to 35	92 to 117	0 to 56	148 to 188		
	16 fewer to 18 fewer FN in pregnancy specific SDB screening tool (Facco)		**82 fewer to 92 fewer FN in pregnancy specific SDB screening tool (Facco)**		**132 fewer to 148 fewer FN in pregnancy specific SDB screening tool (Facco)**			
True negatives	199 to 703	342 to 893	158 to 555	270 to 705	126 to 444	216 to 564	400 (5)	⨁⨁◯◯ **Low**[1,3,4,a,b]
	143 fewer to 190 fewer TN in pregnancy specific SDB screening tool (Facco)		**112 fewer to 150 fewer TN in pregnancy specific SDB screening tool (Facco)**		**90 fewer to 120 fewer TN in pregnancy specific SDB screening tool (Facco)**			
False positives	247 to 751	57 to 608	195 to 592	45 to 480	156 to 474	36 to 384		
	143 more to 190 more FP in pregnancy specific SDB screening tool (Facco)		**112 more to 150 more FP in pregnancy specific SDB screening tool (Facco)**		**90 more to 120 more FP in pregnancy specific SDB screening tool (Facco)**			

CI: confidence interval

Explanations

a. Serious inconsistency suspected due to lack of overlap of sensitivity / specificity CIs of analyzed studies.
b. Serious imprecision due to wide sensitivity / specificity CIs of analyzed studies.

References

1.Dominguez, J. E., Grotegut, C. A., Cooter, M., Krystal, A. D., Habib, A. S.. Screening extremely obese pregnant women for obstructive sleep apnea. Am J Obstet Gynecol; 2018-12.
2.Facco, F. L., Ouyang, D. W., Zee, P. C., Grobman, W. A.. Development of a pregnancy-specific screening tool for sleep apnea. J Clin Sleep Med; 2012-8-15.
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6. Clements, F., Makris, A., Chung, Y., Marshall, N. S., Melehan, K., Shanmugalingam, R., Hennessy, A., & Vedam, H. (2024). Validation of the Apnealink Air for diagnosis of obstructive sleep apnoea (OSA) in pregnant women in early-mid gestation. Sleep Breath, 28(3), 1207-1216. https://doi.org/10.1007/s11325-023-02975-1

Additional Information

STOP-BANG Questionnaire

STUDY-SPECIFIC TEST PERFORMANCE ESTIMATES

SENSITIVITY

Study	Estimate	[95% Conf.	Interval]
1	**0.63**	**0.38**	**0.84**
2	**0.53**	**0.34**	**0.72**
3	**0.57**	**0.18**	**0.90**
4	**0.62**	**0.24**	**0.91**
5	**0.62**	**0.24**	**0.91**
6	**0.64**	**0.53**	**0.74**
7	**0.64**	**0.35**	**0.87**
Combined	**0.61**	**0.53**	**0.69**

Heterogeneity (Chi-square): Q = **1.36**, df = **6.00**, p = **0.97**

Inconsistency (I-square): I2 = **0.00**, 95% CI = [**0.00** - **100.00**]

SPECIFICITY

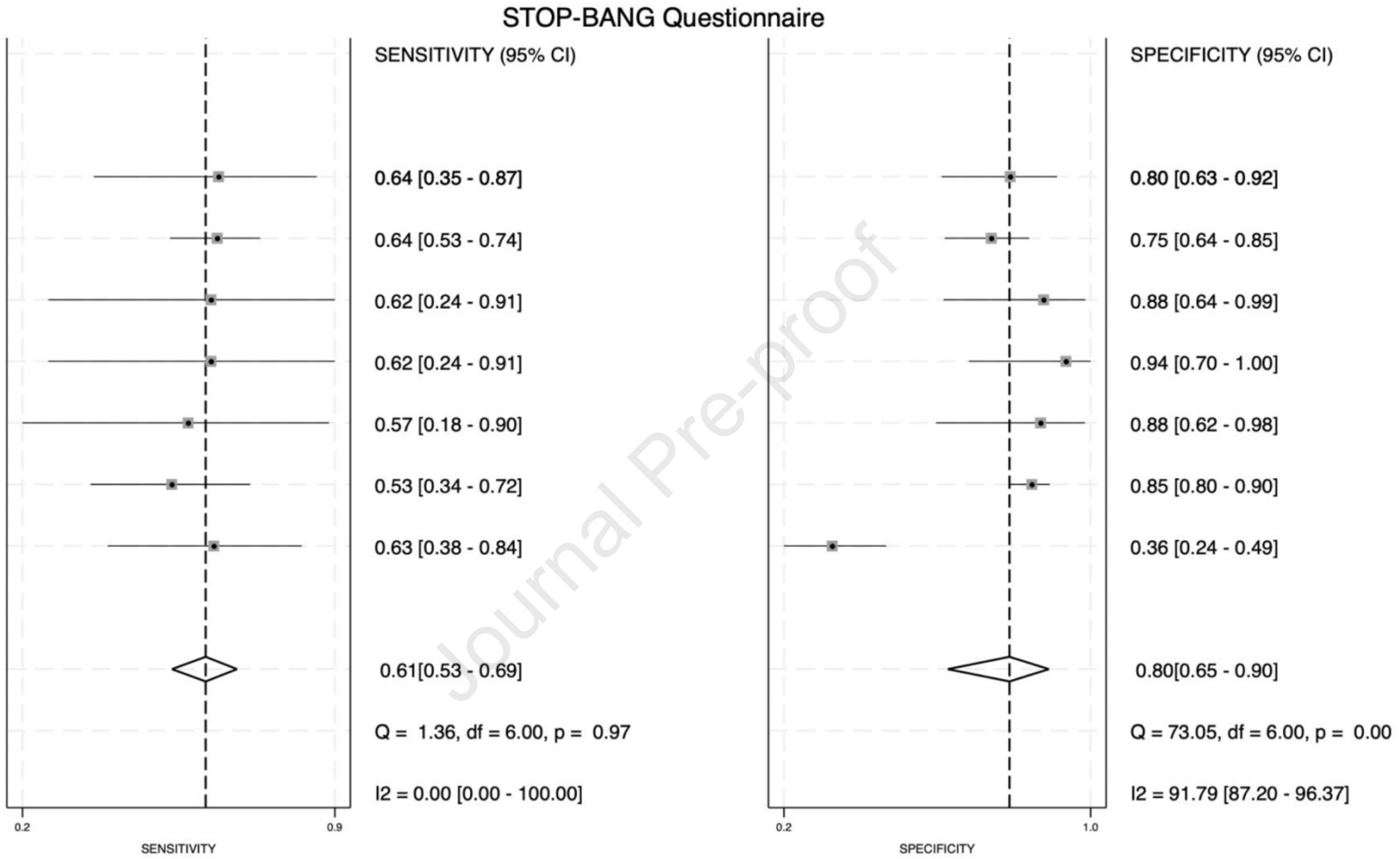
Study	Estimate	[95% Conf.	Interval]
1	**0.36**	**0.24**	**0.49**
2	**0.85**	**0.80**	**0.90**
3	**0.88**	**0.62**	**0.98**
4	**0.94**	**0.70**	**1.00**
5	**0.88**	**0.64**	**0.99**
6	**0.75**	**0.64**	**0.85**
7	**0.80**	**0.63**	**0.92**
Combined	**0.80**	**0.65**	**0.90**

Heterogeneity (Chi-square): Q = **73.05**, df =**6.00**, p = **0.00**

Inconsistency (I-square): I2 = **91.79**, 95% CI = [**87.20** - **96.37**]

ID:

1 Bajaj 2023
2 Clements 2024
3 Dominguez 2018
4 Lockhart 2015
5 Tantrakul 2015 (1)
6 Tantrakul 2015 (2)
7 Tantrakul 2015 (3)



Top to bottom - Bajaj 2023, Clements 2024, Dominguez 2018, Lockhart 2015, Tantrakul 2015 (1-3 trimesters)

Facco et al. Tool

STUDY-SPECIFIC TEST PERFORMANCE ESTIMATES

SENSITIVITY

Study	Estimate	[95% Conf.	Interval]
1	**1.00**	**0.82**	**1.00**
2	**0.86**	**0.67**	**0.96**
3	**0.91**	**0.84**	**0.96**
4	**0.93**	**0.66**	**1.00**
Combined	**0.91**	**0.84**	**0.95**

Heterogeneity (Chi-square): Q = **6.60**, df = **3.00**, p = **0.09**

Inconsistency (I-square): I2 = **54.57**, 95% CI = [**4.31 - 100.00**]

SPECIFICITY

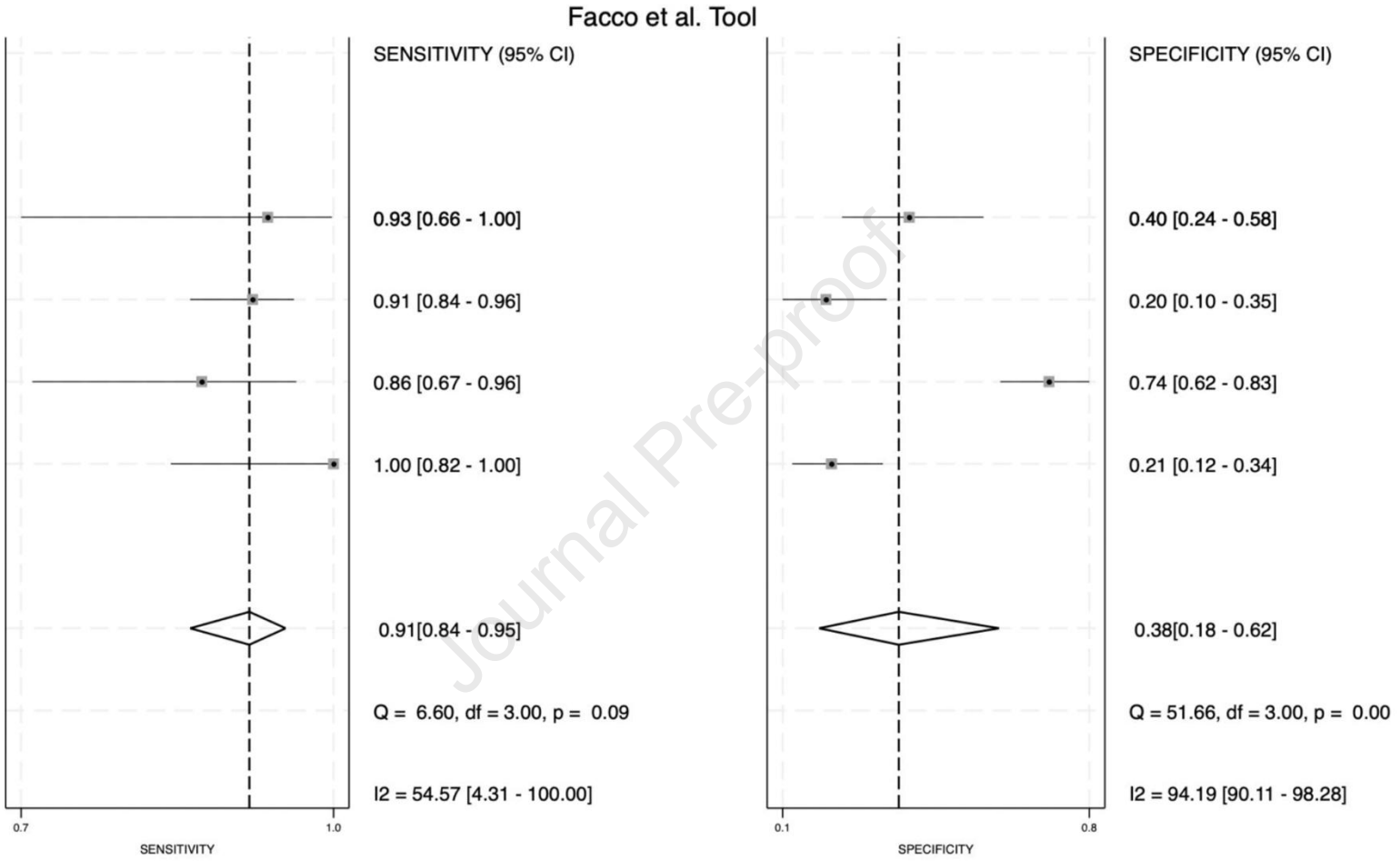
Study	Estimate	[95% Conf.	Interval]
1	**0.21**	**0.12**	**0.34**
2	**0.74**	**0.62**	**0.83**
3	**0.20**	**0.10**	**0.35**
4	**0.40**	**0.24**	**0.58**
Combined	**0.38**	**0.18**	**0.62**

Heterogeneity (Chi-square): Q = **51.66**, df =**3.00**, p = **0.00**

Inconsistency (I-square): I2 = **94.19**, 95% CI = [**90.11 - 98.28**]

ID:

1 Bajaj 2023
2 Clements 2024
3 Dominguez 2018
4 Facco 2012



e-Table 5

Question 4: At-home diagnostic devices compared to lab-based diagnostics in pregnant persons undergoing evaluation for OSA

Certainty assessment							№ of patients		Effect		Certainty	Importance
№ of studies	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	at-home diagnostic devices	lab-based diagnostics	Relative (95% CI)	Absolute (95% CI)		
Diagnostic performance (assessed with: sensitivity/specificity)												

3[1,2,6,7]	non-randomised studies	not serious	serious[a]	not serious	not serious	none	**O'Brien 2012** reports sensitivity (0.88), specificity (0.87), PPV (0.7), and NPV (0.95) for the Watch-PAT to identify PSG-measured AHI >= 5 (did not report sens/spec for PSG) **Sharkey 2014** reports the performance of ARES device (1% algorithm) compared with PSG-measured AHI for detecting OSA ARES device - ● Sensitivity = 1.0 (0.54, 1.0) ● Specificity = 0.3 (0.07, 0.65) ● PPV = 0.46 (0.19, 0.75) ● NPV = 1.0 (0.29, 1.0) PSG - ● Sensitivity = 1.0 (0.54, 1.0) ● Specificity = 0.5 (0.19, 0.81) ● PPV = 0.55 (0.20, 0.83) ● NPV = 1.0 (0.48, 1.0) **Clements 2024** reports the performance of Apnealink autoscored (AL(A)) and Apnealink manual scored (AL(M)) at AHI >= 5 events/hour compared to PSG AS(A) – ● Sensitivity = 0.643 ● Specificity = 0.943 ● PPV = 0.818 ● NPV = 0.868 AS(M) – ● Sensitivity = 0.643 ● Specificity = 0.914 ● PPV = 0.818 ● NPV = 0.868	⨁◯◯◯ Very low[1,2]	CRITICAL

Certainty assessment							№ of patients		Effect		Certainty	Importance
№ of studies	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	at-home diagnostic devices	lab-based diagnostics	Relative (95% CI)	Absolute (95% CI)		
							Wang 2023 reports the performance of a type III portable monitor (PM), Nox-T3, both in lab and at home, for AHI >= 5 events/hour compared to PSG Nox-T3$_{lab}$ – • Sensitivity = 0.93 (0.79, 0.98) • Specificity = 0.94 (0.82, 0.99) • PPV = 0.93 • NPV = 0.94 Nox-T3$_{home}$ • Sensitivity = 0.91 (0.78, 0.97) • Specificity = 0.85 (0.72, 0.93) • PPV = 0.84 • NPV = 0.92					
Time from screening to testing/diagnosis - not reported												
-	-	-	-	-	-	-	-	-	-	-	-	CRITICAL
Time from screening to initiation of treatment - not reported												
-	-	-	-	-	-	-	-	-	-	-	-	CRITICAL
Ability to complete the diagnostic test												
3[1,2,3]	non-randomised studies	serious[b]	serious[c]	not serious	serious[f]	none	103/1583 (6.5%)	65/1583 (4.1%)	**OR 1.87** (0.24 to 14.53)	**33 more per 1,000** (from 31 fewer to 342 more)	⨁◯◯◯ Very low[1,2,3]	CRITICAL
Diagnostic performance (assessed with: agreement between tests)												

Certainty assessment							№ of patients		Effect		Certainty	Importance
№ of studies	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	at-home diagnostic devices	lab-based diagnostics	Relative (95% CI)	Absolute (95% CI)		
3[1,2,4]	non-randomised studies	not serious	not serious	not serious	serious[f]	none	27/77 (35.1%)	17/77 (22.1%)	**OR 2.03** (0.95 to 4.33)	**144 more per 1,000** (from 9 fewer to 330 more)	⨁◯◯◯ Very low[1,2,4]	CRITICAL
Diagnostic performance (assessed with: agreement between tests - Spearman's rank correlation coefficient (rho) and associated p-value)												
2[2,5]	non-randomised studies	not serious	not serious	not serious	serious[d]	none	**Louis 2012** reports *rho* = 0.7 (0.47, 0.92) p<0.001 **Sharkey 2014** reports *rho* = 0.83 p<0.001 [e]				⨁◯◯◯ Very low[2,5]	

CI: confidence interval; **OR:** odds ratio

Explanations

a. Not all point estimates / confidence intervals overlap between the two studies included for analysis here.
b. Antony 2014 shows a serious risk of bias.
c. Not all studies report the same effect.
d. The sample size is very small here, indicating the potential for serious imprecision.
e. NOTE: a value of rho close to +1 indicates a similar rank (i.e. relative position label of the observations within the variable), a rho close to -1 indicates an inverse relationship, a rho close to 0 indicates little to no correlation.
f. Serious imprecision for crossing the null value.

References

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e-Table 6

Question 5: Treatment based solely on an AHI > 15 compared to treatment based on an AHI 5-15 with symptoms/sequelae or comorbidity (HTN, stroke, obesity, etc.) in pregnant persons diagnosed with OSA during pregnancy

Certainty assessment							№ of patients		Effect			
№ of studies	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	treatment based solely on an AHI > 15	treatment based on an AHI 5-15 with symptoms/sequelae or comorbidity (HTN, stroke, obesity, etc.)	Relative (95% CI)	Absolute (95% CI)	Certainty	Importance
Quality of life - not reported												
-	-	-	-	-	-	-	-	-	-	-	-	CRITICAL
Motor vehicle accidents - not reported												
-	-	-	-	-	-	-	-	-	-	-	-	CRITICAL
Maternal complications (assessed with: rate of cesarean delivery)												
1[1]	non-randomised studies	not serious	not serious[a]	not serious	serious[g]	none	14/19 (73.7%)	36/61 (59.0%)	**OR 1.94** (0.62 to 6.09)	**146 more per 1,000** (from 118 fewer to 307 more)	⨁◯◯◯ Very low	CRITICAL
Fetal/neonatal complications (assessed with: pre-term birth)												
2[1,2]	non-randomised studies	not serious	serious[b,c]	serious[d]	serious[g]	none	7/45 (15.6%)	15/95 (15.8%)	**OR 1.26** (0.32 to 5.07)	**33 more per 1,000** (from 101 fewer to 329 more)	⨁◯◯◯ Very low	CRITICAL
Fetal/neonatal complications (assessed with: fetal growth restriction)												

Certainty assessment							№ of patients		Effect		Certainty	Importance
№ of studies	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	treatment based solely on an AHI > 15	treatment based on an AHI 5-15 with symptoms/sequelae or comorbidity (HTN, stroke, obesity, etc.)	Relative (95% CI)	Absolute (95% CI)		
1[2]	non-randomised studies	not serious	not serious[a]	not serious	serious[g,f]	none	2/19 (10.5%)	6/61 (9.8%)	**OR 1.08** (0.20 to 5.85)	**7 more per 1,000** (from 77 fewer to 291 more)	⨁◯◯◯ Very low	CRITICAL
Maternal complications (assessed with: rate of HTN)												
3[1,2,3]	non-randomised studies	not serious	not serious	serious[e]	serious[g]	none	17/74 (23.0%)	53/272 (19.5%)	**OR 1.50** (0.78 to 2.89)	**71 more per 1,000** (from 36 fewer to 217 more)	⨁◯◯◯ Very low	CRITICAL
Maternal complications (assessed with: rate of GDM)												
3[1,2,3]	non-randomised studies	not serious	not serious	not serious	serious[g]	none	9/73 (12.3%)	33/268 (12.3%)	**OR 1.25** (0.53 to 2.94)	**26 more per 1,000** (from 54 fewer to 169 more)	⨁◯◯◯ Very low	CRITICAL
Maternal complications (assessed with: rate of preeclampsia)												

Certainty assessment							№ of patients		Effect		Certainty	Importance
№ of studies	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	treatment based solely on an AHI > 15	treatment based on an AHI 5-15 with symptoms/sequelae or comorbidity (HTN, stroke, obesity, etc.)	Relative (95% CI)	Absolute (95% CI)		
3[1,2,3]	non-randomised studies	not serious	not serious	serious[e]	serious[f,g]	none	18/74 (24.3%)	31/272 (11.4%)	**OR 2.31** (0.93 to 5.74)	**115 more per 1,000** (from 7 fewer to 311 more)	⨁◯◯◯ Very low	CRITICAL

CI: confidence interval; **OR:** odds ratio

Explanations

a. A single study was used here, making inconsistency irrelevant.
b. One study used preterm birth = <37 wks, one used <34 wks
c. The two studies included for analysis of this outcome report different effects altogether.
d. Dominguez 2018 defines preterm birth as < 37 weeks, while Facco 2012 defines preterm birth as < 34 weeks - this could explain some of the inconsistent effects between the two studies.
e. Facco 2012 does not report this outcome directly, rather reports an adverse pregnancy outcome composite, which includes this outcome as one of its measures.
f. The relative effect has a confidence interval that is very wide, indicating the potential for serious imprecision.
g. Serious imprecision for crossing the null value.

References

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e-Table 7

Question 6: Any form of PAP treatment compared to no treatment in pregnant persons diagnosed with OSA during pregnancy

Certainty assessment							№ of patients		Effect		Certainty	Importance
№ of studies	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	any form of PAP treatment	no treatment	Relative (95% CI)	Absolute (95% CI)		
Maternal complications (assessed with: rate of preeclampsia)												
2[1,2]	randomised trials	not serious[a]	not serious	not serious	serious[b]	none	22/171 (12.9%)	35/173 (20.2%)	**RR 0.94** (0.17 to 5.16)	**12 fewer per 1,000** (from 168 fewer to 842 more)	⨁⨁⨁◯ Moderate	CRITICAL
Maternal complications (assessed with: rate of HTN)												
2[2,3]	non-randomised studies	not serious	not serious	not serious	not serious	none	**Rice 2022 (obs)** reports 6 cases of HTN out of a total of 23 participants receiving PAP therapy (26%) vs 28 cases of HTN out of a total of 77 participants receiving no treatment (36%). **Tantrakul 2023 (RCT)** reports 21 cases of HTN out of a total of 153 participants receiving PAP therapy (14%) vs 39 cases of HTN out of a total of 157 participants receiving no treatment (25%).				⨁⨁◯◯ Low	CRITICAL
Maternal complications (assessed with: rate of cesarean delivery)												
2[1,3]	non-randomised studies	not serious[a]	not serious	not serious	not serious	none	**Chirakalwasan 2018 (RCT)** reports 3 *unplanned* cesarean deliveries out of a total of 18 participants receiving PAP therapy (17%) vs 7 unplanned cesarean deliveries out of a total of 17 participants receiving no treatment (41%). **Rice 2022 (obs)** reports 12 cesarean deliveries (*not* subdivided into planned/unplanned) out of a total of 23 participants receiving PAP therapy (52%) vs 50 cesarean deliveries out of a total of 77 participants receiving no treatment (65%).				⨁⨁◯◯ Low	CRITICAL

Certainty assessment							№ of patients		Effect		Certainty	Importance
№ of studies	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	any form of PAP treatment	no treatment	Relative (95% CI)	Absolute (95% CI)		
Fetal/neonatal complications (assessed with: impaired fetal growth, fetal growth restriction, small for gestational age)												
3[1,3,4]	non-randomised studies	not serious[a]	not serious	not serious	not serious	none	**Chirakalwasan 2018 (RCT)** reports 1 case of SGA out of a total of 18 participants receiving PAP therapy (6%) vs 2 cases of SGA out of a total of 16 participants receiving no treatment (13%). **Kneitel 2018 (obs)** reports 4 cases of impaired fetal growth (either birthweight <10th centile OR a fall in growth centile > 33%) out of a total of 14 participants receiving PAP therapy (29%) vs 19 cases of impaired fetal growth out of a total of 31 participants receiving no treatment (61%). **Rice 2022 (obs)** reports 1 case of fetal growth restriction (< 10th percentile) out of a total of 23 participants receiving PAP therapy (4%) vs 6 cases of fetal growth restriction out of a total of 77 participants receiving no treatment (8%).				⨁⨁◯◯ Low	CRITICAL
Fetal/neonatal complications (assessed with: large for gestational age)												
2[1,3]	non-randomised studies	not serious[a]	serious[c]	not serious	not serious	none	**Chirakalwasan 2018 (RCT)** reports 1 case of LGA out of a total of 18 participants receiving PAP therapy (6%) vs 2 cases of LGA out of a total of 16 particpants receiving no treatment (13%). **Rice 2022 (obs)** reports 6 cases of LGA out of a total of 23 participants receiving PAP therapy (26%) vs 16 cases of LGA out of a total of 77 participants receiving no treatment (21%).				⨁◯◯◯ Very low	CRITICAL
Fetal/neonatal complications (assessed with: NICU admission)												
1[1]	randomised trials	not serious[a]	not serious[d]	not serious	serious[e]	none	7/18 (38.9%)	6/16 (37.5%)	**RR 1.04** (0.44 to 2.44)	**15 more per 1,000** (from 210 fewer to 540 more)	⨁⨁⨁◯ Moderate	CRITICAL
Quality of life - not reported												

Certainty assessment							№ of patients		Effect		Certainty	Importance
№ of studies	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	any form of PAP treatment	no treatment	Relative (95% CI)	Absolute (95% CI)		
-	-	-	-	-	-	-	-	-	-	-	-	CRITICAL
Sleepiness score - not reported												
-	-	-	-	-	-	-	-	-	-	-	-	IMPORTANT
Mood disorders - not reported												
-	-	-	-	-	-	-	-	-	-	-	-	CRITICAL
Resolution of HTN and GDM post-partum - not reported												
-	-	-	-	-	-	-	-	-	-	-	-	CRITICAL
Hospitalizations - not reported												
-	-	-	-	-	-	-	-	-	-	-	-	CRITICAL

CI: confidence interval; **RR:** risk ratio

Explanations

a. Chirakalwasan 2018 shows some concerns of bias due to performance bias and detection bias.
b. Chirakalwasan 2018 reports a very large confidence interval, which crosses the null value.
c. The two studies included for analysis of this outcome report different effects altogether.
d. A single study was used here, making inconsistency irrelevant.
e. The sample size is very small here, indicating the potential for serious imprecision.

References

1.Chirakalwasan, N., Amnakkittikul, S., Wanitcharoenkul, E., Charoensri, S., Saetung, S., Chanprasertyothin, S., Chailurkit, L.,O., Panburana, P., Bumrungphuet, S., Thakkinstian, A., Reutrakul, S.. Continuous Positive Airway Pressure Therapy in Gestational Diabetes With Obstructive Sleep Apnea: A Randomized Controlled Trial. J Clin Sleep Med; 2018.
2.Tantrakul, V.. Treatment of obstructive sleep apnea in high risk pregnancy: a multicenter randomized controlled trial. Respiratory Research; 2023.
3.Rice, A. L., Bajaj, S., Wiedmer, A. M., Jacobson, N., Stanic, A. K., Antony, K. M., Bazalakova, M. H.. Continuous positive airway pressure treatment of obstructive sleep apnea and hypertensive complications in high-risk pregnancy. Sleep Breath; 2022-6-24.
4.Kneitel, A. W., Treadwell, M. C., O'Brien, L. M.. Effects of maternal obstructive sleep apnea on fetal growth: a case-control study. J Perinatol; 2018-8.

e-Table 8

Question 7: Alternatives to PAP therapy (MAD, myofunctional therapy, etc.) compared to PAP therapy in pregnant persons diagnosed with OSA during pregnancy

Certainty assessment							№ of patients		Effect		Certainty	Importance
№ of studies	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	alternatives to PAP therapy (MAD, myofunctional therapy, etc.)	PAP therapy	Relative (95% CI)	Absolute (95% CI)		
Sleepiness score (assessed with: Epworth Sleepiness Score) – not reported												
-	-	-	-	-	-	-	-	-	-	-	-	IMPORTANT
Quality of life - not reported												
-	-	-	-	-	-	-	-	-	-	-	-	CRITICAL
Mood disorders - not reported												
-	-	-	-	-	-	-	-	-	-	-	-	CRITICAL
Resolution of HTN and GDM post-partum - not reported												
-	-	-	-	-	-	-	-	-	-	-	-	CRITICAL
Hospitalizations - not reported												
-	-	-	-	-	-	-	-	-	-	-	-	CRITICAL
Maternal complications (assessed with: rate of HTN)												
1[1]	non-randomised studies	not serious	not serious[a]	not serious	serious[d]	none	16/41 (39.0%)	13/50 (26.0%)	**OR 1.82** (0.75 to 4.44)	**130 more per 1,000** (from 51 fewer to 349 more)	⨁◯◯◯ Very low	CRITICAL
Maternal complications (assessed with: rate of preeclampsia)												

Certainty assessment							№ of patients		Effect		Certainty	Importance
№ of studies	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	alternatives to PAP therapy (MAD, myofunctional therapy, etc.)	PAP therapy	Relative (95% CI)	Absolute (95% CI)		
1[1]	non-randomised studies	not serious	not serious[a]	not serious	serious[c]	none	10/41 (24.4%)	4/50 (8.0%)	**OR 3.71** (1.07 to 12.89)	**164 more per 1,000** (from 5 more to 448 more)	⨁◯◯◯ Very low	CRITICAL
Maternal complications (assessed with: rate of cesarean delivery)												
1[1]	non-randomised studies	not serious	not serious[a]	not serious	serious[c]	none	17/41 (41.5%)	10/50 (20.0%)	**OR 2.83** (1.12 to 7.19)	**214 more per 1,000** (from 19 more to 443 more)	⨁◯◯◯ Very low	CRITICAL

CI: confidence interval; **OR:** odds ratio

Explanations

a. A single study was used here, making inconsistency irrelevant.
b. The sample size is very small here, indicating the potential for serious imprecision.
c. Very wide CI, indicating imprecision.
d. CI crosses null value, indicating imprecision.

References

1.Stajić, D., Ilić, D., Vuković, J., Baturan, B., Ilić, A., Milovančev, A.. The effect of continuous positive airway pressure treatment on hypertensive disorder in pregnant women with obstructive sleep apnea. Sleep Breath; 2022-3.

e-Table 9

Question 8: Stimulants compared to scheduled naps for residual sleepiness in pregnant persons currently on PAP therapy for OSA diagnosed during pregnancy

Certainty assessment							№ of patients		Effect		Certainty	Importance
№ of studies	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	stimulants	scheduled naps	Relative (95% CI)	Absolute (95% CI)		
Quality of life - not reported												
-	-	-	-	-	-	-	-	-	-	-	-	CRITICAL
Fetal safety of stimulant(s) - not reported												
-	-	-	-	-	-	-	-	-	-	-	-	CRITICAL
Sleep quality scale - not reported												
-	-	-	-	-	-	-	-	-	-	-	-	CRITICAL
Mood disorders - not reported												
-	-	-	-	-	-	-	-	-	-	-	-	CRITICAL
Maternal complications composite - not reported												
-	-	-	-	-	-	-	-	-	-	-	-	CRITICAL
Fetal/neonatal complications composite - not reported												
-	-	-	-	-	-	-	-	-	-	-	-	CRITICAL

CI: confidence interval

e-Table 10

Question 9: Reassessment for SDB compared to no reassessment in post-partum persons previously diagnosed with OSA during pregnancy

Certainty assessment							№ of patients		Effect		Certainty	Importance
№ of studies	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	reassessment for SDB	no reassessment	Relative (95% CI)	Absolute (95% CI)		
Availability of clinical predictors for PP resolution of OSA - not reported												
-	-	-	-	-	-	-	-	-	-	-	-	CRITICAL
Mood disorders - not reported												
-	-	-	-	-	-	-	-	-	-	-	-	CRITICAL
Presence of persistent OSA symptoms (assessed with: ESS score)												
1[1]	non-randomised studies	not serious	not serious[a]	not serious[b]	serious[c]	none	**Huynh 2022** reports "presence of persistent OSA symptoms" via ESS score at baseline (during pregnancy, trimester 2 or 3) and postpartum (3-6mo) – mean(SD) ● Baseline = 10.1 (5.3) n = 17 ● PP = 7.7 (4) n = 17				⨁◯◯◯ Very low	CRITICAL
Quality of life (assessed with: functional outcome sleep questionnaire)												
1[1]	non-randomised studies	not serious	not serious[a]	not serious[d]	serious[c]	none	**Huynh 2022** reports QoL via FOSQ at baseline (during pregnancy, trimester 2 or 3) and postpartum (3-6mo) – mean(SD) ● Baseline = 10.9 (2.8) n = 17 ● PP = 7.5 (3.6) n = 17				⨁◯◯◯ Very low	CRITICAL
Resolution of maternal complications PP - not reported												
-	-	-	-	-	-	-	-	-	-	-	-	CRITICAL
Motor vehicle accidents - not reported												
-	-	-	-	-	-	-	-	-	-	-	-	CRITICAL
Severity of OSA - during pregnancy (assessed with: REI)												

Certainty assessment							№ of patients		Effect		Certainty	Importance
№ of studies	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	reassessment for SDB	no reassessment	Relative (95% CI)	Absolute (95% CI)		
1[2]	non-randomised studies	not serious[e]	not serious[a]	not serious[f]	serious[c]	none	**Street 2018** reports severity of OSA in women whose OSA remained at the 6-8mo PP sleep study and in women whose OSA had resolved by the 6-8mo PP sleep study – mean(SD) ● OSA remained REI during pregnancy = 20.5 (3.3) n = 16 ● OSA resolved REI during pregnancy = 7.7 (3.4) n = 8				⨁◯◯◯ Very low	CRITICAL

Severity of OSA - postpartum (assessed with: REI)

1[2]	non-randomised studies	not serious[e]	not serious[a]	not serious[f]	serious[c]	none	**Street 2018** reports severity of OSA in women whose OSA remained at the 6-8mo PP sleep study and in women whose OSA had resolved by the 6-8mo PP sleep study – mean(SD) ● OSA remained PP REI = 12.6 (7.2) n = 16 ● OSA resolved PP REI = 2.0 (1.3) n = 8				⨁◯◯◯ Very low	CRITICAL

CI: confidence interval

Explanations

a. A single study was used here, making inconsistency irrelevant.
b. The effect of reassessment of OSA symptoms PP was not directly studied here. However, the presence of persistent OSA symptoms PP (via ESS) was directly measured.
c. The sample size is very small here, indicating the potential for serious imprecision.
d. The effect of reassessment of OSA symptoms PP was not directly studied here. However, quality of life PP (via FOSQ) was directly measured.
e. Street 2018 shows some concerns of risk of bias due to potential confounding.
f. The effect of reassessment of OSA symptoms PP was not directly studied here. However, severity of OSA PP (via REI) was directly measured.

References

1. Huynh, N., Drouin-Gagné, L., Gilbert, C., Arcache, J. P., Rompré, P., Morency, A. M., Gagnon, R., Kimoff, J., & Pamidi, S. (2022). Adherence and efficacy of mandibular advancement splint treatment of sleep-disordered breathing during pregnancy: a pilot study. Sleep Breath. https://doi.org/doi:10.1007/s11325-022-02681-4

2. Street, L. M., et al. (2018). "Gestational Obstructive Sleep Apnea: Biomarker Screening Models and Lack of Postpartum Resolution." J Clin Sleep Med 14(4): 549-555.

e-Table 11

QUESTION 1

Should APAP vs. continued CPAP be used for pregnant persons on CPAP for OSA prior to pregnancy?

ASSESSMENT

Problem Is the problem a priority?		
JUDGEMENT	**RESEARCH EVIDENCE**	**ADDITIONAL CONSIDERATIONS**
○ No ○ Probably no ○ Probably yes ● Yes ○ Varies ○ Don't know	No additional comments.	Hard to call it a priority - APAP seems to be what most patients use due to weight gain during pregnancy - worth trying to get consensus with this group to see if CPAP is a better option Some panelists have experience with patients finding it more comfortable to start on APAP due to body changes happening in pregnancy The panel feels this is certainly worth commenting on we need to understand how to manage these patients and whether to keep these on a fixed pressure we know that OSA can evolve through the pregnancy, this question is important due to the challenging nature of decision making in this area

Desirable Effects

How substantial are the desirable anticipated effects?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
○ Trivial ○ Small ● Moderate ○ Large ○ Varies ○ Don't know	No studies included in analysis.	**Desirable effect of switching from CPAP to APAP at pregnancy** there is a desirable effect of switching due to sleep apnea progressing over time, you have a small time window where it could be difficult to re-test and titrate again if you keep patients on CPAP, in order to make sure they are appropriately treated, you will need to test them again and re-titrate Some panelists feel that they don't know that they've seen someone on CPAP during pregnancy rather than APAP The panel feels that now, people may be defaulting to APAP (recognizes this may be different at different SES and in different settings) some overlap between modern CPAP machines (not fixed) and full APAP

		there could be some settings where people are titrated to one CPAP setting, and are not re-evaluated Panelists feel that the important thing is that people get re-evaluated and monitored through pregnancy even if a patient is on APAP, continuous evaluation and monitoring should be performed

Undesirable Effects

How substantial are the undesirable anticipated effects?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
● Trivial ○ Small ○ Moderate ○ Large ○ Varies ○ Don't know	No studies included in analysis.	Some panelists note that they very, very rarely sees a patient (not in pregnancy, just in general) who does not tolerate APAP well - senses change in pressure and it wakes them up very minimal side effects, including in pregnant persons

Certainty of evidence

What is the overall certainty of the evidence of effects?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
○ Very low ○ Low ○ Moderate ○ High ● No included studies	No studies included in analysis.	No comment.

Values

Is there important uncertainty about or variability in how much people value the main outcomes?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
○ Important uncertainty or variability ○ Possibly important uncertainty or variability ○ Probably no important uncertainty or variability ● No important uncertainty or variability	No studies identified.	Panelists feel that physicians want OSA well-treated, insurance companies probably won't be able to tell a difference

Balance of effects Does the balance between desirable and undesirable effects favor the intervention or the comparison?		
JUDGEMENT	**RESEARCH EVIDENCE**	**ADDITIONAL CONSIDERATIONS**
○ Favors the comparison ○ Probably favors the comparison ○ Does not favor either the intervention or the comparison ● Probably favors the intervention ○ Favors the intervention ○ Varies ○ Don't know	No studies included in analysis.	Comparison - CPAP Intervention - APAP

Resources required How large are the resource requirements (costs)?"		
JUDGEMENT	**RESEARCH EVIDENCE**	**ADDITIONAL CONSIDERATIONS**

○ Large costs ○ Moderate costs ● Negligible costs and savings ○ Moderate savings ○ Large savings ○ Varies ○ Don't know	"Positive airway pressure (PAP) devices like CPAP machines typically cost between $500 and $3,000. This price range reflects wide variation based on the PAP device's brand, model, and features. " "CPAP machines typically cost between $500 and $1,000." "APAP devices usually cost between $600 and $1,600. " https://www.sleepapnea.org/cpap/how-much-do-cpap-machines-cost/	At some practices, there is no difference in cost - same machine, different setting important to note if Medicaid has differences in coverage between the two Some panelists have observed plenty of delays in getting APAP machines to people, but insurance does still cover this (seen patients on Medicaid) Same billing code

Certainty of evidence of required resources What is the certainty of the evidence of resource requirements (costs)?		
JUDGEMENT	**RESEARCH EVIDENCE**	**ADDITIONAL CONSIDERATIONS**
○ Very low ○ Low ● Moderate ○ High ○ No included studies	No comment.	No comment.

Cost effectiveness

Does the cost-effectiveness of the intervention favor the intervention or the comparison?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
○ Favors the comparison ○ Probably favors the comparison ○ Does not favor either the intervention or the comparison ● Probably favors the intervention ○ Favors the intervention ○ Varies ○ No included studies	No studies identified.	Panel realizes there is probably little to no data on this the only way it saves money is it may save physician visits for the provider to tinker with the machine decreases re-titrating

Equity

What would be the impact on health equity?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
○ Reduced ○ Probably reduced ● Probably no impact ○ Probably increased ○ Increased ○ Varies	No studies identified.	if someone is on an old CPAP machine, then they could potentially need to buy a new machine to be able to use APAP, but this may be a nonexistent problem because those "old" machines that would need replacing are 10+ years old and likely no one is using these still

○ Don't know		Panelists feel it would be helpful to see what practitioners in other states are experiencing with insurance coverage of CPAP/APAP Panel wants to make sure we have thought about state differences in coverage by Medicaid

Acceptability

Is the intervention acceptable to key stakeholders?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
○ No ○ Probably no ○ Probably yes ● Yes ○ Varies ○ Don't know	No studies identified.	No comments.

Feasibility

Is the intervention feasible to implement?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
○ No ○ Probably no ● Probably yes	No studies identified.	Panel feels that yes, as long as there is no difference in insurance coverage

○ Yes ○ Varies ○ Don't know		

e-Table 12

QUESTION 2

Should screening for sleep disordered breathing vs. no screening for sleep disordered breathing be used for pregnant persons?

ASSESSMENT

Problem
Is the problem a priority?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
○ No ○ Probably no ○ Probably yes ● Yes ○ Varies ○ Don't know	CHEST approved this topic - considers it a priority.	No comments.

Desirable Effects
How substantial are the desirable anticipated effects?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
○ Trivial ○ Small ○ Moderate ○ Large ● Varies ○ Don't know	No truly direct evidence to support desirable effects - ideally, we can extrapolate from Q3 "using pregnancy-specific screening tool vs standard screening tool" - and also consider how effective treatment can be for the condition for which we are screening (SDB or OSA). *See Appendix 1*	Panelists feel that the issue with this question is that we feel there is a benefit to knowing if a patient has OSA, but the screening tools are not necessarily best quality - difficult to link screening to actual health outcomes - we certainly see benefit in determining OSA status in higher risk pregnancies (higher BMI, for ex) - having OSA being treated can help to avoid negative health outcomes down the line in their pregnancy

	See Appendix 2 *See Appendix 3*	in an ideal world, screening would identify those with OSA, and then you would test and treat - however, our screening tools are not great so screening does not necessarily link to health outcomes - are multiple complications associated with OSA status as well as higher risk individuals during pregnancy, so treating OSA is ideal this is a population of patients that don't always have access to primary outside of OB care - sometimes OB are the only people to ask about OSA or hypertension (and the correlation) - this may present an opportunity to intervene in a pop without much care outside of OB care - some evidence to suggest sleep disruption can lead to negative health outcomes (mental health issues, i.e.) - so there could be potential benefit to treating OSA from a sleep qual standpoint Panelists agree with the potential benefits to treating OSA even if our screening tools are not ideal - see a lot of importance in screening especially in high-risk pregnancy, even if the current tools are not great Panelists feel the benefits vary because depending on population, this may affect the overall benefits of screening and even treating Panelists note that desirable effects may be linked to the population being screened (low-risk vs high-risk; access to therapy (coverage etc....)) or not

Undesirable Effects

How substantial are the undesirable anticipated effects?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
○ Trivial ○ Small ○ Moderate ○ Large ● Varies ○ Don't know	No reported outcomes.	if there is no access to further treatment, this could have detrimental effects - if you're going to screen, you must be able to offer a sleep study and further treatment - if not, you have burdened the patient with a potential disease that you can't do anything about **hopefully, if you are screening, it means you have the tools to propose further testing and treatment** Some panelists would argue there is benefit in knowing whether they have access to further workup or not, this could alter how they are treated peri-partum in the hospital - could potentially lead to positional changes while sleeping (even if not PAP) - could lead to treatment in the future, potentially if we are only using questionnaires, a positive that cannot be followed up with further testing would lead to a knowledge of being higher risk for OSA, may lead to anxiety, but the panel doesn't feel that it would create substantial harm potential undesirable effects would be in the setting of an imperfect screening tool, referral to sleep study, subsequently this may create anxiety and pressure on women who do not really have time or funds to do a sleep study - do feel that undesirable effects are probably small NOT putting in the context of the benefits, the tool itself could possibly lead to moderate undesirable effects due to psychological distress (time crunch, having to go through a whole sleep study only to come out negative, etc.)

		Whenever screening for a disease, this will in fact create distress, but there are other screenings/tests that pregnant persons undergo which are much more distressing (genetic testing, for ex) Some panelists feel this could greatly vary. We are looking at this from a developed nation's perspective, it is worth considering the people who do not have access to further testing or treatment - a person who has access to the internet may in fact self-diagnose and then undergo possibly dangerous lifestyle changes - feels that these undesirable effects may vary a lot from case to case drawing parallels to diabetes treatment - there are some guidelines for resource - limited settings which offer different recommendations Many panelists agrees with "varies" - looking at the institutions which this panel largely works in, the situations arising may be different than in more resource-poor areas Lack of testing or delay in treatment may add to inefficiencies of the system (multiple calls and attempts to schedule etc..) and psychological distress

Certainty of evidence

What is the overall certainty of the evidence of effects?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
● Very low O Low O Moderate O High O No included studies	*See Appendix 4*	No comments.

Values

Is there important uncertainty about or variability in how much people value the main outcomes?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
● Important uncertainty or variability O Possibly important uncertainty or variability O Probably no important uncertainty or variability O No important uncertainty or variability	No studies identified.	Because we don't really know if treatment would follow a positive screening result, this varies how much a person may value screening results. Practitioners who are treating in peri-partum period may value screening results differently than a young, low-risk mother Panelists feel that there may be a lot of variability even amongst patients in how much value they may put on screening (and even treatment) of OSA From patient perspective, screening for OSA is very different than screening for preeclampsia. More people know benefit of screening for and treating preeclampsia, so patients may value that much more than OSA One panelist poses the question, “if we don't believe in the validity of screening, why screen? As a physician, if I have a screening tool that is not diagnostically accurate or precise, why am I using it?”

		Different types of clinicians may also place different emphasis on the types of outcomes. Sleep / medicine providers may want to screen to treat for poor quality of life or fatigue. OB-GYN providers may want to screen to improve pregnancy / fetal outcomes. The emphasis placed on this by patients may be low due to the lack of prioritization of sleep counseling etc. in pregnancy.

Balance of effects

Does the balance between desirable and undesirable effects favor the intervention or the comparison?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
O Favors the comparison O Probably favors the comparison O Does not favor either the intervention or the comparison ● Probably favors the intervention O Favors the intervention O Varies O Don't know	Once again, this question has no truly direct evidence to support desirable effects or undesirable effects - ideally, we can extrapolate from Q3 "using pregnancy-specific screening tool vs standard screening tool" - and consider how effective treatment can be for the condition for which we are screening (SDB or OSA). *See Appendix 3* *See Appendix 2* *See Appendix 3*	It really depends on the population you are screening - high risk may benefit more from screening may be a different recommendation for different populations - feels this probably favors the intervention feels we need to phrase this in the right clinical context - feels in the right context, there is benefit to screening **The group feels that the benefits of screening may really vary from population to population, but in the right clinical context, screening the right populations, this will probably favor the intervention**

Resources required How large are the resource requirements (costs)?"		
JUDGEMENT	**RESEARCH EVIDENCE**	**ADDITIONAL CONSIDERATIONS**
○ Large costs ○ Moderate costs ● Negligible costs and savings ○ Moderate savings ○ Large savings ○ Varies ○ Don't know	No studies identified.	*How expensive is screening? Is cost a consideration? How about other resources required? Like time, transportation, etc.* Cost for screening is overall **negligible.** Is this referring to the cost of the screening tool itself, or the additional costs involved if people are screened positive and then need a sleep study? Then, weighing up the savings if they are diagnosed with OSA, treated, and potentially have better perinatal outcomes? I think the costs will **vary** – depending on the outcome of the screening and whether it is followed up or not. There is probably uncertainty given we don't have very clear evidence about the efficacy of CPAP for preventing adverse outcomes in pregnancy. screening leading to treatment to healthcare utilization in this population. - relatively speaking , this doesn't seem like an expensive task Down the road, treatment could be kind of expensive, but this is also a group of patients who can very efficiently treat their SDB and that may save them money down the line - questionnaires themselves are cheap

Certainty of evidence of required resources

What is the certainty of the evidence of resource requirements (costs)?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
○ Very low ○ Low ○ Moderate ○ High ● No included studies	No included studies.	N/A

Cost effectiveness

Does the cost-effectiveness of the intervention favor the intervention or the comparison?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
○ Favors the comparison ○ Probably favors the comparison ○ Does not favor either the intervention or the comparison ○ Probably favors the intervention ○ Favors the intervention ○ Varies ● No included	No studies identified.	Can use expert opinion here, but don't really have data to back this up – no included studies.

studies		

Equity

What would be the impact on health equity?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
○ Reduced ○ Probably reduced ○ Probably no impact ● Probably increased ○ Increased ○ Varies ○ Don't know	No studies identified.	The health equity would **probably increase.** If we perform a universal screening at prenatal visits, it means that we can reach people who do not see a doctor on a regular basis outside of pregnancy. Assuming screening works for the patient and they are treated for OSA, **this will hopefully improve their pregnancy-related outcomes?** Depends on how screening is implemented and if it **is conditional on early access to care for instance.** There could be **opportunities to screen that would enhance equity** if this is standard screening done on all pregnant persons, then this could increase health equity - down the line, different people may be able to afford treatment and some may not - anyone can get a screening, but what is the point if you can't act on the results lower income areas have greater barriers to treatment access, screening or no

		if a pregnant person were to get positive screening results for OSA, and they cannot act on this at all, that would highlight health inequity would this, though, help increase the equity by showing us over time more and more high-risk individuals, would that be a driver of policy change?

Acceptability

Is the intervention acceptable to key stakeholders?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
○ No ○ Probably no ○ Probably yes ● Yes ○ Varies ○ Don't know	No studies identified.	The intervention itself (screening tool) should be quick and easy and acceptable to stakeholders, but the outcome of the tool (sleep study) for those who test positive may be less acceptable, particularly during pregnancy which woman may have other health concerns/issues to deal with. insurance company may not be as happy about it - but the screening is not harmful or challenging, doesn't seem objectionable

Feasibility Is the intervention feasible to implement?		
JUDGEMENT	**RESEARCH EVIDENCE**	**ADDITIONAL CONSIDERATIONS**
○ No ○ Probably no ● Probably yes ○ Yes ○ Varies ○ Don't know	No studies identified.	Screening tool should we relatively feasible to implement into antenatal visits.

APPENDICES

Appendix 1

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	№ of participants (studies)	Certainty of the evidence (GRADE)	Comments
	Risk with no screening for sleep disordered breathing	Risk with screening for sleep disordered breathing				
Screening results (ESS) assessed with: Epworth sleepiness scale score	The mean screening results was **0**	MD **0.59 higher** (0.66 lower to 1.85 higher)	-	179 (3 non-randomised studies)	⨁◯◯◯ Very low[a]	
Screening results (ESS) assessed with: Epworth sleepiness scale score (median(IQR))	**Dominguez 2018** reports in a total of n = 19 OSA+ participants, • median (IQR) = 2 (2,5) and in a total of n = 61 OSA- participants, • median (IQR) = 3 (2, 5) **Wanitcharoenkul 2017** reports in a total of n = 43 OSA+ participants, • median (IQR) = 6 (3, 9) and in a total of n = 39 OSA- participants, • median (IQR) = 6 (3, 9)		-	162 (2 non-randomised studies)	⨁◯◯◯ Very low[a]	
Diagnostic performance assessed with: high risk screening results	Study population		**OR 1.70** (0.62 to 4.63)	287 (4 non-randomised studies)	⨁◯◯◯ Very low[b,c]	
	460 per 1,000	**592 per 1,000** (346 to 798)				

a. Unable to identify extractable evidence regarding the original critical outcome, "percent positive leading to treatment"
b. Tantrakul 2015 reports a very different BQ performance than all other included studies.
c. The calculated CI is quite large and spans across the null value.

Appendix 2

Test result	Number of results per 1000 patients tested (95% CI)						№ of participants (studies)	Certainty of the evidence (GRADE)
	Prevalence 5%		Prevalence 25%		Prevalence 40%			
	pregnancy-specific SDB screening tool (Facco)	standard SDB screening tool (STBA)	pregnancy-specific SDB screening tool (Facco)	standard SDB screening tool (STBA)	pregnancy-specific SDB screening tool (Facco)	standard SDB screening tool (STBA)		
True positives patients with OSA	43 to 50	27 to 32	215 to 250	133 to 158	344 to 400	212 to 252	180 (2)	⨁⨁◯◯ Low[1,2,a,b]
	16 more to 18 more TP in pregnancy-specific SDB screening tool (Facco)		82 more to 92 more TP in pregnancy-specific SDB screening tool (Facco)		132 more to 148 more TP in pregnancy-specific SDB screening tool (Facco)			
False negatives patients incorrectly classified as not having OSA	0 to 7	18 to 23	0 to 35	92 to 117	0 to 56	148 to 188		
	16 fewer to 18 fewer FN in pregnancy-specific SDB screening tool (Facco)		82 fewer to 92 fewer FN in pregnancy-specific SDB screening tool (Facco)		132 fewer to 148 fewer FN in pregnancy-specific SDB screening tool (Facco)			
True negatives patients without OSA	199 to 703	342 to 893	158 to 555	270 to 705	126 to 444	216 to 564	400 (5)	⨁⨁◯◯ Low[1,3,4,a,b]
	143 fewer to 190 fewer TN in pregnancy-specific SDB screening tool (Facco)		112 fewer to 150 fewer TN in pregnancy-specific SDB screening tool (Facco)		90 fewer to 120 fewer TN in pregnancy-specific SDB screening tool (Facco)			
False positives patients incorrectly classified as having OSA	247 to 751	57 to 608	195 to 592	45 to 480	156 to 474	36 to 384		
	143 more to 190 more FP in pregnancy-specific SDB screening tool (Facco)		112 more to 150 more FP in pregnancy-specific SDB screening tool (Facco)		90 more to 120 more FP in pregnancy-specific SDB screening tool (Facco)			

1. Dominguez, J. E., Grotegut, C. A., Cooter, M., Krystal, A. D., Habib, A. S.. Screening extremely obese pregnant women for obstructive sleep apnea.Am J Obstet Gynecol; 2018-12.
2. Facco, F. L., Ouyang, D. W., Zee, P. C., Grobman, W. A.. Development of a pregnancy-specific screening tool for sleep apnea.J Clin Sleep Med; 2012-8-15.
3. Lockhart, E. M., Ben Abdallah, A., Tuuli, M. G., Leighton, B. L.. Obstructive Sleep Apnea in Pregnancy: Assessment of Current Screening Tools.Obstet Gynecol; 2015-7.
4. Tantrakul, V., Sirijanchune, P., Panburana, P., Pengjam, J., Suwansathit, W., Boonsarngsuk, V., Guilleminault, C.. Screening of obstructive sleep apnea during pregnancy: differences in predictive values of questionnaires across trimesters.J Clin Sleep Med; 2015-1-15.

a. Serious inconsistency suspected due to lack of overlap of sens/spec CIs of analyzed studies.
b. Serious imprecision due to wide sens/spec CIs of analyzed studies.

Appendix 3

Outcomes	With no treatment	With any form of PAP treatment	Difference	Relative effect (95% CI)
Maternal complications assessed with: rate of preeclampsia	202 per 1,000	**190 per 1,000** (34 to 1,000)	**12 fewer per 1,000** (168 fewer to 842 more)	**RR 0.94** (0.17 to 5.16)
Maternal complications assessed with: rate of HTN	**Rice 2022 (obs)** reports 6 cases of HTN out of a total of 23 participants receiving PAP therapy (26%) vs 28 cases of HTN out of a total of 77 participants receiving no treatment (36%). **Tantrakul 2023 (RCT)** reports 21 cases of HTN out of a total of 153 participants receiving PAP therapy (14%) vs 39 cases of HTN out of a total of 157 participants receiving no treatment (25%).			
Maternal complications assessed with: rate of cesarean delivery	**Chirakalwasan 2018 (RCT)** reports 3 *unplanned* cesarean deliveries out of a total of 18 participants receiving PAP therapy (17%) vs 7 unplanned cesarean deliveries out of a total of 17 participants receiving no treatment (41%). **Rice 2022 (obs)** reports 12 cesarean deliveries (*not* subdivided into planned/unplanned) out of a total of 23 participants receiving PAP therapy (52%) vs 50 cesarean deliveries out of a total of 77 participants receiving no treatment (65%).			
Fetal/neonatal complications assessed with: impaired fetal growth, fetal growth restriction, small for gestational age	**Chirakalwasan 2018 (RCT)** reports 1 case of SGA out of a total of 18 participants receiving PAP therapy (6%) vs 2 cases of SGA out of a total of 16 participants receiving no treatment (13%). **Kneitel 2018 (obs)** reports 4 cases of impaired fetal growth (either birthweight <10th centile OR a fall in growth centile > 33%) out of a total of 14 participants receiving PAP therapy (29%) vs 19 cases of impaired fetal growth out of a total of 31 participants receiving no treatment (61%). **Rice 2022 (obs)** reports 1 case of fetal growth restriction (< 10th percentile) out of a total of 23 participants receiving PAP therapy (4%) vs 6 cases of fetal growth restriction out of a total of 77 participants receiving no treatment (8%).			
Fetal/neonatal complications assessed with: large for gestational age	**Chirakalwasan 2018 (RCT)** reports 1 case of LGA out of a total of 18 participants receiving PAP therapy (6%) vs 2 cases of LGA out of a total of 16 particpants receiving no treatment (13%). **Rice 2022 (obs)** reports 6 cases of LGA out of a total of 23 participants receiving PAP therapy (26%) vs 16 cases of LGA out of a total of 77 participants receiving no treatment (21%).			
Fetal/neonatal complications assessed with: NICU admission	375 per 1,000	**389 per 1,000** (139 to 718)	**14 more per 1,000** (236 fewer to 343 more)	**OR 1.06** (0.27 to 4.24)
Quality of life - not reported	0 per 1,000	**0 per 1,000** (0 to 0)	**0 fewer per 1,000** (0 fewer to 0 fewer)	-

Appendix 4

Outcomes	Importance	Certainty of the evidence (GRADE)
Screening results assessed with: Epworth sleepiness scale score	CRITICAL	⨁◯◯◯ Very low[a]
Screening results assessed with: Epworth sleepiness scale score (median(IQR))	CRITICAL	⨁◯◯◯ Very low[a]
Diagnostic performance assessed with: high risk screening results	CRITICAL	⨁◯◯◯ Very low[b,c]

a. Unable to identify extractable evidence regarding the original critical outcome, "percent positive leading to treatment"
b. Tantrakul 2015 reports a very different BQ performance than all other included studies.
c. The calculated CI is quite large and spans across the null value.

e-Table 13

QUESTION 3

Should pregnancy-specific SDB screening tool (Facco) vs. standard SDB screening tool (BQ or STBA) be used to diagnose OSA in pregnant persons?

ASSESSMENT

Problem Is the problem a priority?		
JUDGEMENT	**RESEARCH EVIDENCE**	**ADDITIONAL CONSIDERATIONS**
○ No ○ Probably no ○ Probably yes ● Yes ○ Varies ○ Don't know	No comments.	pregnancy is a dynamic state in which physical changes as pregnancy progresses - large population which this affects - need a specific tool for this large population nature of pregnancy necessitates considering different outcomes than the general population
Test accuracy How accurate is the test?		
JUDGEMENT	**RESEARCH EVIDENCE**	**ADDITIONAL CONSIDERATIONS**
○ Very inaccurate ○ Inaccurate ○ Accurate ○ Very accurate ● Varies	*See Appendix 1* *See Appendix 1*	compared to STBA, Facco is not good at excluding those who do not have the disease - lots of TP but also lots of FN BQ tool appears to have lots of CIs crossing the null value - lots of FP (similar to STBA)

○ Don't know	*See Appendix 2* *See Appendix 3* *See Appendix 4* *See Appendix 5*	Facco is highly sensitive, not highly specific we're comparing suboptimal tools together, not comparing to a gold standard - it may pick up more disease than other tools, it doesn't mean that we would recommend its use - maybe with a pregnancy specific tool, we can id more disease, but our screening to eliminate people we DONT need to test, we need to have a tool which is more specific than this Many panelists would say the accuracy varies because it highly depends on the prevalence of the disease

Desirable Effects

How substantial are the desirable anticipated effects?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
○ Trivial ○ Small ● Moderate ○ Large ○ Varies ○ Don't know	No data collected.	Panelists feel the desirable effect is moderate to large, we definitely need a good screening tool for pregnant persons - large need in current practice - from a clinical standpoint, suspect that if we develop a tool that is helpful, it would have a large effect on how we manage women with SDB in pregnancy obviously, very desirable to have a pregnancy specific tool, but worth considering the tool we have data on (Facco tool) a tool that can exclude people for further testing would be very important in this population (lots of testing already, potential added worry if more testing)

		Some panelists are not as convinced on the "desirable effects" due to lack of specificity of endpoints (not clear that there are well defined positive outcomes associated with this) **The panel states the importance of including the caveat that modifying the health of the pregnancy with a screening tool is not clearly shown in data currently**

Undesirable Effects

How substantial are the undesirable anticipated effects?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
○ Trivial ○ Small ● Moderate ○ Large ○ Varies ○ Don't know	No data collected.	in an abstract sense, there may not be a lot of undesirable effects for a pregnancy specific tool however, for this specific tool (Facco) - there are a large number of FP which could lead to a large psychological burden which comes with further testing for SDB when its FP For many panelists, the first thing that comes to mind is unnecessary testing (stress that comes with this) unnecessary testing can also come with a larger burden on the healthcare system, FP may take the place of those who more so need to be tested extra appointments is not necessarily trivial for a lot of these patients

Certainty of the evidence of test accuracy

What is the overall certainty of the evidence of test accuracy?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
○ Very low ● Low ○ Moderate ○ High ○ No included studies	*See Appendix 1* *See Appendix 1*	No comments.

Certainty of the evidence of test's effects

What is the overall certainty of the evidence for any critical or important direct benefits, adverse effects or burden of the test?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
○ Very low ○ Low ○ Moderate ○ High ● No included studies	No included studies.	No comments.

Certainty of the evidence of management's effects

What is the overall certainty of the evidence of effects of the management that is guided by the test results?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
● Very low ○ Low ○ Moderate ○ High ○ No included studies	*See Appendix 6*	No comments.

Certainty of the evidence of test result/management

How certain is the link between test results and management decisions?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
○ Very low ● Low ○ Moderate ○ High ○ No included studies	*See Appendix 1* *See Appendix 1*	No comments.

Certainty of effects

What is the overall certainty of the evidence of effects of the test?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
○ Very low ○ Low ○ Moderate ○ High ● No included studies	No data collected.	No comments.

Values

Is there important uncertainty about or variability in how much people value the main outcomes?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
○ Important uncertainty or variability ○ Possibly important uncertainty or variability ● Probably no important uncertainty or variability ○ No important uncertainty or variability	No studies identified.	The panel feels that, theoretically, we do need a pregnancy specific tool due to physical differences in pregnant persons, but if there were a standard tool which performed very well in a pregnant population, most providers would be very happy with using that Other panelists think it depends, if we have a perfect pregnancy specific tool, it would be no important uncertainty or variability, but given the tool we have, they would rate it as "probably no"

Balance of effects

Does the balance between desirable and undesirable effects favor the intervention or the comparison?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
○ Favors the comparison ○ Probably favors the comparison ○ Does not favor either the intervention or the comparison ○ Probably favors the intervention ○ Favors the intervention ● Varies ○ Don't know	No studies identified.	intervention – Facco, comparison - STBA/BQ split between "probably favors comparison" and "does not favor either" Some panelists feel that BQ/STBA does not perform very well, but also feel the Facco tool doesn't perform very well - if we're just interpreting the data here, it appears that it favors the comparison (doesn't mean we want to make a recommendation for this) it seems that a lot of the desirable/undesirable effects vary

Resources required How large are the resource requirements (costs)?"		
JUDGEMENT	**RESEARCH EVIDENCE**	**ADDITIONAL CONSIDERATIONS**
○ Large costs ○ Moderate costs ● Negligible costs and savings ○ Moderate savings ○ Large savings ○ Varies ○ Don't know	No data collected.	no difference in cost to screening, just a question of which questions you ask - difference may be the cost of a FP leading to unnecessary testing if there are a lot of FPs, that could cost a lot in unnecessary testing no difference in cost of screening itself, only sleep studies

Certainty of evidence of required resources

What is the certainty of the evidence of resource requirements (costs)?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
○ Very low ○ Low ○ Moderate ○ High ● No included studies	No comment.	No comments.

Cost effectiveness

Does the cost-effectiveness of the intervention favor the intervention or the comparison?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
○ Favors the comparison ● Probably favors the comparison ○ Does not favor either the intervention or the comparison ○ Probably favors the intervention ○ Favors the intervention ○ Varies ○ No included studies	No studies identified.	No comments.

Equity

What would be the impact on health equity?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
○ Reduced ○ Probably reduced ● Probably no impact ○ Probably increased ○ Increased ○ Varies ○ Don't know	No studies identified.	maybe doesn't impact health equity as long as it's only pertaining to the screening tool itself, but once it may lead to a PSG or sleep study, this could have an impact on health equity initial screening doesn't really impact health equity, but further diagnostics could be an issue with health equity, especially lower SES women

Acceptability

Is the intervention acceptable to key stakeholders?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
○ No ○ Probably no ○ Probably yes ● Yes ○ Varies ○ Don't know	No studies identified.	No comments.

Feasibility

Is the intervention feasible to implement?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
○ No ○ Probably no	No studies identified.	each healthcare provider needs to be trained, but if they are, it seems feasible to implement

● Probably yes ○ Yes ○ Varies ○ Don't know		components of screening tool are pretty easy, issue is getting education to providers and have them fit it into the rest of their practice Some panelists note that technological advances especially in EMR could help the feasibility of implementing a tool like this

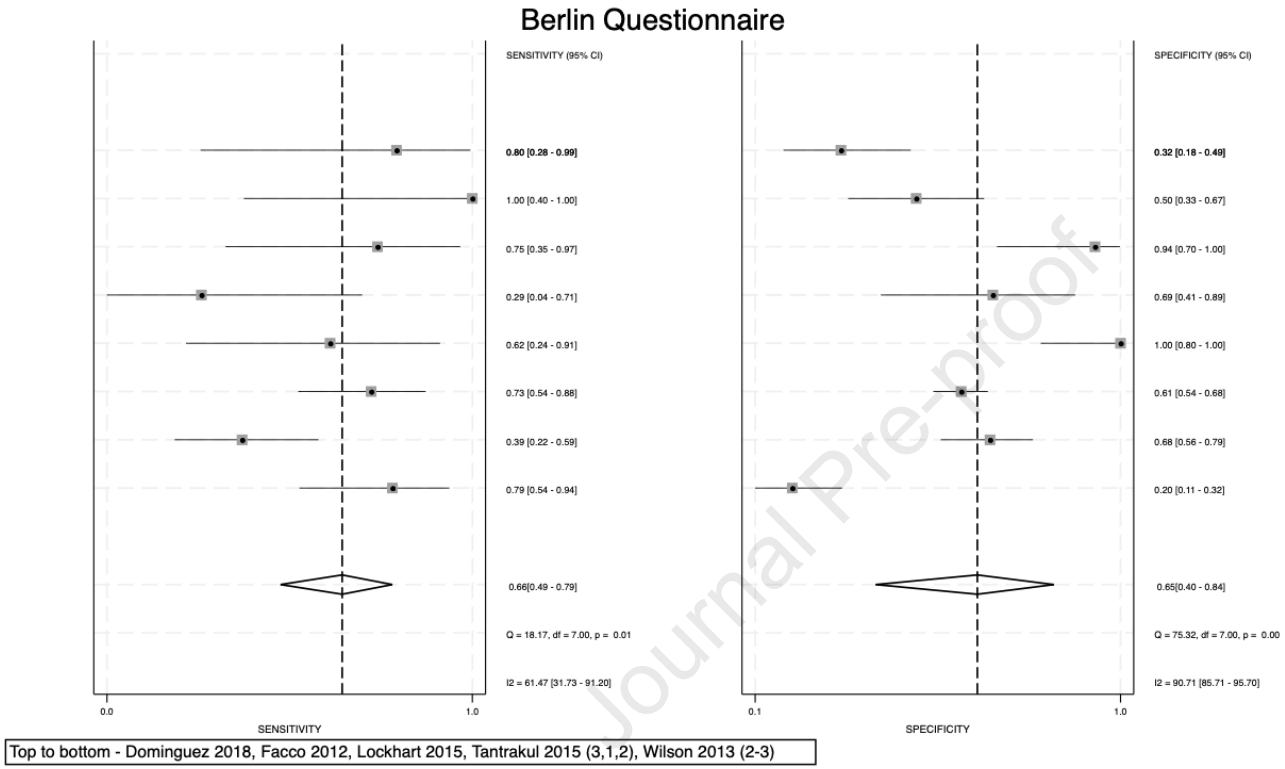
APPENDICES

Appendix 1

Outcome	Study design	Test accuracy CoE	Effect per 1000 patients/year for pre-test probability of 5%		Effect per 1000 patients/year for pre-test probability of 25%		Effect per 1000 patients/year for pre-test probability of 40%		Importance
			pregnancy-specific SDB screening tool (Facco)	standard SDB screening tool (BQ)	pregnancy-specific SDB screening tool (Facco)	standard SDB screening tool (BQ)	pregnancy-specific SDB screening tool (Facco)	standard SDB screening tool (BQ)	
True positives	cross-sectional (cohort type accuracy study)	⊕⊕◯◯ Low[a,b]	43 to 50	14 to 50	215 to 250	73 to 250	344 to 400	116 to 400	CRITICAL
TP absolute difference			29 more to 0 fewer TP in pregnancy-specific SDB screening tool (Facco)		142 more to 0 fewer TP in pregnancy-specific SDB screening tool (Facco)		228 more to 0 fewer TP in pregnancy-specific SDB screening tool (Facco)		
False negatives			0 to 7	0 to 36	0 to 35	0 to 177	0 to 56	0 to 284	CRITICAL
FN absolute difference			29 fewer to 0 fewer FN in pregnancy-specific SDB screening tool (Facco)		142 fewer to 0 fewer FN in pregnancy-specific SDB screening tool (Facco)		228 fewer to 0 fewer FN in pregnancy-specific SDB screening tool (Facco)		
True negatives	cross-sectional (cohort type accuracy study)	⊕⊕◯◯ Low[b,c]	199 to 703	190 to 950	158 to 555	150 to 750	126 to 444	120 to 600	CRITICAL
TN absolute difference			9 more to 247 fewer TN in pregnancy-specific SDB screening tool (Facco)		8 more to 195 fewer TN in pregnancy-specific SDB screening tool (Facco)		6 more to 156 fewer TN in pregnancy-specific SDB screening tool (Facco)		
False positives			247 to 751	0 to 760	195 to 592	0 to 600	156 to 474	0 to 480	CRITICAL
FP absolute difference			9 fewer to 247 more FP in pregnancy-specific SDB screening tool (Facco)		8 fewer to 195 more FP in pregnancy-specific SDB screening tool (Facco)		6 fewer to 156 more FP in pregnancy-specific SDB screening tool (Facco)		

a. Dominguez 2018 and Facco 2012 have significantly different estimates of specificity.
b. Serious imprecision due to wide sens/spec CIs in analyzed studies.
c. Multiple studies included in analysis have significantly different estimates of specificity.

Appendix 2

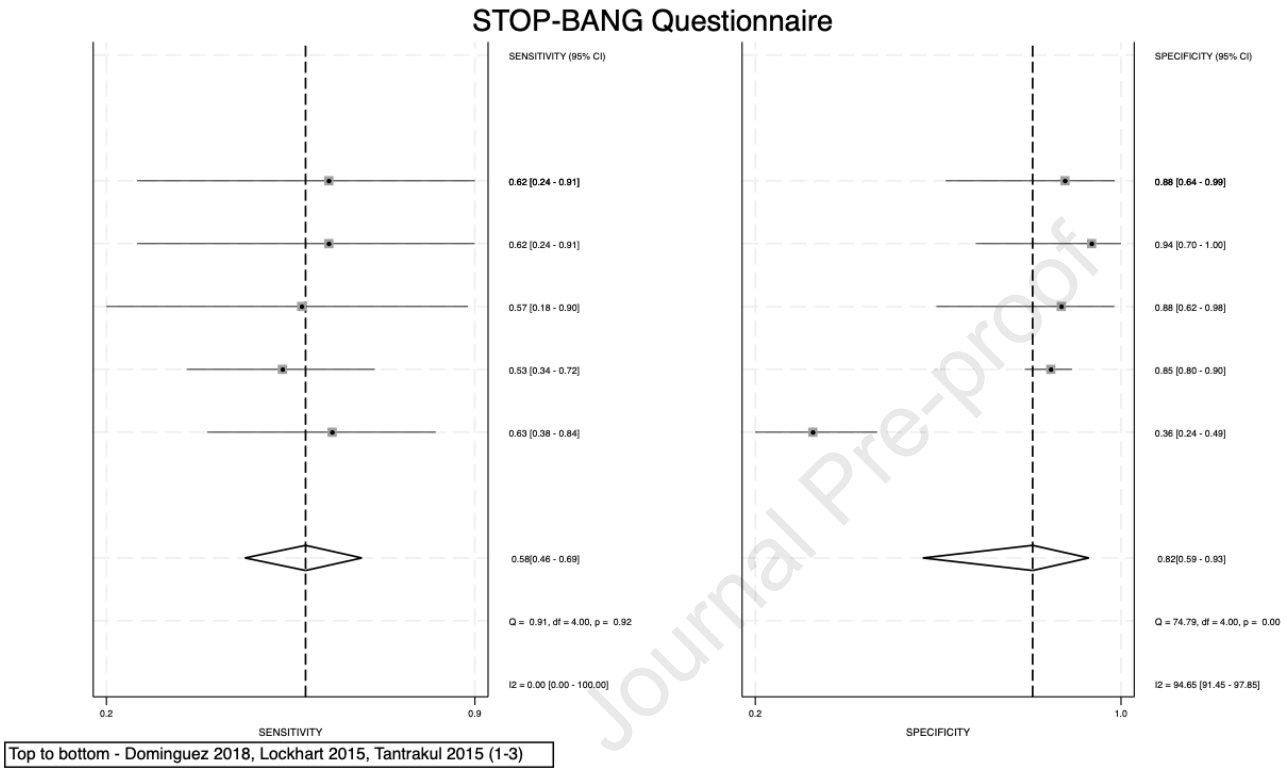


Appendix 3

SUMMARY PERFORMANCE ESTIMATES

Parameter	Estimate	95% CI
Sensitivity	0.66	[0.49, 0.79]
Specificity	0.65	[0.40, 0.84]
Positive Likelihood Ratio	1.9	[1.0, 3.5]
Negative Likelihood Ratio	0.53	[0.33, 0.85]
Diagnostic Odds Ratio	4	[1, 10]

Appendix 4



Appendix 5

SUMMARY PERFORMANCE ESTIMATES

Parameter	Estimate	95% CI
Sensitivity	0.58	[0.46, 0.69]
Specificity	0.82	[0.59, 0.93]
Positive Likelihood Ratio	3.1	[1.3, 7.8]
Negative Likelihood Ratio	0.52	[0.37, 0.71]
Diagnostic Odds Ratio	6	[2, 19]

Appendix 6

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	№ of participants (studies)	Certainty of the evidence (GRADE)	Comments
	Risk with no treatment	Risk with any form of PAP treatment				
Maternal complications assessed with: rate of preeclampsia	Study population		**RR 0.94** (0.17 to 5.16)	344 (2 RCTs)	⨁⨁⨁◯ Moderate[a,b]	
	202 per 1,000	**190 per 1,000** (34 to 1,000)				
Maternal complications assessed with: rate of HTN	**Rice 2022 (obs)** reports 6 cases of HTN out of a total of 23 participants receiving PAP therapy (26%) vs 28 cases of HTN out of a total of 77 participants receiving no treatment (36%). **Tantrakul 2023 (RCT)** reports 21 cases of HTN out of a total of 153 participants receiving PAP therapy (14%) vs 39 cases of HTN out of a total of 157 participants receiving no treatment (25%).		-	(2 non-randomised studies)	⨁⨁◯◯ Low	
Maternal complications assessed with: rate of cesarean delivery	**Chirakalwasan 2018 (RCT)** reports 3 *unplanned* cesarean deliveries out of a total of 18 participants receiving PAP therapy (17%) vs 7 unplanned cesarean deliveries out of a total of 17 participants receiving no treatment (41%). **Rice 2022 (obs)** reports 12 cesarean deliveries (*not* subdivided into planned/unplanned) out of a total of 23 participants receiving PAP therapy (52%) vs 50 cesarean deliveries out of a total of 77 participants receiving no treatment (65%).		-	(2 non-randomised studies)	⨁⨁◯◯ Low[a]	
Fetal/neonatal complications assessed with: impaired fetal growth, fetal growth restriction, small for gestational age	**Chirakalwasan 2018 (RCT)** reports 1 case of SGA out of a total of 18 participants receiving PAP therapy (6%) vs 2 cases of SGA out of a total of 16 participants receiving no treatment (13%). **Kneitel 2018 (obs)** reports 4 cases of impaired fetal growth (either birthweight <10th centile OR a fall in growth centile > 33%) out of a total of 14 participants receiving PAP therapy (29%) vs 19 cases of impaired fetal growth out of a total of 31 participants receiving no treatment (61%). **Rice 2022 (obs)** reports 1 case of fetal growth restriction (< 10th percentile) out of a total of 23 participants receiving PAP therapy (4%) vs 6 cases of fetal growth restriction out of a total of 77 participants receiving no treatment (8%).		-	(3 non-randomised studies)	⨁⨁◯◯ Low[a]	
Fetal/neonatal complications (LGA) assessed with: large for gestational age	**Chirakalwasan 2018 (RCT)** reports 1 case of LGA out of a total of 18 participants receiving PAP therapy (6%) vs 2 cases of LGA out of a total of 16 particpants receiving no treatment (13%). **Rice 2022 (obs)** reports 6 cases of LGA out of a total of 23 participants receiving PAP therapy (26%) vs 16 cases of LGA out of a total of 77 participants receiving no treatment (21%).		-	(2 non-randomised studies)	⨁◯◯◯ Very low[a,c]	
Fetal/neonatal complications assessed with: NICU admission	Study population		**OR 1.06** (0.27 to 4.24)	34 (1 RCT)	⨁⨁⨁◯ Moderate[a,d,e]	
	375 per 1,000	**389 per 1,000** (139 to 718)				
Quality of life - not reported	-	-	-	-	-	
Sleepiness score - not reported	-	-	-	-	-	

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	№ of participants (studies)	Certainty of the evidence (GRADE)	Comments
	Risk with no treatment	Risk with any form of PAP treatment				
Mood disorders - not reported	-	-	-	-	-	
Resolution of HTN and GDM post-partum - not reported	-	-	-	-	-	
Hospitalizations - not reported	-	-	-	-	-	

a. Chirakalwasan 2018 shows a some concerns of bias due to concerns regarding performance bias and detection bias.
b. Chirakalwasan 2018 reports a very large confidence interval, which crosses the null value.
c. The two studies included for analysis of this outcome report different effects altogether.
d. A single study was used here, making inconsistency irrelevant.
e. The sample size is very small here, indicating the potential for serious imprecision.

e-Table 14

QUESTION 4

Should at-home diagnostic devices vs. lab-based diagnostics be used for pregnant persons undergoing evaluation for OSA?

ASSESSMENT

Problem Is the problem a priority?		
JUDGEMENT	**RESEARCH EVIDENCE**	**ADDITIONAL CONSIDERATIONS**
○ No ○ Probably no ○ Probably yes ● Yes ○ Varies ○ Don't know	No studies included.	important because diagnostics affects treatment and ultimately everything important due to the logistics of in-lab testing (especially in a pregnant patient population) limitations with home sleep testing (particularly with young women) - this question is important to discuss whether at-home devices are accurate in capturing cases and affecting outcomes
Desirable Effects How substantial are the desirable anticipated effects?		
JUDGEMENT	**RESEARCH EVIDENCE**	**ADDITIONAL CONSIDERATIONS**
○ Trivial ○ Small ○ Moderate ● Large	*See Appendix 1*	the fact that you are able to complete the at-home test on more patients is significant

○ Varies ○ Don't know		

Undesirable Effects

How substantial are the undesirable anticipated effects?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
○ Trivial ● Small ○ Moderate ○ Large ○ Varies ○ Don't know	No data on undesirable effects were collected.	possible misdiagnoses - delay in diagnosis - if high enough clinical suspicion, you will then have to complete an in-lab study possible device failure leading to repeat testing Panelists stress that providers must train patient how to place the device themselves, which introduces the possibility for error in placement and thus inaccurate results possible inconvenience for patients, have to go pick them up and bring them back, find transportation to do this even in nonpregnant persons, at home devices are not great at capturing mild OSA cases - potential for misdiagnoses leading to repeat testing (or untreated OSA)

Certainty of evidence What is the overall certainty of the evidence of effects?		
JUDGEMENT	**RESEARCH EVIDENCE**	**ADDITIONAL CONSIDERATIONS**
● Very low ○ Low ○ Moderate ○ High ○ No included studies	*See Appendix 2*	No comments.
Values Is there important uncertainty about or variability in how much people value the main outcomes?		
JUDGEMENT	**RESEARCH EVIDENCE**	**ADDITIONAL CONSIDERATIONS**
○ Important uncertainty or variability ○ Possibly important uncertainty or variability ● Probably no important uncertainty or variability ○ No important uncertainty or variability	No studies identified.	majority of patients value a home sleep study because it's much more convenient (patient perspective) - of course there is an inconvenience in obtaining and returning equipment - but they do value being in their own bed greatest value comes in convenience and practicality of using at home device in pregnant population - and for provider, timely diagnosis leading to treatment PSG remains gold standard for diagnostics (so maybe most physicians would prefer an attended sleep study, because it is much more comprehensive) - but if we're looking strictly for

		diagnosis of mod-severe OSA, then at home test would probably be fine - depends on what we're looking for in the diagnostic evaluation

Balance of effects

Does the balance between desirable and undesirable effects favor the intervention or the comparison?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
○ Favors the comparison ○ Probably favors the comparison ○ Does not favor either the intervention or the comparison ● Probably favors the intervention ○ Favors the intervention ○ Varies ○ Don't know	*See Appendix 1* No data on undesirable effects were collected.	intervention - at home device comparison - in lab PSG

Resources required

How large are the resource requirements (costs)?"

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
○ Large costs ○ Moderate costs ○ Negligible costs and savings ○ Moderate savings ○ Large savings ● Varies	"The average price of an in-lab sleep study is $3,000. The National Center for Biotechnology Information advances science and health by providing access to biomedical and genomic information. Prices can range from $1,000 to over $10,000, depending on insurance coverage. Facility charges for hospital outpatients can also drive up the total cost of an in-lab sleep study. Fortunately, many insurance providers cover much of a sleep study's cost."	Panelists note that it really depends on insurance - if your insurance covers everything for both options (no copay) then the difference in cost is nothing - Medicaid does not cover home sleep testing (at least in FL) -depends so much on location and insurer - very difficult to generalize an answer to this question due to high variability

○ Don't know	"At-home sleep studies can range from $150 to around $1,000 or more**,** which is much less than in-lab sleep studies. This type of sleep study uses less equipment and takes place at a person's home, unattended by technicians. The price of an at-home sleep study also depends on the equipment required. " https://www.sleepfoundation.org/sleep-studies/how-much-does-a-sleep-study-cost	50-55% of pregnancies in US utilize Medicaid, so makes this question even more difficult to answer (or generalize) caveat that we could ultimately asterisk the answer to this question with "it depends on your insurance" PSG requires attendants which causes costs to health system, whether insurance is covering this or no ultimate cost to the health systems and cost to patient could be different varies depending on system you work in, hospital you work in, and patients' insurance

Certainty of evidence of required resources

What is the certainty of the evidence of resource requirements (costs)?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
○ Very low ○ Low ○ Moderate ● High ○ No included studies	No comment.	No comment.

Cost effectiveness

Does the cost-effectiveness of the intervention favor the intervention or the comparison?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
○ Favors the comparison ○ Probably favors the comparison ○ Does not favor either the intervention or the comparison ○ Probably favors the intervention ○ Favors the intervention ● Varies ○ No included studies	RD Kim et al. 2015. "An Economic Evaluation of Home Versus Laboratory-Based Diagnosis of Obstructive Sleep Apnea" **Sleep**. 38(7): 1027–1037. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4481018/ "**Measurements and Results**: From the payer perspective, per subject costs for the laboratory-based pathway were $1,840 (95% confidence interval [CI] $1,660, $2,015) compared to $1,575 (95% CI $1,439, $1,716) for the home-based pathway under the base case. Costs were $264 (95% CI $39, $496, P = 0.02) in favor of the home arm. From the provider perspective, per subject costs for the laboratory arm were $1,697 (95% CI $1,566,	patient perspective is going to differ from a systems perspective vs insurance perspective specifically for the patient, it varies - insurance may not cover HSD - resulting in higher cost to patient - but in other areas, it's a lower copayment for patient to use HSD in safety-net hospital, Medicaid covers completely in lab PSG, but does not cover HSD - commercial payers however cover more of a home sleep study than in lab - so much variability.

	$1,826) compared to $1,736 (95% CI $1,621, $1,857) in the home arm, for a difference of $40 (95% CI −$213, $142, P = 0.66) in favor of the laboratory arm under the base case. The provider operating margin was $142 (95% CI $85, $202,P < 0.01) in the laboratory arm, compared to a loss of −$161 (95% CI −$202, −$120, P < 0.01) in the home arm. **Conclusions:** For payers, a home-based diagnostic pathway for obstructive sleep apnea with robust patient support incurs fewer costs than a laboratory-based pathway. For providers, costs are comparable if not higher, resulting in a negative operating margin."	Looking at a health system, HSD are most likely more cost effective

Equity
What would be the impact on health equity?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
○ Reduced ○ Probably reduced ○ Probably no impact ● Probably increased ○ Increased ○ Varies ○ Don't know	O Henry, et al. 2022. "A Model for Sleep Apnea Management in Underserved Patient Populations". J Prim Care Community Health. 13: 21501319211068969. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8771751/ **"Methods:** We designed and implemented a specialty sleep clinic at Shade Tree Clinic, Vanderbilt's student-run, free primary care clinic. Patients with signs and symptoms of OSA were identified at primary care appointments and screened using the STOP-BANG questionnaire. Clinic visits took place over telehealth with a medical student and sleep specialist. Patients were diagnosed using a home sleep test, and if indicated, were prescribed and given a CPAP device for treatment. CPAP adherence was monitored using a cloud-based remote monitoring system.	patients who cannot afford in lab PSG (cost of child care, transportation to clinic, etc.) this could increase equity by giving an option to this patient who otherwise would go undiagnosed, potentially - however, those who are unable to set up a home diagnostic device (due to potential disabilities, or other reasons) may not be able to utilize the home sleep test, thus equity would be unaffected some patients get equipment via picking it up, some via mail - can be dependent on public transit or someone driving you to go get your equipment long term outcomes - a bus ride vs the negative health outcomes associated with untreated OSA could ultimately come out favoring the HSD

	Results: From December 2020 through August 2021, we hosted 6 telehealth Sleep Clinics, seeing a total of 28 patients across these visits. We have received a total of 37 referrals and have coordinated sleep evaluations and diagnostic testing for 18 of these patients so far. Prior to initiation of the sleep clinic, there were 17 patients on our primary care panel at Shade Tree with a diagnosis of OSA. These patients were using donated equipment, and many had been lost to follow-up or had broken parts. We were able to replace 10 of these patient's CPAP devices and plan to replace the remaining seven. **Conclusions:** We have created a model of integrated specialty care that is efficient and cost-effective. This paradigm can be replicated for the many specialties that are typically overlooked and undertreated when working with uninsured patients. As awareness of this sleep medicine program becomes more widespread at Shade Tree Clinic, we anticipate reaching more primary care patients with signs and symptoms of sleep apnea through student education, cost-effective diagnostics, and partnership with sleep specialists." No studies identified directly discussing the effect on equity, however, studies (like Henry 2022, above) discuss utilizing home-based diagnostics to deliver care to patient populations.	Panelists note that we have to assume someone is actually going to show up to the in lab sleep study varies depending on area (access to transit and insurance coverage) with the HSD, introduces more flexibility in using the diagnostic device, so you could engineer this to increase equity - potential for more equity Panelists mention that it's valuable to consider the sometimes extended wait time for in-lab PSG at-home devices could decrease wait times - wait time tends to be less for HSD due to less fixed variables (number of beds available, staffing, etc.) lab may be maxed on number of devices you can loan out - but generally, wait time for attended in-lab test is longer than at home test

Acceptability

Is the intervention acceptable to key stakeholders?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
○ No ○ Probably no	No studies identified.	No comments.

○ Probably yes ● Yes ○ Varies ○ Don't know		

Feasibility

Is the intervention feasible to implement?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
○ No ○ Probably no ○ Probably yes ● Yes ○ Varies ○ Don't know	No studies identified.	No comments.

APPENDICES

Appendix 1

Outcomes	With lab-based diagnostics	With at-home diagnostic devices	Difference	Relative effect (95% CI)
Diagnostic performance assessed with: sensitivity/specificity	**O'Brien 2012** reports sensitivity (0.88), specificity (0.87), PPV (0.7), and NPV (0.95) for the Watch-PAT to identify PSG-measured AHI that is greater than or equal to 5 (did not report sens/spec for PSG) **Sharkey 2014** reports the performance of ARES device (1% algorithm) compared with PSG-measured AHI for detecting OSA ARES device - • Sensitivity = 1.0 (0.54, 1.0) • Specificity = 0.3 (0.07, 0.65) • PPV = 0.46 (0.19, 0.75) • NPV = 1.0 (0.29, 1.0) PSG - • Sensitivity = 1.0 (0.54, 1.0) • Specificity = 0.5 (0.19, 0.81) • PPV = 0.55 (0.20, 0.83) • NPV = 1.0 (0.48, 1.0) [1,2]			
Time from screening to testing/diagnosis - not reported	0 per 1,000	**0 per 1,000** (0 to 0)	**0 fewer per 1,000** (0 fewer to 0 fewer)	-
Time from screening to initiation of treatment - not reported	0 per 1,000	**0 per 1,000** (0 to 0)	**0 fewer per 1,000** (0 fewer to 0 fewer)	-
Ability to complete the diagnostic test	41 per 1,000	**74 per 1,000** (10 to 384)	**33 more per 1,000** (31 fewer to 342 more)	**OR 1.87** (0.24 to 14.53)
Diagnostic performance assessed with: agreement between tests	221 per 1,000	**365 per 1,000** (212 to 551)	**144 more per 1,000** (9 fewer to 330 more)	**OR 2.03** (0.95 to 4.33)
Diagnostic performance assessed with: agreement between tests -	**Louis 2012** reports *rho* = 0.7 (0.47, 0.92) p<0.001 **Sharkey 2014** reports *rho* = 0.83 p<0.001 [a]			

Outcomes	With lab-based diagnostics	With at-home diagnostic devices	Difference	Relative effect (95% CI)
Spearman's rank correlation coefficient (rho) and associated p-value				

1. O'Brien, L. M., Bullough, A. S., Shelgikar, A. V., Chames, M. C., Armitage, R., Chervin, R. D.. Validation of Watch-PAT-200 against polysomnography during pregnancy. J Clin Sleep Med; 2012-6-15.
2. Sharkey, K. M., Waters, K., Millman, R. P., Moore, R., Martin, S. M., Bourjeily, G.. Validation of the Apnea Risk Evaluation System (ARES) device against laboratory polysomnography in pregnant women at risk for obstructive sleep apnea syndrome. J Clin Sleep Med; 2014-5-15.

a. NOTE: a value of rho close to +1 indicates a similar rank (i.e. relative position label of the observations within the variable), a rho close to -1 indicates an inverse relationship, a rho close to 0 indicates little to no correlation.

Appendix 2

Outcomes	Importance	Certainty of the evidence (GRADE)
Diagnostic performance assessed with: sensitivity/specificity	CRITICAL	⨁◯◯◯ Very low[a]
Time from screening to testing/diagnosis - not reported	CRITICAL	-
Time from screening to initiation of treatment - not reported	CRITICAL	-
Ability to complete the diagnostic test	CRITICAL	⨁◯◯◯ Very low[b,c]
Diagnostic performance assessed with: agreement between tests	CRITICAL	⨁⨁◯◯ Low
Diagnostic performance assessed with: agreement between tests - Spearman's rank correlation coefficient (rho) and associated p-value		⨁◯◯◯ Very low[d]

a. Not all point estimates / confidence intervals overlap between the two studies included for analysis here.
b. Antony 2014 shows a serious risk of bias.
c. Not all studies report the same effect.
d. The sample size is very small here, indicating the potential for serious imprecision.

e-Table 15

QUESTION 5

Should treatment based solely on an AHI > 15 vs. treatment based on an AHI 5-15 with symptoms/sequelae or comorbidity (HTN, stroke, obesity, etc.) be used for pregnant persons diagnosed with OSA during pregnancy?

ASSESSMENT

Problem Is the problem a priority?		
JUDGEMENT	**RESEARCH EVIDENCE**	**ADDITIONAL CONSIDERATIONS**
○ No ○ Probably no ○ Probably yes ● Yes ○ Varies ○ Don't know	CHEST approved this topic and indicated its status as high priority.	important to know who to target for treatment a question in the general population as well as pregnant persons
Desirable Effects How substantial are the desirable anticipated effects?		
JUDGEMENT	**RESEARCH EVIDENCE**	**ADDITIONAL CONSIDERATIONS**
○ Trivial ○ Small ○ Moderate ○ Large ● Varies ○ Don't know	*See Appendix 1*	very difficult question to answer because it's dependent on trimester during which AHI was measured - early in pregnancy, treatment would make a larger difference than treatment in week 36 so many variables that can impact efficacy of treatment (adherence, timing of diagnosis, etc.) -number of patients in these studies is insufficient to truly answer this question based solely on data

		-"do we have a reason to treat women with AHI of 5 (comorbidities) or do we wait until AHI >15" "are we comfortable withholding treatment from a large majority of people diagnosed with OSA" considering AHI > 5 plus any comorbidities would be important in deciding on treatment - this would be helpful in influencing pregnancy outcomes even in "mild" OSA there is a dose response in terms of complications with regards to OSA severity - even very mild OSA is associated with complications treatment for even mild OSA may decrease severity of maternal/fetal/neonatal complications data we have shows that those even with mild OSA show some complications, panel feels that this supports use of treatment even in this population OSA severity can worsen throughout pregnancy - anyone experiencing symptoms has decreased quality of life, so offering treatment is reasonable AHI can go up throughout pregnancy, so following up throughout the pregnancy is important - treatment to prevent progression should be considered - repeated testing throughout pregnancy - even less than 5, repeat testing should

		be considered trimester of diagnosis makes a large difference in terms of benefit seen from treatment - impact of improving the symptoms regardless of complication rates may be significant - may not have the data in this population to support this

Undesirable Effects

How substantial are the undesirable anticipated effects?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
○ Trivial ○ Small ● Moderate ○ Large ○ Varies ○ Don't know	----	treating early is important to potentially prevent undesirable outcomes - waiting to treat at AHI > 15 could lead to more undesirable outcomes many symptoms of OSA could also be categorized as pregnancy symptoms - can be difficult to figure out which is causing these undesirable anticipated effects could be moderate-large (depends on specific case) - but it risks missing cases that could progress to a more severe spectrum throughout pregnancy long term, not treating AHI 5-15 could discourage treatment even beyond pregnancy (if it persists) - women are most likely to accept treatment during pregnancy (due to presence of the baby and outcomes for baby) so beginning treatment during pregnancy could lead to prolonged treatment after pregnancy

Certainty of evidence

What is the overall certainty of the evidence of effects?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
● Very low ○ Low ○ Moderate ○ High ○ No included studies	*See Appendix 2*	No comments.

Values

Is there important uncertainty about or variability in how much people value the main outcomes?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
○ Important uncertainty or variability ○ Possibly important uncertainty or variability ● Probably no important uncertainty or variability ○ No important uncertainty or variability	No studies identified.	The panel feels that patients would value the outcomes as important regardless of AHI thinking of OB providers as an audience, unlikely that there would be pushback for starting treatment at AHI 5 rather than 15 - unlikely for patients to pushback at treatment for mild OSA rather than moderate-severe some patients (based on risk of developing complications based on dose-response to OSA severity), if they perceive themselves to be at lower risk, they may feel that they can "get away with" not undergoing treatment

		acceptability of CPAP treatment may vary from patient to patient based on perceived severity of OSA patients tend to accept treatment if they perceive themselves to meet a more severe cutoff- also depends on how they are counseled - depends how they are followed and who counsels and screens them education also makes a difference - more educated patients who have researched the potential complications may be more likely to accept treatment - also depends on other lifestyle factors (number of children, etc.)

Balance of effects

Does the balance between desirable and undesirable effects favor the intervention or the comparison?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
○ Favors the comparison ● Probably favors the comparison ○ Does not favor either the intervention or the comparison ○ Probably favors the intervention ○ Favors the intervention ○ Varies ○ Don't know	*See Appendix 1* No undesirable effects identified.	**Intervention - AHI > 15** **Comparison - AHI 5 -15** The panel expects minimal side effects from treatment, even mild OSA is associated with negative health outcomes - the evidence here is not necessarily robust, however number of events in the mild group is still pretty significant (comparable with the moderate-severe group) so for this reason, the panel favors the comparison

Resources required How large are the resource requirements (costs)?"		
JUDGEMENT	**RESEARCH EVIDENCE**	**ADDITIONAL CONSIDERATIONS**
○ Large costs ○ Moderate costs ○ Negligible costs and savings ○ Moderate savings ○ Large savings ● Varies ○ Don't know	No studies identified.	if we decide we are only treating AHI > 15 even if we know that people in the mild range will likely progress, this would mean repeat tests throughout the pregnancy to monitor progression Some panelists feel there are moderate costs, due to treatment may be saving on repeat tests throughout pregnancy sleep studies may be cost prohibitive for some CPAP can also be cost prohibitive cannot prove there are any savings

Certainty of evidence of required resources

What is the certainty of the evidence of resource requirements (costs)?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
○ Very low ○ Low ○ Moderate ○ High ● No included studies	No studies identified.	No comments.

Cost effectiveness

Does the cost-effectiveness of the intervention favor the intervention or the comparison?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
○ Favors the comparison ○ Probably favors the comparison ○ Does not favor either the intervention or the comparison ○ Probably favors the intervention ○ Favors the intervention ○ Varies ● No included studies	No studies identified. *See Appendix 1*	**Comparison - mild OSA** **Intervention - mod-severe OSA** The panel states that there are no included studies, because it is very complex to compare the two groups (and no control group of no OSA) - see that there are less complications with comparison group than with intervention - how much of a cost saving would that be? - we don't really have data to equate complications to dollar amounts

		we know that mild OSA often progresses to mod-severe during pregnancy, so there is inherently overlap in these groups - considering trimester could be important - there won't be a lot of cost savings if treatment occurs at week 35 (as much as cost savings if treatment occurs at week 20)

Equity

What would be the impact on health equity?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
○ Reduced ○ Probably reduced ○ Probably no impact ● Probably increased ○ Increased ○ Varies ○ Don't know	No studies identified.	if we consider OSA affecting outcomes that significantly impact maternal morbidity and mortality, and we suggest not treating all women with OSA, this could negatively impact those women which are more likely to develop maternal complications Some members of the panel suggest that treating mild OSA can drive policy changes and ideally improve equity because of this treating women who are more likely at risk for OSA during pregnancy (more preexisting factors) could increase health equity

Acceptability

Is the intervention acceptable to key stakeholders?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
○ No ○ Probably no ● Probably yes ○ Yes ○ Varies ○ Don't know	No studies identified.	No comments. (see comments under “values” section)

Feasibility

Is the intervention feasible to implement?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
○ No ○ Probably no ● Probably yes ○ Yes ○ Varies ○ Don't know	No studies identified.	Probably yes, assuming no more shortages of equipment and coverage no difference in challenges of starting a pregnant patient on CPAP, whether you start at AHI 5 or AHI 15 - however, insurance may not cover CPAP at AHI 5, so that's worth considering there could be a challenging wait period for a pregnant patient for CPAP machine - need to intervene in challenging ways - challenges from a systems perspective and from an individual patient perspective (unique to pregnancy) probably feasible, with caveat that insurance companies must cooperate

APPENDICES

Appendix 1

Outcomes	With treatment based on an AHI 5-15 with symptoms/sequelae or comorbidity (HTN, stroke, obesity, etc.)	With treatment based solely on an AHI > 15	Difference	Relative effect (95% CI)
Quality of life - not reported	0 per 1,000	**0 per 1,000** (0 to 0)	**0 fewer per 1,000** (0 fewer to 0 fewer)	-
Motor vehicle accidents - not reported	0 per 1,000	**0 per 1,000** (0 to 0)	**0 fewer per 1,000** (0 fewer to 0 fewer)	-
Maternal complications assessed with: rate of cesarean delivery	590 per 1,000	**736 per 1,000** (472 to 898)	**146 more per 1,000** (118 fewer to 307 more)	**OR 1.94** (0.62 to 6.09)
Fetal/neonatal complications assessed with: pre-term birth	158 per 1,000	**191 per 1,000** (57 to 487)	**33 more per 1,000** (101 fewer to 329 more)	**OR 1.26** (0.32 to 5.07)
Fetal/neonatal complications assessed with: fetal growth restriction	98 per 1,000	**105 per 1,000** (21 to 390)	**7 more per 1,000** (77 fewer to 291 more)	**OR 1.08** (0.20 to 5.85)
Maternal complications assessed with: rate of HTN	195 per 1,000	**266 per 1,000** (159 to 412)	**71 more per 1,000** (36 fewer to 217 more)	**OR 1.50** (0.78 to 2.89)
Maternal complications assessed with: rate of GDM	123 per 1,000	**149 per 1,000** (69 to 292)	**26 more per 1,000** (54 fewer to 169 more)	**OR 1.25** (0.53 to 2.94)

Appendix 2

Outcomes	Importance	Certainty of the evidence (GRADE)
Quality of life - not reported	CRITICAL	-
Motor vehicle accidents - not reported	CRITICAL	-
Maternal complications assessed with: rate of cesarean delivery	CRITICAL	⨁⨁◯◯ Low[a]
Fetal/neonatal complications assessed with: pre-term birth	CRITICAL	⨁◯◯◯ Very low[b,c]
Fetal/neonatal complications assessed with: fetal growth restriction	CRITICAL	⨁⨁◯◯ Low[a]
Maternal complications assessed with: rate of HTN	CRITICAL	⨁◯◯◯ Very low[d]
Maternal complications assessed with: rate of GDM	CRITICAL	⨁⨁◯◯ Low

a. A single study was used here, making inconsistency irrelevant.
b. Dominguez 2018 defines preterm birth as < 37 weeks, while Facco 2012 defines preterm birth as < 34 weeks - this could explain some of the inconsistent effects between the two studies.
c. The two studies included for analysis of this outcome report different effects altogether.

Facco 2012 does not report this outcome directly, rather reports an adverse pregnancy outcome composite, which includes this outcome as one of its measures

e-Table 16

QUESTION 6

Should any form of PAP treatment vs. no treatment be used for pregnant persons diagnosed with OSA during pregnancy?

ASSESSMENT

Problem Is the problem a priority?		
JUDGEMENT	**RESEARCH EVIDENCE**	**ADDITIONAL CONSIDERATIONS**
○ No ○ Probably no ○ Probably yes ● Yes ○ Varies ○ Don't know	CHEST approved this topic and indicated its status as high priority.	No comments.
Desirable Effects How substantial are the desirable anticipated effects?		
JUDGEMENT	**RESEARCH EVIDENCE**	**ADDITIONAL CONSIDERATIONS**
○ Trivial ○ Small ○ Moderate ● Large ○ Varies ○ Don't know	*See Appendix 1*	effects are large, this is a special population (mother and child) which is uniquely affected by any change in magnitude of symptoms a small improvement is significant - based on current data, would call this moderate (ideally large, but not sufficient data to support this) data are not great, but any improvement is very important in this population

Undesirable Effects

How substantial are the undesirable anticipated effects?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
○ Trivial ● Small ○ Moderate ○ Large ○ Varies ○ Don't know	No undesirable effects identified.	CPAP may cause skin irritation with the mask, may cause belching, bloating, cumbersome nature of machine/face mask claustrophobia/anxiety can be an issue

Certainty of evidence

What is the overall certainty of the evidence of effects?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
● Very low ○ Low ○ Moderate ○ High ○ No included studies	*See Appendix 2*	No comments.

Values

Is there important uncertainty about or variability in how much people value the main outcomes?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
○ Important uncertainty or variability ○ Possibly important uncertainty or variability	**Adherence to Continuous Positive Airway Pressure Therapy:** https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2645251/	Panelists note that they mostly run into patients who take these outcomes very seriously, medically

● Probably no important uncertainty or variability ○ No important uncertainty or variability	"No single factor has been consistently identified as predictive of adherence. Patient perception of symptoms and improvement in sleepiness and daily functioning may be more important in determining patterns of use than physiologic aspects of disease severity. Emerging data suggest that various behavioral interventions may be effective in improving CPAP adherence." **Willingness score obtained after a short CPAP trial predicts CPAP use at 1 year:** https://pubmed.ncbi.nlm.nih.gov/23812639/ "Of the 580 patients we followed, 377 continued CPAP therapy beyond 1 year. A low willingness score (<50) was expressed by 77 patients but only 7 of them used CPAP >4 h daily at 1 year, yielding a specificity of 97 % in predicting CPAP failure. At 1 year, patients with a self-efficacy score >20, expressed prior to CPAP initiation, used CPAP more often than the patients with a score <20 (average use 4.4 ± 2.2 h vs. 3.7 ± 2.3 h, p<0.001)." **CPAP therapy: outcomes and patient use:** https://thorax.bmj.com/content/53/suppl_3/S47 "The most common problem rated as severe was nasal stuffiness followed by the sensation of cold air, noise, and mask pressure. CPAP noise and nocturnal awakenings due to CPAP therapy correlated negatively with CPAP use and with benefits from CPAP therapy, indicating that these were the problems that the patients blamed for lack of CPAP use. Care must be taken, however, in interpreting these data as it could be that other factors were waking the patients making them aware of the noise. The noise of the CPAP machine and wakenings throughout the night were negatively correlated with apnoea/hypopnoea frequency, indicating that patients in whom the condition was milder found these to be a bigger problem."	literate and educated, want to do everything they can to have a healthy baby different in different patient populations - they value the outcome probably similarly not as simple as "reducing BP" as this results in improving outcomes for the baby as well

Balance of effects

Does the balance between desirable and undesirable effects favor the intervention or the comparison?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
○ Favors the comparison ○ Probably favors the comparison ○ Does not favor either the intervention or the comparison ○ Probably favors the intervention ● Favors the intervention ○ Varies ○ Don't know	*See Appendix 1*	No comments.

Resources required

How large are the resource requirements (costs)?"

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
○ Large costs ○ Moderate costs ○ Negligible costs and savings ○ Moderate savings ○ Large savings ● Varies ○ Don't know	**How Much Do CPAP Machines Cost?:** https://www.sleepfoundation.org/cpap/how-much-do-cpap-machines-cost "A CPAP machine's cost can range anywhere from $500 to $1,000 or more, with prices generally rising for **CPAP machines** with more advanced features. Bilevel positive airway pressure (BiPAP) machines are more complex and tend to cost more as a result. Most BiPAP machines cost $1,700 to $3,000, but some can run significantly higher. These prices do not include the cost of accessories. Your CPAP machine cost will also vary based on whether or not you have **insurance**, and if you do, what type of coverage you have. Some medical insurance policies cover the majority of the machine's cost, while others cover only a fraction."	The panel notes that the following should be considered: cost of visits, cost of maintaining patient care, not just initiating care - transportation - parking - lost wages - copayments - child care during appointment(s)

Certainty of evidence of required resources

What is the certainty of the evidence of resource requirements (costs)?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
○ Very low ○ Low ○ Moderate ● High ○ No included studies	Plethora of studies available discussing required resources for PAP therapy.	No comments.

Cost effectiveness

Does the cost-effectiveness of the intervention favor the intervention or the comparison?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
○ Favors the comparison ○ Probably favors the comparison ○ Does not favor either the intervention or the comparison ○ Probably favors the intervention ● Favors the intervention ○ Varies ○ No included studies	**Cost-effectiveness of continuous positive airway pressure therapy for obstructive sleep apnea: health care system and societal perspectives:** https://pubmed.ncbi.nlm.nih.gov/31403163/ "From the health care system perspective, estimated cost of CPAP therapy to treat OSA was $12 495 per DALY averted while from a societal perspective the effect was dominant (-$10 688 per DALY (disability-adjusted life years) averted) meaning it costs more not to treat the problem than to treat it." **CPAP for OSA is cost effective:** https://thorax.bmj.com/content/61/11/999 "At an individual level, CPAP was found to be more effective but more costly than no CPAP with an incremental cost	No comments.

	effectiveness ratio (ICER) of $3354 per quality adjusted life year gained (QALY). When the economic benefit to society of the reduction in road traffic accidents was taken into account, the cost/QALY was reduced by 10-fold."	

Equity

What would be the impact on health equity?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
○ Reduced ○ Probably reduced ○ Probably no impact ● Probably increased ○ Increased ○ Varies ○ Don't know	**Neighborhoods with Greater Prevalence of Minority Residents Have Lower Continuous Positive Airway Pressure Adherence:** https://www.atsjournals.org/doi/10.1164/rccm.202009-3685OC "Among 787,236 patients living in 26,180 ZIP code tabulation areas, the prevalence of CPAP adherence was 1.3% (95% confidence interval [CI], 1.0–1.6%) lower in neighborhoods with high (⩾25%) versus low (<1%) percentages of Black residents and 1.2% (95% CI, 0.9–1.5%) lower in neighborhoods with high versus low percentages of Hispanic residents ($P < 0.001$ for both), even after adjusting for neighborhood differences in poverty and education. Mean CPAP usage was similar across neighborhoods for the first 2 days, but by 90 days, differences in CPAP usage increased to 22 minutes (95% CI, 18–27 min) between neighborhoods with high versus low percentages of Black residents and 22 minutes (95% CI 17–27 min) between neighborhoods with high versus low percentages of Hispanic residents ($P < 0.001$ for both)."	See detailed judgements and comments for Q7.

Acceptability Is the intervention acceptable to key stakeholders?		
JUDGEMENT	**RESEARCH EVIDENCE**	**ADDITIONAL CONSIDERATIONS**
○ No ○ Probably no ● Probably yes ○ Yes ○ Varies ○ Don't know	**Adherence to Continuous Positive Airway Pressure Therapy:** https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2645251/ "No single factor has been consistently identified as predictive of adherence. Patient perception of symptoms and improvement in sleepiness and daily functioning may be more important in determining patterns of use than physiologic aspects of disease severity. Emerging data suggest that various behavioral interventions may be effective in improving CPAP adherence." **Willingness score obtained after a short CPAP trial predicts CPAP use at 1 year:** https://pubmed.ncbi.nlm.nih.gov/23812639/ "Of the 580 patients we followed, 377 continued CPAP therapy beyond 1 year. A low willingness score (<50) was expressed by 77 patients but only 7 of them used CPAP >4 h daily at 1 year, yielding a specificity of 97 % in predicting CPAP failure. At 1 year, patients with a self-efficacy score >20, expressed prior to CPAP initiation, used CPAP more often than the patients with a score <20 (average use 4.4 ± 2.2 h vs. 3.7 ± 2.3 h, p<0.001)." **CPAP therapy: outcomes and patient use:** https://thorax.bmj.com/content/53/suppl_3/S47 "The most common problem rated as severe was nasal stuffiness followed by the sensation of cold air, noise, and mask pressure. CPAP noise and nocturnal awakenings due to CPAP therapy correlated negatively with CPAP use and with benefits from CPAP therapy, indicating that these were the problems that the patients blamed for lack of CPAP use. Care must be taken, however, in interpreting these data as it could be that other factors were waking the patients making them aware of	See comments for Q7.

	the noise. The noise of the CPAP machine and awakenings throughout the night were negatively correlated with apnea/hypopnea frequency, indicating that patients in whom the condition was milder found these to be a bigger problem."	

Feasibility

Is the intervention feasible to implement?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
○ No ○ Probably no ○ Probably yes ○ Yes ● Varies ○ Don't know	No studies identified.	Patients require encouragement and attention to improve adherence to treatment with PAP

APPENDICES

Appendix 1

Outcomes	With no treatment	With any form of PAP treatment	Difference	Relative effect (95% CI)
Maternal complications assessed with: rate of preeclampsia	202 per 1,000	**190 per 1,000** (34 to 1,000)	**12 fewer per 1,000** (168 fewer to 842 more)	**RR 0.94** (0.17 to 5.16)
Maternal complications assessed with: rate of HTN	**Rice 2022 (obs)** reports 6 cases of HTN out of a total of 23 participants receiving PAP therapy (26%) vs 28 cases of HTN out of a total of 77 participants receiving no treatment (36%). **Tantrakul 2023 (RCT)** reports 21 cases of HTN out of a total of 153 participants receiving PAP therapy (14%) vs 39 cases of HTN out of a total of 157 participants receiving no treatment (25%).			
Maternal complications assessed with: rate of cesarean delivery	**Chirakalwasan 2018 (RCT)** reports 3 *unplanned* cesarean deliveries out of a total of 18 participants receiving PAP therapy (17%) vs 7 unplanned cesarean deliveries out of a total of 17 participants receiving no treatment (41%). **Rice 2022 (obs)** reports 12 cesarean deliveries (*not* subdivided into planned/unplanned) out of a total of 23 participants receiving PAP therapy (52%) vs 50 cesarean deliveries out of a total of 77 participants receiving no treatment (65%).			
Fetal/neonatal complications assessed with: impaired fetal growth, fetal growth restriction, small for gestational age	**Chirakalwasan 2018 (RCT)** reports 1 case of SGA out of a total of 18 participants receiving PAP therapy (6%) vs 2 cases of SGA out of a total of 16 participants receiving no treatment (13%). **Kneitel 2018 (obs)** reports 4 cases of impaired fetal growth (either birthweight <10th centile OR a fall in growth centile > 33%) out of a total of 14 participants receiving PAP therapy (29%) vs 19 cases of impaired fetal growth out of a total of 31 participants receiving no treatment (61%). **Rice 2022 (obs)** reports 1 case of fetal growth restriction (< 10th percentile) out of a total of 23 participants receiving PAP therapy (4%) vs 6 cases of fetal growth restriction out of a total of 77 participants receiving no treatment (8%).			
Fetal/neonatal complications assessed with: large for gestational age	**Chirakalwasan 2018 (RCT)** reports 1 case of LGA out of a total of 18 participants receiving PAP therapy (6%) vs 2 cases of LGA out of a total of 16 participants receiving no treatment (13%). **Rice 2022 (obs)** reports 6 cases of LGA out of a total of 23 participants receiving PAP therapy (26%) vs 16 cases of LGA out of a total of 77 participants receiving no treatment (21%).			
Fetal/neonatal complications assessed with: NICU admission	375 per 1,000	**389 per 1,000** (139 to 718)	**14 more per 1,000** (236 fewer to 343 more)	**OR 1.06** (0.27 to 4.24)
Quality of life - not reported	0 per 1,000	**0 per 1,000** (0 to 0)	**0 fewer per 1,000** (0 fewer to 0 fewer)	-
Sleepiness score - not reported	0 per 1,000	**0 per 1,000** (0 to 0)	**0 fewer per 1,000** (0 fewer to 0 fewer)	-
Mood disorders - not reported	0 per 1,000	**0 per 1,000** (0 to 0)	**0 fewer per 1,000** (0 fewer to 0 fewer)	-

Outcomes	With no treatment	With any form of PAP treatment	Difference	Relative effect (95% CI)
Resolution of HTN and GDM post-partum - not reported	0 per 1,000	**0 per 1,000** (0 to 0)	**0 fewer per 1,000** (0 fewer to 0 fewer)	-
Hospitalizations - not reported	0 per 1,000	**0 per 1,000** (0 to 0)	**0 fewer per 1,000** (0 fewer to 0 fewer)	-

Appendix 2

Outcomes	Importance	Certainty of the evidence (GRADE)
Maternal complications assessed with: rate of preeclampsia	CRITICAL	⨁⨁⨁◯ Moderate[a,b]
Maternal complications assessed with: rate of HTN	CRITICAL	⨁⨁◯◯ Low
Maternal complications assessed with: rate of cesarean delivery	CRITICAL	⨁⨁◯◯ Low[a]
Fetal/neonatal complications assessed with: impaired fetal growth, fetal growth restriction, small for gestational age	CRITICAL	⨁⨁◯◯ Low[a]
Fetal/neonatal complications assessed with: large for gestational age	CRITICAL	⨁◯◯◯ Very low[a,c]
Fetal/neonatal complications assessed with: NICU admission	CRITICAL	⨁⨁⨁◯ Moderate[a,d,e]
Quality of life - not reported	CRITICAL	-
Sleepiness score - not reported	IMPORTANT	-
Mood disorders - not reported	CRITICAL	-
Resolution of HTN and GDM post-partum - not reported	CRITICAL	-
Hospitalizations - not reported	CRITICAL	-

a. Chirakalwasan 2018 shows some concerns of bias due to concerns regarding performance bias and detection bias.
b. Chirakalwasan 2018 reports a very large confidence interval, which crosses the null value.
c. The two studies included for analysis of this outcome report different effects altogether.
d. A single study was used here, making inconsistency irrelevant.
e. The sample size is very small here, indicating the potential for serious imprecision.

e-Table 17

QUESTION 7

Should alternatives to PAP therapy (MAD, myofunctional therapy, etc.) vs. PAP therapy be used for pregnant persons diagnosed with OSA during pregnancy?

ASSESSMENT

Problem Is the problem a priority?		
JUDGEMENT	**RESEARCH EVIDENCE**	**ADDITIONAL CONSIDERATIONS**
○ No ○ Probably no ○ Probably yes ● Yes ○ Varies ○ Don't know	CHEST approved this topic and indicated its status as high priority.	adherence to CPAP may not be great - good to examine alternatives
Desirable Effects How substantial are the desirable anticipated effects?		
JUDGEMENT	**RESEARCH EVIDENCE**	**ADDITIONAL CONSIDERATIONS**
○ Trivial ○ Small ○ Moderate ○ Large ● Varies ○ Don't know	*See Appendix 1* Alternatives to PAP = refused CPAP - positional therapy with a positional device (tennis ball technique) - avoid sedatives/alcohol - advised about BMI	not many studies directly comparing MAD and PAP therapy not surprising to see these results, positional therapy is not usually very effective and is often a "last ditch effort"

	Current data in above table - from Stajic study	must be clear that the women who did not use CPAP were not necessarily suffering from positional CPAP Stajic "conservative" group was not necessarily just positional therapy, they were offered multiple alternatives "alternative to PAP" was not a clear designation - "some alternative" cannot say which one - CPAP compared to alternative or nothing is beneficial The panel wishes to be clear that they are not recommending "one alternative" over nothing - just that CPAP offers some benefit over an alternative OR nothing personalized, shared decision making will be key here draw on CPAP studies not during pregnancy - first line treatment - important to consider timing during pregnancy - MAD may take up to 6 months to see benefit, whereas CPAP may be shorter **should consider that MAD devices may not all be indicated during pregnancy according to their labels (solely due to lack of study during pregnancy - lawsuits) - theoretical risk of dislocation** if patient has MAD (and is well controlled) and continues it during pregnancy, they would need to

		be closely monitored due to the above reasons (wouldn't necessarily start someone on it for a first line therapy) if someone is on MAD prior to pregnancy, it may be necessary to monitor closely in case of worsening OSA symptoms (repeat sleep studies, etc) CPAP is usually the simplest way for pregnant persons to start treatment for OSA

Undesirable Effects

How substantial are the undesirable anticipated effects?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
○ Trivial ● Small ○ Moderate ○ Large ○ Varies ○ Don't know	No data regarding undesirable effects were found.	although no data found in this literature search, women would need to be monitored - especially during use of alternatives to CPAP Patients would need to be monitored for undesirable effects such as heartburn, jaw pain, will vary from person to person undesirable effects also included worsening OSA symptoms and untreated OSA symptoms (cannot adjust MAD during pregnancy like you can using CPAP) Relaxin levels increased during pregnancy could cause dislocation of jaw (theoretical risk)

		bleeding may increase using MAD during pregnancy any symptom that could be attributed to use of therapy should be included as "undesirable effects" - patients' symptoms vary heavily monitoring should be performed by - most likely OB, but dentists may field questions about MAD though - patients should be seen by sleep doctor (if they have one), dentist second (will look for issues with the jaw, but may not monitor for OSA symptoms)

Certainty of evidence

What is the overall certainty of the evidence of effects?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
● Very low ○ Low ○ Moderate ○ High ○ No included studies	*See Appendix 2*	No comments.

Values

Is there important uncertainty about or variability in how much people value the main outcomes?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
● Important uncertainty or variability O Possibly important uncertainty or variability O Probably no important uncertainty or variability O No important uncertainty or variability	**Adherence to Continuous Positive Airway Pressure Therapy:** https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2645251/ "No single factor has been consistently identified as predictive of adherence. Patient perception of symptoms and improvement in sleepiness and daily functioning may be more important in determining patterns of use than physiologic aspects of disease severity. Emerging data suggest that various behavioral interventions may be effective in improving CPAP adherence." **Willingness score obtained after a short CPAP trial predicts CPAP use at 1 year:** https://pubmed.ncbi.nlm.nih.gov/23812639/ "Of the 580 patients we followed, 377 continued CPAP therapy beyond 1 year. A low willingness score (<50) was expressed by 77 patients but only 7 of them used CPAP >4 h daily at 1 year, yielding a specificity of 97 % in predicting CPAP failure. At 1 year, patients with a self-efficacy score >20, expressed prior to CPAP initiation, used CPAP more often than the patients with a score <20 (average use 4.4 ± 2.2 h vs. 3.7 ± 2.3 h, p<0.001)." **CPAP therapy: outcomes and patient use:** https://thorax.bmj.com/content/53/suppl_3/S47 "The most common problem rated as severe was nasal stuffiness followed by the sensation of cold air, noise, and mask pressure. CPAP noise and nocturnal awakenings due to CPAP therapy correlated negatively with CPAP use and with benefits	pregnant women value treatment due to concern for baby's health - this is an important driver for adherence - things may become less consistent postpartum due to the loss of this "motivator" Patients values are likely impacted by comorbidities, severity of OSA, and prior pregnancy Some panelists have found opting for treatment is very variable dependent on knowledge of disease, possibility of treatment improving outcomes of pregnancy predictors of treatment success: severity of illness and follow-ups Values also vary based on how a patient is diagnosed - if a patient is diagnosed because they were participating in a study vs in passing with their OB - these people may have different motivations to start CPAP - depends on what the person counselling them is saying ("you must be on CPAP because this disease is severe" or "treatment may or may not affect pregnancy outcomes") Some panelists state that they do have experience with study participants with severe OSA not seeking treatment

	from CPAP therapy, indicating that these were the problems that the patients blamed for lack of CPAP use. Care must be taken, however, in interpreting these data as it could be that other factors were waking the patients making them aware of the noise. The noise of the CPAP machine and awakenings throughout the night were negatively correlated with apnea/hypopnea frequency, indicating that patients in whom the condition was milder found these to be a bigger problem."	

Balance of effects

Does the balance between desirable and undesirable effects favor the intervention or the comparison?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
○ Favors the comparison ● Probably favors the comparison ○ Does not favor either the intervention or the comparison ○ Probably favors the intervention ○ Favors the intervention ○ Varies ○ Don't know	*See Appendix 1* No undesirable effects were found.	caveat - data is poor here, basing some of this on expert opinion

Resources required How large are the resource requirements (costs)?"		
JUDGEMENT	**RESEARCH EVIDENCE**	**ADDITIONAL CONSIDERATIONS**
○ Large costs ○ Moderate costs ○ Negligible costs and savings ○ Moderate savings ○ Large savings ● Varies ○ Don't know	**How Much Do CPAP Machines Cost?:** https://www.sleepfoundation.org/cpap/how-much-do-cpap-machines-cost "A CPAP machine's cost can range anywhere from $500 to $1,000 or more, with prices generally rising for **CPAP machines** with more advanced features. Bilevel positive airway pressure (BiPAP) machines are more complex and tend to cost more as a result. Most BiPAP machines cost $1,700 to $3,000, but some can run significantly higher. These prices do not include the cost of accessories. Your CPAP machine cost will also vary based on whether or not you have **insurance**, and if you do, what type of coverage you have. Some medical insurance policies cover the majority of the machine's cost, while others cover only a fraction." **Which Costs More: CPAP or Oral Appliance Therapy?:** https://sleepreviewmag.com/sleep-treatments/therapy-devices/oral-appliances/costs-cpap-oral-appliance-therapy/ "Based on the Medicare fee schedule of the devices alone, CPAP would look much less expensive than OAT, with an average reimbursement of $42.46 for the CPAP machine versus an average reimbursement of $1,429 for OAT, according to this analysis. Factor in the replacement schedule, and the difference remains dramatic, favoring CPAP as far less expensive. The CPAP machine replacement schedule is 1,095 days, which, divided by the average reimbursement amounts to a daily cost of $0.04.	coverage by insurance varies widely (especially based on definition of OSA of insurance company) - AHI required varies from insurance to insurance (or REI) The panel feels they may need to revisit this and talk more about this - this guideline could impact insurance coverage, so want to phrase this in a way that would help encourage insurance coverage about 50% of births in the US are covered by Medicaid - important to discuss costs carefully in guideline

	With a replacement schedule of 1,825 days, OAT has a daily cost of $0.78, the analysis finds. But reimbursement for OAT is a singular structure, and inclusive of the device as well as professional services associated with administering, adjusting, and monitoring treatment over five years, the analysis notes. By comparison, the reimbursement structure for CPAP consists of a series of distinct codes for components that are itemized separately from the machine. Some of these components may cost more than the machine itself. The mask, for example, has a 90-day replacement schedule and an average reimbursement of $89.67, for a daily cost of $1.00. And the mask cushion has a replacement schedule of 30 days and an average reimbursement of $34.48, for an average daily cost of $1.15. Average daily costs for these components, as well as the mask nasal pillows, tubing, headgear, and disposable filters bring the daily cost of CPAP to $2.99, more than triple the daily cost for OAT." "Another drawback of this analysis is Medicare reimbursement rates may not reflect what costs would look like with private payors. In addition, an analysis based on average reimbursement rates nationwide doesn't reflect what can be quite stark regional differences in costs."	

Certainty of evidence of required resources

What is the certainty of the evidence of resource requirements (costs)?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
○ Very low ○ Low ○ Moderate ● High ○ No included studies	Plethora of studies available discussing required resources for both CPAP and alternative treatments for OSA.	No comments.

Cost effectiveness

Does the cost-effectiveness of the intervention favor the intervention or the comparison?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
○ Favors the comparison ○ Probably favors the comparison ○ Does not favor either the intervention or the comparison ○ Probably favors the intervention ○ Favors the intervention ● Varies ○ No included studies	**Cost-effectiveness of continuous positive airway pressure therapy for obstructive sleep apnea: health care system and societal perspectives:** https://pubmed.ncbi.nlm.nih.gov/31403163/ "From the health care system perspective, estimated cost of CPAP therapy to treat OSA was $12 495 per DALY averted while from a societal perspective the effect was dominant (-$10 688 per DALY (disability-adjusted life years) averted) meaning it costs more not to treat the problem than to treat it." **CPAP for OSA is cost effective:** https://thorax.bmj.com/content/61/11/999	using CPAP can save money, even if used 1 hour a night The panel would like to note that these data are regarding nonpregnant persons - indirectness difficult to compare the two - CPAP and associated supplies are generally well covered by insurance. MAD may not be as well covered (partially), heavily dependent on insurance company oral device may require adjustment, multiple visits to dentist, could be expensive long term

	"At an individual level, CPAP was found to be more effective but more costly than no CPAP with an incremental cost effectiveness ratio (ICER) of $3354 per quality adjusted life year gained (QALY). When the economic benefit to society of the reduction in road traffic accidents was taken into account, the cost/QALY was reduced by 10-fold." **Clinical- and Cost-Effectiveness of a Mandibular Advancement Device Versus Continuous Positive Airway Pressure in Moderate Obstructive Sleep Apnea:** https://pubmed.ncbi.nlm.nih.gov/31596213/ "In the 85 randomized patients (n = 42 CPAP, n = 43 MAD), AHI reduction was significantly greater with CPAP (median reduction AHI 18.3 [14.8-22.6] events/h) than with MAD therapy (median reduction AHI 13.5 [8.5-18.4] events/h) after 12 months. Societal costs after 12 months were higher for MAD than for CPAP (mean difference €2.156). MAD was less cost-effective than CPAP after 12 months (ICER -€305 [-€3.003 to €1.572] per AHI point improvement). However, in terms of quality-adjusted life-years (QALY), MAD performed better than CPAP after 12 months (€33.701 [-€191.106 to €562.271] per QALY gained)."	some dentists don't take insurance, some insurance companies may cover the device but no repeat visits pure numbers (cost) of CPAP may be more, but in terms of insurance coverage, CPAP is covered more and easier to procure - more likely that CPAP would be cost effective - not great data to support all of this though

Equity

What would be the impact on health equity?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
○ Reduced ○ Probably reduced ○ Probably no impact ● Probably increased	**Neighborhoods with Greater Prevalence of Minority Residents Have Lower Continuous Positive Airway Pressure Adherence:** https://www.atsjournals.org/doi/10.1164/rccm.202009-3685OC	increased access to CPAP may decrease existing health disparities

○ Increased ○ Varies ○ Don't know	"Among 787,236 patients living in 26,180 ZIP code tabulation areas, the prevalence of CPAP adherence was 1.3% (95% confidence interval [CI], 1.0–1.6%) lower in neighborhoods with high (⩾25%) versus low (<1%) percentages of Black residents and 1.2% (95% CI, 0.9–1.5%) lower in neighborhoods with high versus low percentages of Hispanic residents (*P* < 0.001 for both), even after adjusting for neighborhood differences in poverty and education. Mean CPAP usage was similar across neighborhoods for the first 2 days, but by 90 days, differences in CPAP usage increased to 22 minutes (95% CI, 18–27 min) between neighborhoods with high versus low percentages of Black residents and 22 minutes (95% CI 17–27 min) between neighborhoods with high versus low percentages of Hispanic residents (*P* < 0.001 for both)."	this is a very complex situation - many social determinants of health involved in this - having CPAP available to everyone would theoretically increase equity, but so many variables that truly affect health equity other determinants of health equity include ability to see a provider, a complex situation copayments, tubing, and mask procurement affects access to treatment - all things being equal, increased access to CPAP would increase health equity, but so many different variables involved such as access to visits, copayments, ability to see a dentist, etc. common for patients to not have the time to seek treatment (regardless of cost being covered) not all centers have dentists that would be able to provide these devices patients may need to travel to get to a dentist to provide a MAD pregnant women need to have highly customized MAD

Acceptability Is the intervention acceptable to key stakeholders?		
JUDGEMENT	**RESEARCH EVIDENCE**	**ADDITIONAL CONSIDERATIONS**
○ No ○ Probably no ● Probably yes ○ Yes ○ Varies ○ Don't know	**Adherence to Continuous Positive Airway Pressure Therapy:** https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2645251/ "No single factor has been consistently identified as predictive of adherence. Patient perception of symptoms and improvement in sleepiness and daily functioning may be more important in determining patterns of use than physiologic aspects of disease severity. Emerging data suggest that various behavioral interventions may be effective in improving CPAP adherence." **Willingness score obtained after a short CPAP trial predicts CPAP use at 1 year:** https://pubmed.ncbi.nlm.nih.gov/23812639/ "Of the 580 patients we followed, 377 continued CPAP therapy beyond 1 year. A low willingness score (<50) was expressed by 77 patients but only 7 of them used CPAP >4 h daily at 1 year, yielding a specificity of 97 % in predicting CPAP failure. At 1 year, patients with a self-efficacy score >20, expressed prior to CPAP initiation, used CPAP more often than the patients with a score <20 (average use 4.4 ± 2.2 h vs. 3.7 ± 2.3 h, p<0.001)." **CPAP therapy: outcomes and patient use:** https://thorax.bmj.com/content/53/suppl_3/S47 "The most common problem rated as severe was nasal stuffiness followed by the sensation of cold air, noise, and mask pressure. CPAP noise and nocturnal awakenings due to CPAP therapy correlated negatively with CPAP use and with benefits from CPAP therapy, indicating that these were the problems that the patients blamed for lack of CPAP use. Care must be taken, however, in interpreting these data as it could be that other factors were waking the patients making them aware of	CPAP can be more cumbersome, but to get the MAD, it can be more difficult - once the MAD is adjusted, it can be "easier" to use - reasonable acceptability, just not ideal depends what stage of pregnancy/ symptoms of pregnancy the patient is experiencing - if someone is on MAD already, they would want to keep it - in general population, MAD is often more acceptable, but don't know for pregnant pop add in another routine appointment to the dentist to get the MAD adjusted through pregnancy, but CPAP requires less appointments to maintain - still cumbersome to use though The panel feels that CPAP is acceptable with the appropriate education about outcomes for mother and baby - acceptability will also vary based on symptoms, severity of illness

	the noise. The noise of the CPAP machine and wakenings throughout the night were negatively correlated with apnoea/hypopnoea frequency, indicating that patients in whom the condition was milder found these to be a bigger problem." **Adherence of Mandibular Advancement Device for Obstructive Sleep Apnea in a Veteran Population:** https://www.aadsm.org/docs/jdsm.1.10.2021.o4.pdf "The MAD should be considered a valuable first-line treatment option for mild or moderate OSA in the veteran population, although maintaining adherence across time seems to be a challenge. It appears that MAD adherence may be superior to CPAP adherence in this population." **Long-Term Objective Adherence to Mandibular Advancement Device Therapy Versus Continuous Positive Airway Pressure in Patients With Moderate Obstructive Sleep Apnea:** https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6853388/ "Objective adherence with MAD and CPAP is comparable and consistent over time. Self-reported adherence is higher with MAD than with CPAP giving rise to interesting discrepancy between objective and self-reported adherence with CPAP."	

Feasibility

Is the intervention feasible to implement?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
O No O Probably no	No studies identified.	same comments as above - access to provider appointments, cumbersomeness of device, copayments, adjustments, etc.

● Probably yes ○ Yes ○ Varies ○ Don't know		clinics that have a program that can monitor patients (connects with patients periodically) will help with feasibility and adherence - feasible to implement, but need to have a support system around this group partners can play a large role in adherence - a supportive partner may increase adherence, a partner who is not supportive of PAP therapy may decrease adherence education to the patient and the partner is important as well - OB doctor is the best partner to reinforce the need for adherence to treatment

APPENDICES

Appendix 1

Outcomes	With PAP therapy	With alternatives to PAP therapy (MAD, myofunctional therapy, etc.)	Difference	Relative effect (95% CI)
Sleepiness score assessed with: Epworth Sleepiness Score	**4.2 +/- 2.3**	**9.4 +/- 4.1**	mean **5.2 higher** in the intervention group (3.79 higher to 6.61 higher)	-
Quality of life - not reported	0 per 1,000	**0 per 1,000** (0 to 0)	**0 fewer per 1,000** (0 fewer to 0 fewer)	-
Mood disorders - not reported	0 per 1,000	**0 per 1,000** (0 to 0)	**0 fewer per 1,000** (0 fewer to 0 fewer)	-
Resolution of HTN and GDM post-partum - not reported	0 per 1,000	**0 per 1,000** (0 to 0)	**0 fewer per 1,000** (0 fewer to 0 fewer)	-
Hospitalizations - not reported	0 per 1,000	**0 per 1,000** (0 to 0)	**0 fewer per 1,000** (0 fewer to 0 fewer)	-
Maternal complications assessed with: rate of HTN	260 per 1,000	**390 per 1,000** (209 to 609)	**130 more per 1,000** (51 fewer to 349 more)	**OR 1.82** (0.75 to 4.44)
Maternal complications assessed with: rate of preeclampsia	80 per 1,000	**244 per 1,000** (85 to 528)	**164 more per 1,000** (5 more to 448 more)	**OR 3.71** (1.07 to 12.89)
Maternal complications assessed with: rate of cesarean delivery	200 per 1,000	**414 per 1,000** (219 to 643)	**214 more per 1,000** (19 more to 443 more)	**OR 2.83** (1.12 to 7.19)

Appendix 2

Outcomes	Importance	Certainty of the evidence (GRADE)
Sleepiness score assessed with: Epworth Sleepiness Score	IMPORTANT	⨁◯◯◯ Very low[a,b]
Quality of life - not reported	CRITICAL	-
Mood disorders - not reported	CRITICAL	-
Resolution of HTN and GDM post-partum - not reported	CRITICAL	-
Hospitalizations - not reported	CRITICAL	-
Maternal complications assessed with: rate of HTN	CRITICAL	⨁◯◯◯ Very low[a,c]
Maternal complications assessed with: rate of preeclampsia	CRITICAL	⨁◯◯◯ Very low[a,c]
Maternal complications assessed with: rate of cesarean delivery	CRITICAL	⨁◯◯◯ Very low[a,c]

a. A single study was used here, making inconsistency irrelevant.
b. The sample size is very small here, indicating the potential for serious imprecision.
c. Large CI which also crosses the null value.

e-Table 18

QUESTION 8

Should stimulants vs. scheduled naps be used for residual sleepiness in pregnant persons currently on PAP therapy for OSA diagnosed during pregnancy ?

ASSESSMENT

Problem Is the problem a priority?		
JUDGEMENT	**RESEARCH EVIDENCE**	**ADDITIONAL CONSIDERATIONS**
○ No ○ Probably no ○ Probably yes ● Yes ○ Varies ○ Don't know	CHEST selected topic as a priority.	No comments.
Desirable Effects How substantial are the desirable anticipated effects?		
JUDGEMENT	**RESEARCH EVIDENCE**	**ADDITIONAL CONSIDERATIONS**
○ Trivial ○ Small ○ Moderate	**No studies included.**	because there is no data on stimulants efficacy in

○ Large ○ Varies ● Don't know	"I don't prescribe stimulants in my practice, so they are not medications that I use at all in pregnancy or otherwise. I don't know how effective they are vs. scheduled naps, but would imagine that they are a lot easier for patients to use given that not all work environments can accommodate scheduled naps"	pregnancy - the sleepiness could be coming from OSA **or** other symptoms related to pregnancy - small effects, because there is data **outside** of pregnancy showing that stimulants **do** work - this is indirect evidence though
	"Based on non-pregnant literature, stimulants are strongly recommended for the treatment of daytime sleepiness. For patients with narcolepsy, scheduled naps are recommended for treatment naive and individuals on treatment. However, daytime sleepiness in pregnancy is likely different from central sleepiness and related to sleep disturbances related to physical and biological factors. No data are available examining the effectiveness of stimulants in pregnant women; hence desirable effects are unclear, and it is hard to say that they would be more favorable compared to scheduled naps."	
	"Using stimulants and taking scheduled naps may have small desirable effects on residual sleepiness in pregnant individuals with OSA on PAP therapy. However, it is essential to weigh these potential benefits against the risks and limitations associated with each approach. Using stimulants: Stimulants can provide short-term improvements in alertness and wakefulness, which may help pregnant individuals with residual sleepiness function during the day. Limitations and risks: Potential adverse effects: 1) Stimulants can have adverse effects on both the mother and the developing fetus, including increased heart rate and blood pressure, restricted fetal growth, and an increased risk of preterm labor. 2) Stimulants can disrupt sleep architecture, leading to decreased sleep quality and potential worsening of sleepiness in the long term. 3) Prolonged use of stimulants can lead to tolerance and dependence, requiring higher doses to achieve the same effect. Taking scheduled naps: Scheduled naps can help improve alertness and cognitive function, providing temporary relief from residual sleepiness. Napping generally has minimal side effects compared to stimulant use. Limitations and risks: 1) **Napping may not address the underlying cause of residual sleepiness and could potentially disrupt nighttime sleep**. 2) Pregnant individuals may have difficulty finding the time to take scheduled naps due to personal or professional obligations. Instead of relying on stimulants or naps, it is better to focus on optimizing PAP therapy, assessing, screening, and treating other sleep disorders, encouraging good sleep hygiene, engaging in regular physical activity, and considering cognitive-behavioral therapy for insomnia. These strategies can provide more sustainable and safer solutions for managing residual sleepiness in pregnant individuals with OSA on PAP therapy."	the stimulants DO work – the panel stresses the need to weigh them against the potential adverse events in this specific population
	"Based on my experience, the desirable effects of using a stimulant vs taking scheduled naps are small. The reason is that residual sleepiness in pregnant persons already on PAP therapy for OSA (and with good treatment compliance) usually is not so severe to impair daily activities. Stimulants may be considered for those cases where there are other conditions leading to sleepiness (in addition to OSA) and where sleepiness can be more severe. For these more severe cases, pregnant persons should be followed by a multidisciplinary team and use of stimulants can be considered based on specific cases where risk of untreated sleepiness is higher than the risk of adverse effects of the drugs."	stimulants do work, newer ones (not amphetamines) have a better side effect profile - but this

	"I do think that from a patient's perspective being able to take a medication that would be safe during pregnancy over napping would be deemed as important for some women." "limited data on this, especially with regards to toxicity"	is indirect evidence for our patient population A pregnant person with OSA and residual sleepiness cannot necessarily get accommodations from employers for scheduled naps (like those diagnosed with narcolepsy) in the absence of collected data, we don't know - probably need to rely on clinical experience The panel stresses the importance of each provider having a frank discussion with each patient about benefit/risk ratio

		- patients who truly need medications even before pregnancy may want to stay on them due to the likelihood of symptoms worsening For some, stimulants could be very effective, but for some it may not be

Undesirable Effects

How substantial are the undesirable anticipated effects?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
○ Trivial ○ Small ○ Moderate ○ Large ● Varies ○ Don't know	**No studies included in analysis.** "I don't think we have enough data to understand the impact of stimulants on the fetal developing brain - but we know they cross the placenta. As in most pregnancy drug decisions - this will be an individual physician-patient decision based on risk benefit. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9185785/#:~:text=Generally%2C%20all%20drugs%20used%20for,by%20 " "I'd say moderate to large. In real patient data, stimulants such as modafinil were associated with side effects in a significant proportion of patients (including cardiovascular and mental health side effects). From a pregnancy and lactation safety standpoint: 1- Modafinil and armodafinil: Teratogenicity may be species specific. European Health	The panel recognizes two categories of adverse events in this situation - general adverse events and adverse events specific to pregnant persons

	Ministry and health Canada advised against its use based on some reports of major malformations with the drug. Though some of the data was not compared to a control group, and some of the "malformations" were not real malformations, and no adjusting for underlying morbidities, there is still concern about the drug's safety in pregnancy and its use needs to outweigh potential harm. In lactation, case reports show no clinical adverse effects. However, drug peaks between 2 and 4 hours post dose, but peak breastmilk and infant circulating levels are likely underestimated because S-modafinil was not measured and only racemic (R-modafinil) was. 2- Solriamfetol: Increased risk of "alterations" rather than malformations by the FDA. No human studies. Mean elimination half-life in breast milk is 5 hours; 78% is eliminated by 8 hours. Minimal clinical data available 3- Methylphenidate: demonstrated in animal fetal brain after IP dosing. Impulsivity and reward seeking behavior at 3 months after exposure in animals. In human studies, (quite a few larger datasets), some larger studies did not demonstrate an increase in risk of major malformations. However, in metanalysis in 2023 of female patients exposed in 1st trimester, there was a significant increase in total cardiac abnormalities. Other pregnancy effects studied: no increased risk of autism, ADHD, or growth delay. Increased risk of NICU admission. Lactation: levels very low in breast milk and not detectable in infant blood. lactation not a reason to stop 4- amphetamine: Neurodevelopmental issues in exposed pups, decreased fetal growth in animals. teratogenicity in animals as well. in humans, 3 major malformations identified but risk not higher than non-exposed. Other data combined methylphenidate and amphetamine exposure and inability to say which is responsible for an increased risk. Mostly with methamphetamine (rather than prescription) there was an increased risk of preeclampsia, preterm birth and infant / neonatal death. Amphetamines are associated with increased risk for hypertensive disorders of pregnancy. Neonatal complications include jitteriness, withdrawal symptoms. Lactation: excreted in breast milk and found in infant urine. AAP and ACOG recommended against lactation if mothers using amphetamines. 5- Pitolisant: decreased embryofetal viability in animal studies. No human studies. Lactation: higher milk than plasma (by 1-3-fold)." "The potential undesirable effects of using stimulants and taking scheduled naps for residual sleepiness in pregnant individuals with OSA on PAP therapy can range from trivial to large, depending on various factors. Here's a general assessment of the potential undesirable effects: Using stimulants: Potential adverse effects: Varying to large. The severity of adverse effects on both the mother and the developing fetus can depend on factors such as the type of stimulant, dosage, frequency of use, and individual sensitivity. Disrupted sleep architecture: Small to moderate. The extent of sleep disruption can vary between individuals and may depend on factors such as the timing and frequency of stimulant use. Tolerance and dependence: Small to moderate. The development of tolerance and dependence can vary between individuals and may depend on factors such as the duration of stimulant use, dosage, and individual susceptibility. Taking scheduled naps: Not a definitive solution: Small to moderate. The extent to which napping fails to address the underlying cause of residual sleepiness can vary between individuals and may depend on factors such as nap duration, timing, and frequency. Time constraints: Small to moderate. The difficulty in finding time for scheduled naps can vary between individuals and may depend on factors such as personal and professional obligations, as well as individual preferences."	we don't have a lot of data that have reported on this - a lot of what we have are animal studies for the newer drugs - amphetamines are tricky because multiple drugs have been combined in larger datasets animal data is not truly applicable, not reliable - data from 80 years ago also seems unreliable The panel wants to recognize that often, in animal studies, researchers only use max human dose - though often 10-20x the recommended dose, so truly not comparable

	"In my experience, pregnant women with OSA (in absence of other conditions such as narcolepsy) who are already on PAP therapy (with good compliance) experience minimal/moderate residual sleepiness that can be treated with non-pharmacological interventions (scheduled naps). Compared to scheduled naps, stimulants may increase the risk for adverse fetal outcomes. Use of stimulants in pregnancy should be reserved to those persons who have severe residual sleepiness impairing daily life activities. Those cases should be followed by a multidisciplinary team and patients should receive close antenatal fetal surveillance and neonatal follow-up. Pregnant persons who do not have severe residual sleepiness may not accept use of stimulants during the antenatal period." "Ensuring that stimulants are safe in pregnancy if used for sleepiness would be a very important factor for women to consider when choosing between a pill and a nap." "some may have unknown effects on the fetus as there is limited data"	it's reasonable to mention this data because the use of these drugs will change from patient to patient, risk/benefit will change depending on each patient's circumstances - need to state the data as it is because it needs to be an individual decision

Certainty of evidence

What is the overall certainty of the evidence of effects?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
○ Very low ○ Low ○ Moderate ○ High ● No included studies	**No included studies.**	No comments.

Values Is there important uncertainty about or variability in how much people value the main outcomes?		
JUDGEMENT	**RESEARCH EVIDENCE**	**ADDITIONAL CONSIDERATIONS**
● Important uncertainty or variability ○ Possibly important uncertainty or variability ○ Probably no important uncertainty or variability ○ No important uncertainty or variability	**No studies identified.** "These variables will have to be weighed individually for each pt. and will vary greatly" "Sleep clinicians would be uncomfortable deciding on safety of stimulants in pregnancy (not sure if I'm interpreting this correctly" "The value placed on outcomes such as quality of life, fetal safety of stimulants, sleep quality, mood disorders, maternal complications, and fetal/neonatal complications can vary significantly between individuals. This variability can be influenced by many factors. These are: Personal preferences: Individuals may have different priorities and preferences regarding the outcomes they consider most important. For example, some pregnant individuals may prioritize fetal safety above their own quality of life or sleep quality, while others may place equal importance on both. Cultural and societal factors: Cultural and societal beliefs and values can influence how individuals perceive and prioritize various outcomes. For example, in some cultures, maternal well-being may be emphasized more than fetal safety, while in others, the opposite may be true. Medical history and risk factors: Individuals with a history of medical complications or specific risk factors may place a higher value on certain outcomes. For example, a pregnant individual with a history of depression may prioritize mood disorders more than someone without such a history. Healthcare provider perspectives: Healthcare providers may have different opinions on the relative importance of various outcomes, which can influence the information and recommendations they provide to their patients. Knowledge and awareness: The level of knowledge and awareness about OSA in pregnancy and its potential consequences can affect how individuals value different outcomes. Greater awareness and understanding of the potential risks and complications may lead to a higher prioritization of certain outcomes." "Yes, very likely there are important uncertainty and variability in how people value the main outcomes. The reasons are multiple: there are limited data on stimulants in pregnancy, not all the OB/GYN and MFM providers receive adequate training on medication safety in pregnancy (especially in case of stimulants), sleep disorders are still underdiagnosed in pregnancy and not all pregnant persons with a diagnosis with OSA receive appropriate care in pregnancy, unless they are followed in a tertiary center."	Panelists feel it is important for patients to have a good quality of life without compromising the health of their babies - maybe here we make the recommendation that employers should give pregnant persons with OSA with residual daytime sleepiness the opportunity to take scheduled naps, in light of the possible negative health outcomes associated with stimulants should include a discussion of the applicability of this

	"I might not be fully appreciating this question but I do not think there is uncertainty or variability in how patients value these outcomes."	recommendation in multiple cultures

Balance of effects

Does the balance between desirable and undesirable effects favor the intervention or the comparison?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
○ Favors the comparison ○ Probably favors the comparison ○ Does not favor either the intervention or the comparison ○ Probably favors the intervention ○ Favors the intervention ● Varies ○ Don't know	**No studies included.**	**Intervention - stimulants** **Comparison - scheduled naps** The panel stresses the importance of individual decision making between patient and care-team - some patients may value the health of the baby over the health of the mother, important to discuss the specific values and symptoms of the patient

Resources required How large are the resource requirements (costs)?"		
JUDGEMENT	**RESEARCH EVIDENCE**	**ADDITIONAL CONSIDERATIONS**

○ Large costs ○ Moderate costs ○ Negligible costs and savings ○ Moderate savings ○ Large savings ● Varies ○ Don't know	"cost of treatment moderate. Need to also consider cost of taking time out of work to take scheduled naps in the alternative option"	moderate cost - on the low end $150/mo. - is a lot
	"The resource requirements (costs) for residual sleepiness in pregnant persons currently on PAP therapy for OSA diagnosed during pregnancy can vary depending on the chosen treatment approach. Based on the information provided from the study by Carlton et al. (2014), the costs for pharmacological treatments such as armodafinil and modafinil can be as follows: Armodafinil: The mean monthly drug-specific pharmacy cost was $166. This can be considered a moderate cost, as it is not negligible but is also not excessively high compared to other medications or treatments. Modafinil: The mean monthly drug-specific pharmacy cost was $326. This can be considered a large cost, as it is significantly higher than the cost of armodafinil and may be a substantial financial burden for some individuals. It is important to note that these costs are based on a single study and may not be representative of all cases. The actual costs can vary depending on factors such as insurance coverage, location, and the specific pharmacy. Non-pharmacological treatments, such as scheduled naps, cognitive-behavioral therapy for insomnia CBT-I, or lifestyle modifications, may have negligible costs or even result in moderate savings. For example, taking scheduled naps or making lifestyle changes typically does not involve any direct financial expenses, while CBT may be covered by insurance or have lower costs compared to long-term pharmacological treatments. Thus, the resource requirements (costs) for residual sleepiness in pregnant persons currently on PAP therapy for OSA diagnosed during pregnancy can range from negligible costs or moderate savings to large costs, depending on the chosen treatment approach."	This would be a larger burden for those without insurance comparing to scheduled naps, there could still be a cost there (taking time out of work, cost to employer, or cost to individual) scheduled naps could cost very different things for different people working in different environments
	"Treatment of excessive sleepiness, especially severe, is associated with moderate healthcare costs, given that the required therapy is usually chronic (daily use of stimulants and need of other interventions). Moreover, patients with severe sleepiness may require numerous clinical and emergency departments visits. In addition, severe sleepiness affects work productivity and may negatively affect patients income."	Many panelists don't feel comfortable making any

	"This range of as high as $300 per month for a medication might be prohibitive for patients if not covered by insurance for this indication."	assumptions regarding financial burden of these medications - these are so tied to very person-specific factors It can be difficult to tell how scheduled naps could affect people in different environments with different employers (maybe fired? lost insurance? possible stigmatization, affected interpersonal relationships?)
Certainty of evidence of required resources What is the certainty of the evidence of resource requirements (costs)?		
JUDGEMENT	**RESEARCH EVIDENCE**	**ADDITIONAL CONSIDERATIONS**

○ Very low ○ Low ○ Moderate ○ High ● No included studies	No comments.	No comments.

Cost effectiveness

Does the cost-effectiveness of the intervention favor the intervention or the comparison?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
○ Favors the comparison ○ Probably favors the comparison ○ Does not favor either the intervention or the comparison ○ Probably favors the intervention ○ Favors the	**No studies identified.** "But there is also loss of productivity on the other side - so I can't make a judgement on this without data" "Individuals who are able to take time and have the ability to take a nap during work hours do much better. The cost will fall on individuals from low SES with low paying jobs (and possibly minoritized individuals) who are unable to afford the luxury of a nap during work hours" "In my judgment, the cost-effectiveness of stimulants versus scheduled naps for residual sleepiness in pregnant individuals with OSA likely varies, as it depends on various factors such as individual preferences, treatment efficacy, and potential adverse effects. However, considering the information provided about the costs of armodafinil and modafinil, as well as the negligible costs associated with scheduled naps, it is plausible that scheduled naps may be more cost-effective in some cases. Here's a breakdown of the possible cost-effectiveness scenarios: Favors scheduled naps: In cases where scheduled naps are effective in reducing residual sleepiness and do not cause significant disruptions to the individual's daily life, they may be more cost-effective than using stimulants, given the moderate to large costs associated with these medications. Probably favors scheduled naps: In situations where the efficacy of scheduled naps is somewhat	very much varies - some women may or may not be able to take naps - does napping actually help? - can the patient take stimulants or no? - do stimulants or napping actually resolve symptoms? if there is a risk to the baby, more patients

intervention ○ Varies ● No included studies	uncertain or varies between individuals, but the costs are still significantly lower than those of stimulants, scheduled naps may still be a more cost-effective option for some pregnant individuals with OSA. Does not favor either the use of stimulants or scheduled naps: In cases where both scheduled naps and stimulants have limited efficacy or are associated with significant adverse effects, neither option may be considered cost-effective. Probably favors the use of stimulants: In situations where the efficacy of stimulants is high and the adverse effects are minimal, they may be considered cost-effective in some cases, despite the moderate to large costs associated with these medications. This may be particularly true for individuals who cannot effectively incorporate scheduled naps into their daily lives. Favors the use of stimulants: In cases where stimulants are highly effective, have minimal adverse effects, and the individual cannot effectively use scheduled naps, the use of stimulants may be considered cost-effective, even with the moderate to large costs associated with these medications" "In my experience, residual sleepiness in pregnant persons with OSA on PAP therapy can be effectively treated with scheduled naps, which is also an intervention less expensive than use of stimulants. In addition the cost of stimulants in pregnancy is also increased by the cost of the close fetal surveillance (such as level II prenatal ultrasound, assessed by a specialist or tertiary center...) that may be required in some cases." "Naps are clearly free but at the cost of loss of potential productive time for the individual patient when they could be addressing other life tasks. There is no dollar amount that could be placed on time in my opinion." "naps on their own do not cost anything but if that means the patient loses their employment, the cost is high"	may be utilizing health resources

Equity

What would be the impact on health equity?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
○ Reduced ○ Probably reduced ○ Probably no impact ○ Probably increased	**No studies identified.** "Cost vs. potentially an intervention that makes it more feasible for women to work and do ADLs without assistance." "if stimulants are covered by insurances at no cost, then stimulants would improve health equity."	may reduce equity because some women may not be able to access this treatment - though this is probably true of

○ Increased ● Varies ○ Don't know	"The impact on health equity if recommending the use of stimulants for residual sleepiness in pregnant individuals with OSA would vary, as it depends on factors such as access to healthcare, insurance coverage, and individual financial circumstances. It is essential to consider these factors when making treatment recommendations to ensure that all individuals have an equal opportunity to access effective care." "Use of stimulants in pregnancy is associated with higher costs compared to scheduled naps. In addition, lower socioeconomic conditions are risk factors for OSA in pregnancy. Therefore, the healthcare cost of stimulants may decrease therapy compliance, especially among those pregnant persons with lower socioeconomic status." "I think because of the cost of stimulants, there would be patient populations who would not be able to afford or access this class of medications." "people at the lower socioeconomic end would possibly be able to function better at work when pregnancy and thus not lose employment"	a lot of treatments here if drug costs were very, very low, then it would probably either increase equity or make no difference, but since this is high cost, it probably reduces equity scheduled naps may in fact decrease equity as well (specifically in people lower SES) it could potentially help certain patients keep their job to use stimulants and remain productivity **this could increase health equity in some cases and**

		reduce it in others
Acceptability Is the intervention acceptable to key stakeholders?		
JUDGEMENT	**RESEARCH EVIDENCE**	**ADDITIONAL CONSIDERATIONS**
○ No ○ Probably no ○ Probably yes ○ Yes ● Varies ○ Don't know	"If compelling benefit to pt. vs. theoretical risk of harm to fetal developing brain" "I say varies because depends on insurance coverage (or lack of)" "The acceptability of using stimulants for residual sleepiness in pregnant individuals with OSA varies, as it depends on various factors and the perspectives of different key stakeholders. It is essential to consider these factors and engage in shared decision-making with patients and their healthcare providers to ensure that treatment choices align with individual preferences, values, and clinical needs." "Given that certain stimulants are associated with increased risk for adverse fetal outcomes and considering that the data available are overall limited, the acceptability of stimulants varies."	for patient, acceptability could vary - for healthcare providers based on specialty - someone who does sleep may accept differently than someone who does OBGYN full time
Feasibility Is the intervention feasible to implement?		
JUDGEMENT	**RESEARCH EVIDENCE**	**ADDITIONAL CONSIDERATIONS**
○ No ○ Probably no ● Probably yes ○ Yes	"Should not be difficult - already used" "It will depend on severity of daytime sleepiness, how much it interferes with daytime functioning, and how willing a pregnant individual is to take the medication and the risk associated with it. Formal counseling about risk and benefit is required."	The panel feels stimulants are feasible to use assuming people can get the medication

○ Varies ○ Don't know	"The feasibility of implementing the use of stimulants may vary depending on factors such as the specific clinical setting, available resources, and the individual needs and preferences of patients." "The feasibility of use of stimulants in pregnancy varies. Overall there are limited data on the use of these medications in pregnancy. OB/GYN and MFM specialists should receive appropriate training on the use of these medications. Use of stimulants in pregnancy should be evaluated by a multidisciplinary team (OB/GYN, MFM, neurologist...). The reason is that stimulants are not usually prescribed by general OB/GYN and even among MFM specialists, only a minority has experience on the use of these medications in pregnancy." "I do think there will be hurdles that will be encountered. I think prescribing physicians might be hesitant in prescribing pregnant women with a controlled substance. I do also still think that there will be patient populations like my safety net population in which the cost of these medications might prohibit their ability to access this therapy." "depends on situation and the concerns of providers"	scheduled naps are not always easy for people in the workplace OB/GYN providers may need to be trained to comfortably prescribe stimulants to these patients, so a referral may also need to happen - should also be evaluated by a multidisciplinary team - this may reduce feasibility Referrals certainly reduce feasibility - referrals can take a long time may vary based on where you are located, how easy is it to

		access a specialized care team this population is already diagnosed with OSA - this likely means they already have a provider - they are already on CPAP - now they have a sleep specialist need to include comments about costs during this discussion - there will be a proportion of patients who are in fact plugged into this healthcare system/team, but cannot afford the medication

e-Table 19

QUESTION 9

Should reassessment for SDB vs. no reassessment be used for post-partum persons previously diagnosed with OSA during pregnancy?

ASSESSMENT

Problem Is the problem a priority?		
JUDGEMENT	**RESEARCH EVIDENCE**	**ADDITIONAL CONSIDERATIONS**
○ No ○ Probably no ○ Probably yes ● Yes ○ Varies ○ Don't know	CHEST determined topic to be a priority during selection of guideline proposals.	If pregnancy is a risk factor - we need to investigate what happens once pregnancy is over - treatment and risk assessment
Desirable Effects How substantial are the desirable anticipated effects?		
JUDGEMENT	**RESEARCH EVIDENCE**	**ADDITIONAL CONSIDERATIONS**
○ Trivial ○ Small ● Moderate ○ Large ○ Varies ○ Don't know	*See Appendix 1*	not surprising to see that those with pre-existing "more severe" OSA had less OSA resolution PP if someone has OSA before pregnancy, in pregnancy, they will most likely have it PP (no need to repeat) - reason to repeat would be

		for those who are not "chronic" (didn't have it pre-pregnancy) BMI plays a role in wanting to reassess most likely to resolve in those who have been able to lose weight, which may or may not happen PP – the panel agrees they would check PP for HTN and GDM based on clinical experience If there is evidence to suggest that it does not completely resolve PP, the panel agrees they would most likely want to reassess PP because of this The panel feels that because of the ties OSA has to CVD, the potential positive health impacts could be moderate (from receiving reassessment PP) The panel points out that from an anesthesiology perspective, there are patients who ignore their OSA during pregnancy in hopes that it will resolve PP (or in general, it may be overwhelming to deal with OSA treatment as well as other pregnancy related medical visits) - could imagine that reassessing with these same

		women PP could actually be more helpful long-term because it has not resolved (notes that this is from personal experience) - some people don't even know if they're symptomatic during pregnancy, so PP could be a good time to follow-up on these patients based on severity of OSA during pregnancy, outcomes could vary PP PP period could lead to varying changes in the body that may alter OSA symptoms

Undesirable Effects

How substantial are the undesirable anticipated effects?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
● Trivial ○ Small ○ Moderate ○ Large ○ Varies ○ Don't know	No reported undesirable effects.	No comments.

Certainty of evidence

What is the overall certainty of the evidence of effects?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
● Very low ○ Low ○ Moderate ○ High ○ No included studies	*See Appendix 2*	No comments.

Values

Is there important uncertainty about or variability in how much people value the main outcomes?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
○ Important uncertainty or variability ● Possibly important uncertainty or variability ○ Probably no important uncertainty or variability ○ No important uncertainty or variability	No studies identified.	The panel feels there is some uncertainty - qualitative data regarding how women think about OSA in pregnancy and CPAP treatment - uncertainty and variability may exist around the PP period because pregnancy outcomes are no longer as relevant - some women use CPAP for the sake of the baby, but once baby is born, CPAP isn't used as frequently - some patients note that OSA is low on the list of priorities during pregnancy, may move up the list during the PP period - uncertainty on the patients side certainly

		Some panelists find that patients tend to defer thinking about the OSA during pregnancy and immediately PP - tend to start thinking more about it years down the road once longer-term health outcomes begin to appear (CVD, etc.)

Balance of effects

Does the balance between desirable and undesirable effects favor the intervention or the comparison?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
○ Favors the comparison ○ Probably favors the comparison ○ Does not favor either the intervention or the comparison ○ Probably favors the intervention ● Favors the intervention ○ Varies ○ Don't know	*See Appendix 1* No reported undesirable effects.	No comments.

Resources required How large are the resource requirements (costs)?"		
JUDGEMENT	**RESEARCH EVIDENCE**	**ADDITIONAL CONSIDERATIONS**
○ Large costs ○ Moderate costs ○ Negligible costs and savings ○ Moderate savings ○ Large savings ● Varies ○ Don't know	https://www.sleepfoundation.org/sleep-studies/how-much-does-a-sleep-study-cost#:~:text=The%20average%20price%20of%20an,an%20in%2Dlab%20sleep%20study. The Sleep Foundation found that the average cost of an in-lab sleep study is $3,000, ranging from $1,000 to over $10,000 depending on type of insurance, insurance coverage, and location within the US. They note that most major insurance providers do cover the majority of the cost of an in-lab sleep study. The Sleep Foundation found that the cost of an at-home sleep study can range from $500 to over $1,000. They note that the cost can depend not only on type of insurance/insurance coverage, but also on the type of equipment used during the at-home sleep study.	PP patients most likely would not be able to get insurance to cover and in-lab PSG, would most likely need to get an at-home first - cost varies heavily based on insurance - could be savings over the years if we are considering negative health outcomes down the line if insurance is obtained during pregnancy, it lasts 6wks PP and then they lose it - for this reason, they may not be covered to have much done PP (if not in that first 6 wks.) - depends heavily on state varies heavily based on income, insurance, location, state varies by country! "for patients insured in the US, starting with in-home SS is acceptable, then move to in-lab PSG if necessary" -low cost for this specific population

		people without insurance in the US, this could have moderate to large cost

Certainty of evidence of required resources

What is the certainty of the evidence of resource requirements (costs)?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
○ Very low ○ Low ● Moderate ○ High ○ No included studies	-----	No comments.

Cost effectiveness

Does the cost-effectiveness of the intervention favor the intervention or the comparison?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
○ Favors the comparison ○ Probably favors the comparison ○ Does not favor either the intervention or the comparison ○ Probably favors the intervention ● Favors the intervention ○ Varies ○ No included studies	https://pubmed.ncbi.nlm.nih.gov/17557487/ Identified studies suggest that various types of sleep studies have different levels of cost effectiveness, potentially with a split-night sleep study being the most cost effective.	if providers don't do the reassessment, then they don't know if they have OSA - use of CPAP has been shown to decrease healthcare costs if you can reduce healthcare complications in this relatively younger population, that's a lot of savings down the line The panel feels that, based on years of clinical experience (and published data), favors the intervention

Equity

What would be the impact on health equity?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
○ Reduced ○ Probably reduced ○ Probably no impact ○ Probably increased ● Increased ○ Varies ○ Don't know	No studies identified.	this very much depends on the country - developing country where there is little access to sleep labs it's very different than Canada where healthcare is universal, and that is different than USA varies within USA by area and SES - could potentially increase equity

		those in safety-net hospitals couldn't afford the out-of-pocket expense for a PP sleep-study transportation could be a major barrier to the sleep study recommending a PP sleep test could improve equity if it is adopted into policy/insurance coverage patients who do not get adequate PP care also will not receive adequate PP sleep care certain technological advances can make home sleep-tests more accessible and thus increase health equity Assuming all women who do need a reassessment for OSA PP do in fact get one, this would increase health equity PP period is a very under studied period and thus has a higher mortality and morbidity rate, so this is very worth discussing at length in the manuscript

Acceptability Is the intervention acceptable to key stakeholders?		
JUDGEMENT	**RESEARCH EVIDENCE**	**ADDITIONAL CONSIDERATIONS**
○ No ○ Probably no ● Probably yes ○ Yes ○ Varies ○ Don't know	No studies identified.	there are so many things to consider during and also after pregnancy, that may decrease the ability of women to come back for reassessment Mostly acceptable to key stakeholders
Feasibility Is the intervention feasible to implement?		
JUDGEMENT	**RESEARCH EVIDENCE**	**ADDITIONAL CONSIDERATIONS**
○ No ○ Probably no ○ Probably yes ○ Yes ● Varies ○ Don't know	No studies identified.	most people can most likely get a home sleep test, not everyone - many hurdles to get the sleep test - insurance, ability to pay for the test, ability to pay for the treatment if they do still have OSA varies, especially in a global context because PP entails a transition between doctors (OB to PCP), follow up on OSA during pregnancy may be lost not everyone has access to PCPs - may have a community health center instead, this decreases flow of info to

		the new provider - assuming women even do attend a PCP PP

APPENDICES

Appendix 1

Outcomes	With no reassessment	With reassessment for SDB	Difference	Relative effect (95% CI)
Availability of clinical predictors for PP resolution of OSA - not reported	0 per 1,000	**0 per 1,000** (0 to 0)	**0 fewer per 1,000** (0 fewer to 0 fewer)	-
Mood disorders - not reported	0 per 1,000	**0 per 1,000** (0 to 0)	**0 fewer per 1,000** (0 fewer to 0 fewer)	-
Presence of persistent OSA symptoms assessed with: ESS score	**Huynh 2022** reports "presence of persistent OSA symptoms" via ESS score at baseline (during pregnancy, trimester 2 or 3) and postpartum (3-6mo) ● Baseline = 10.1 (5.3) n = 17 ● PP = 7.7 (4) n = 17			
Quality of life assessed with: functional outcome sleep questionnaire	**Huynh 2022** reports QoL via FOSQ at baseline (during pregnancy, trimester 2 or 3) and postpartum (3-6mo) ● Baseline = 10.9 (2.8) n = 17 ● PP = 7.5 (3.6) n = 17			
Resolution of maternal complications PP - not reported	0 per 1,000	**0 per 1,000** (0 to 0)	**0 fewer per 1,000** (0 fewer to 0 fewer)	-
Motor vehicle accidents - not reported	0 per 1,000	**0 per 1,000** (0 to 0)	**0 fewer per 1,000** (0 fewer to 0 fewer)	-
Severity of OSA - during pregnancy assessed with: REI	**Street 2018** reports severity of OSA in women whose OSA remained at the 6-8mo PP sleep study and in women whose OSA had resolved by the 6-8mo PP sleep study ● OSA remained REI during pregnancy = 20.5 (3.3) n = 16 ● OSA resolved REI during pregnancy = 7.7 (3.4) n = 8			
Severity of OSA - postpartum assessed with: REI	**Street 2018** reports severity of OSA in women whose OSA remained at the 6-8mo PP sleep study and in women whose OSA had resolved by the 6-8mo PP sleep study ● OSA remained PP REI = 12.6 (7.2) n = 16 ● OSA resolved PP REI = 2.0 (1.3) n = 8			

Appendix 2

Outcomes	Importance	Certainty of the evidence (GRADE)
Availability of clinical predictors for PP resolution of OSA - not reported	CRITICAL	-
Mood disorders - not reported	CRITICAL	-
Presence of persistent OSA symptoms assessed with: ESS score	CRITICAL	⨁◯◯◯ Very low[a,b,c]
Quality of life assessed with: functional outcome sleep questionnaire	CRITICAL	⨁◯◯◯ Very low[a,c,d]
Resolution of maternal complications PP - not reported	CRITICAL	-
Motor vehicle accidents - not reported	CRITICAL	-
Severity of OSA - during pregnancy assessed with: REI	CRITICAL	⨁◯◯◯ Very low[a,c,e,f]
Severity of OSA - postpartum assessed with: REI	CRITICAL	⨁◯◯◯ Very low[a,c,e,f]

a. A single study was used here, making inconsistency irrelevant.
b. The effect of reassessment of OSA symptoms PP was not directly studied here. However, the presence of persistent OSA symptoms PP (via ESS) was directly measured.
c. The sample size is very small here, indicating the potential for serious imprecision.
d. The effect of reassessment of OSA symptoms PP was not directly studied here. However, quality of life PP (via FOSQ) was directly measured.
e. Street 2018 shows some concerns of risk of bias due to potential confounding.

The effect of reassessment of OSA symptoms PP was not directly studied here. However, severity of OSA PP (via REI) was di

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