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Impact of Obstructive Sleep Apnoea and Experiences of Using Positive Airway Pressure

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Abstract

The aim of this thesis was to explore the impact of the common sleep-related breathing disorder, obstructive sleep apnoea (OSA); specifically for people with a bipolar disorder (BD) diagnosis but also the wider experience of the first-line treatment for OSA, positive airway pressure (PAP).

Chapter 1 is a systematic literature review and thematic synthesis of experiences using PAP to treat OSA. Twenty-five papers were reviewed and included in the thematic synthesis. The quality of each paper was appraised and considered in relation to contribution to the resultant analytical themes. The metasynthesis gave voice to user experiences of PAP and revealed barriers to PAP use at a healthcare service level. The findings highlight the need for a biopsychosocial approach and long-term person-centred support to enhance PAP use.

Chapter 2 is a primary empirical research paper on an investigation as to whether people with suspected-OSA and a BD diagnosis experience more sleep and affect instability when “inter-episode” compared to people with a BD diagnosis alone. Ecological momentary assessment was utilised. Eighteen participants (twelve with suspected-OSA) wore an actigraph for two weeks whilst completing an affect questionnaire twice daily. Measures of instability were calculated using the mean squared successive difference and probability of acute change indices. The groups were not found to significantly differ other than reduced sleep efficiency in the suspected-OSA group. However, only 48% of the intended sample was successfully recruited due to the COVID-19 pandemic. Important avenues for further research are highlighted.

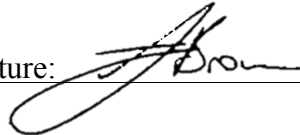
Chapter 3 is a critical appraisal of the thesis. Salient issues relevant to future research and clinical practice are discussed, in addition to the under recognised clinical issue of sleep which inspired this thesis.

Declaration

No portion of the work referred to in this thesis has been submitted in support of an application for another degree or qualification of this or any other university or other institute of learning.

Name: Amy Brown

Signature:

A handwritten signature in black ink, appearing to read 'Amy Brown', written over a horizontal line.

Date: 4th September 2020

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I would like to sincerely thank the people who generously committed their time to take part in the research study, making it possible. Your motivation to contribute despite lack of reimbursement and your passion for enhancing awareness in the area really reinforced my belief in the importance of the study. It is such a disappointment for all of us that the COVID-19 pandemic has limited the scope of the findings but I really hope the paper will inspire continued research into the relationship between OSA and a BD diagnosis.

I would also like to thank my supervisor, Dr Guillermo Perez-Algorta for his passion, ideas, sense of humour and unwavering support throughout this journey. Thank you also to Professor Steven Jones for his guidance and suggestions, to Tanya Williamson for her expert input around systematic literature searching and to Christopher Lodge and all other consultants who kindly provided their expertise to inform the research project materials.

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Chapter 1: Systematic Literature Review

**Experiences of Using Positive Airway Pressure for Treatment of Obstructive Sleep Apnoea: A
Systematic Review and Thematic Synthesis**

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Abstract

Purpose

Sub-optimal use of positive airway pressure (PAP) to treat obstructive sleep apnoea (OSA) continues to be a major challenge to effective treatment. Meanwhile, the individual and societal impacts of untreated OSA make effective treatment a priority. Although extensive research has been conducted into factors that impact PAP use, it is estimated that at least half of users do not use it as prescribed. However, the voice of users is notably minimal in the literature. A systematic review and qualitative metasynthesis of PAP user experience was conducted to contribute to understandings of how PAP is experienced and to inform how usage could be improved.

Methods

PsycINFO, MEDLINE, CINAHL and EMBASE databases were systematically searched. Primary research findings of adult experiences using PAP that had been inductively analysed were included. Inclusion papers were critically appraised using the CASP qualitative checklist to generate a “hierarchy of evidence”. Thematic synthesis was then conducted to generate analytical themes.

Results

Results are presented in accordance with Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA). 25 papers reporting on over 398 people’s experiences were analysed to generate 4 themes: Journey to PAP, Discomfort from and around PAP, Adapting to and using PAP, and Benefits from PAP. Author reflexivity and vulnerability to bias is acknowledged.

Conclusion

This metasynthesis gave voice to user experiences of PAP, revealing barriers to PAP use at a healthcare service level across the world. The findings highlight the need for a biopsychosocial approach and long-term person-centred support to enhance PAP use.

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Keywords: Obstructive sleep apnoea (OSA); positive airway pressure; experience; metasynthesis

Experiences of Using Positive Airway Pressure for Treatment of Obstructive Sleep Apnoea: A Systematic Review and Thematic Synthesis

Obstructive sleep apnoea (OSA), the most common sleep-related breathing disorder, involves the upper airway repeatedly obstructing airflow during sleep. Estimated prevalence ranges from 1-19% for females, 2-33% for males [1–4], and up to 49% for people of advanced age [4]. OSA is linked to serious physical, mental, cognitive and social difficulties [5–11] and reduced sleep and quality of life for bed partners [12]. Many cases are believed to go unrecognised [1, 13], and prevalence is increasing as obesity is a significant risk factor [4, 14]. It is considered that untreated OSA doubles healthcare expenses, largely due to increased cardiovascular risk [15]. Effective treatment is crucial to reducing the individual and societal impacts [16]. However, evidence suggests that substantial barriers to effective treatment exist which psychological understandings may help address.

Positive airway pressure (PAP or CPAP for continuous) is the first-line treatment for OSA [17–20]. Recent developments include bilevel (BiPAP), auto-adjusting and flexible PAP [21]. All involve connection to an air supply, covering at least the nostrils and sometimes mouth, to keep the airway inflated overnight. PAP can significantly reduce symptoms and improve health outcomes for people with OSA [22–24]. However, whilst prescribed usage is at least 4 hours every night, it is estimated that 46-83% of users do not achieve this [25], referred to as a lack of “adherence” and/or “compliance”. These usage rates haven’t changed since the introduction of PAP in 1981 [26], presenting a significant challenge to effective OSA treatment.

Suboptimal usage of PAP is not well understood. Much research focuses on biomedical factors and has linked usage with body mass index, OSA severity, age and blood oxygen levels [27, 28]. Meanwhile, some research has established links with psychological factors such as health value and beliefs, self-efficacy, coping strategies, low mood and perceived partner support [29–34]. Further research has also found lower PAP use to be associated with ethnic minority status, less education, lower socioeconomic status, living alone, and employment [35–40]. PAP side effects, such as mask leakage, nasal stuffiness and feeling

claustrophobic, also affect use [41–43]. No individual factor has been able to account for all the variance in PAP use [29, 44, 45], indicating the need for a biopsychosocial understanding [46].

Previous reviews have proposed a biopsychosocial approach, advocating holistic assessment and a person-centred approach to identifying and addressing risks for sub-optimum use [44, 47]. There has been a more recent focus on person-centred care [48–51] and the development of educational and supportive interventions to improve PAP use [52–55]. Despite the suggested efficacy of these interventions, few have progressed beyond research trials as further understanding is still considered necessary to determine feasible and cost-effective interventions [52, 56]. Meanwhile, there is relatively little research into psychosocial variables that may affect PAP use [44]. A review [57] concluded that user perspectives within the literature are minimised by medical research paradigms of “compliance” as the ultimate outcome measure, placing users in a non-expert position and silencing their experiences. This review reflected the dominance of quantitative methodology around experiences in the PAP literature and recommended further exploration of qualitative user experiences to determine how PAP use can be improved.

Therefore, a systematic review and metasynthesis of qualitative research detailing first-person experiences was conducted to explore what people’s reported experiences are of using PAP. To the author’s knowledge, this is the first metasynthesis of its kind. Synthesis of qualitative experiences make important contributions to healthcare innovation and policy [58]. This review aimed to increase awareness of PAP users’ experiences to help understandings of how to support PAP use.

Method

This review followed The Preferred Reporting Items for Systematic Reviews and Meta-Analyses [59] (Appendix A) and Enhancing Transparency in Reporting the Synthesis of Qualitative Research [60] (Appendix B) guidelines. The protocol was pre-registered on PROSPERO (CRD42020157767).

Metasynthesis

This metasynthesis was informed by pragmatism where the contribution of research to improving healthcare and people’s lives is prioritised over other considerations [61]. Thematic synthesis [62] was

developed to answer healthcare questions and can be used to synthesise qualitative findings generated from different methodologies and epistemologies. This inclusive methodology was befitting to the review's multidisciplinary scope.

Search

The author independently searched PsycINFO, MEDLINE, CINAHL and EMBASE databases from inception on January 16th 2020. The PEO framework [63], papers found through a scoping search, and relevant previous systematic search terms [57] informed pre-planned free-text search terms. Free-text terms and any relevant thesaurus terms for each PEO framework category were combined with Boolean operator “OR” and these groups were combined with “AND”. Table 1 depicts the full search used in MEDLINE alongside differing database-specific thesaurus terms and limits. Due to being the first review of its kind, no date limits were applied. The search strategy was developed in consultation with a subject-specific librarian.

Insert Table 1 here

Eligibility

Primary research papers reporting first-person qualitative experiences of adults (aged 18 or older) using PAP to treat OSA were included. As the first review of its kind, experiences were limited to adult users and accounts from adolescents, caregivers and partners were not included [64–66]. Included papers must have used an inductive analytic method as thematic synthesis involves further inductive analysis [62, 67]. Papers also had to be in English and published in a peer-reviewed journal. Papers were excluded if (i) other participants (e.g. partners) contributed data and these findings were not separable; (ii) participants had additional health concerns/needs that are not typical of people with OSA and (iii) discourse analysis was used such that the results focussed on the language used rather than the experiences.

Appraisal

Papers were appraised on their contribution to answering the research question using the Critical Appraisal Skills Programme [CASP] Qualitative Checklist [68] (Appendix C). Aligning with the proposed methodology for thematic synthesis [62], answers of “yes” to the CASP checklist beyond the screening items were considered “1 point”, generating a “hierarchy of evidence” and determining each paper's

“value”. Therefore, the CASP checklist was revised to omit the question, “how valuable is this research?”. The “hierarchy of evidence” was used to monitor the contribution of differently appraised papers to the review findings. The author’s appraisal of a random subset of three papers was peer-reviewed by a trainee clinical psychologist.

Data Extraction and Synthesis

Data extraction and analysis were conducted in keeping with thematic synthesis methodology [62]. All papers were entered into QSR’s NVivo 12 software. The author selected all content under “findings/results” within each paper and novel findings or interpretations presented elsewhere (e.g. discussion).

The author coded selected content inductively following Braun and Clarke’s principles of thematic analysis [69]. The “hierarchy of evidence” was consulted to ensure more poorly appraised papers did not largely inform final analytical themes. Analytical themes were generated by “going beyond” the primary findings to create novel interpretations that answered the review question [62].

Reflexivity

Prior to analysis the author noted that they had no personal experiences of PAP or close relationships with anyone who had. However, repeated readings of negative experiences during the literature search had informed an expectation to read further negative experiences. The author was mindful of this when conducting the metasynthesis [68, 70]. The process and emerging themes were discussed in supervision to minimise the influence of such expectations on the results.

Results

The search retrieved 6398 papers; 586 were duplicates. The author first reviewed titles and abstracts against inclusion/exclusion criteria, eliminating 5,714 papers, and then a further 78 through full text review (eliminated papers largely reported on entirely quantitative research or were narrative reviews; see Figure 1). Five papers were identified through “snowballing” and “reverse snowballing” [71] using the 20 inclusion papers retrieved from the systematic search.

Insert Figure 1 here

Table 2 summarises the 25 inclusion papers. Papers S1-S3 reported on one dataset, as did V1 and V2. Supplementary material available with paper E was included. Table 3 details the critical appraisal outcome. The papers reported on over 398 people's experiences from across the world, but largely from Western cultures (see Table 2). Experiences were synthesised into 2898 codes and sorted into four analytical themes: Journey to PAP, Discomfort from and around PAP, Adapting to and using PAP, and Benefits from PAP. These themes are explored with supporting direct quotations from participants. Table 4 shows the papers that contributed to each theme.

Insert Tables 2-4 here

Journey to PAP – The Context Into Which Diagnosis and PAP Must Be Assimilated

People's experiences of PAP were relative to their experiences with OSA. Journeys to learning about and acquiring PAP were often difficult and long.

Difficulties Before PAP

Prior to PAP, participants' fatigue impacted their social life, relationships, mood, and functioning. Some slept poorly and disturbed bed partners. Apnoeas could be traumatic and stressful for the whole family. Similar symptoms affected participants differently but difficulties motivated participants to seek help.

Delays to Getting Treatment

A lack of public and professional awareness caused delays. Participants received misdiagnoses and misattribution of their fatigue, "The answer I got was: 'It is because you are going to an all girl school.'" (P, p.187). General Practitioners' unawareness made sleep service referrals inaccessible and only possible through specialists. Services also felt inaccessible due to long waiting times, no transparent funding routes, and existing tiredness.

Participants were also largely unaware of OSA. Snoring was embarrassing to talk about, particularly for females, and OSA was difficult to recognise without the testimony of loved ones. Some people denied

having a problem due to the stigma of snoring and being overweight, not believing others or avoiding the consequences, “I don’t need a doctor, I don’t need to bill this to my insurance.” (I, p.53). Some participants suffered for up to 30 years and were often encouraged to seek help by others.

Experiences of Assessment and Diagnosis

Some participants found their referral and assessment satisfactory. Others were too uncomfortable on their diagnostic night to sleep much, and felt staff lacked skills and confidence, which made them question their diagnosis. The OSA diagnosis was a surprise for some and experienced as threatening, “He [the MD] really scared me.” (M, p.1240). Despite fears, taking on PAP was not a decision made lightly and sometimes partners influenced choices. Some people struggled with the trial and recommended that a better fitting mask and humidifier would increase comfort.

Discomfort From and Around PAP – Affects Relationships, Generating More Discomfort and Affecting PAP Use

The discomfort accompanying PAP affected multiple relationships, including the users’ relationship with PAP.

Relationship With PAP

PAP was described as uncomfortable. The mask was a common complaint due to poor fit and difficulties adjusting, resulting in noisy air leaks. “The first six months or so was challenging. . . (..) it was all to do with the masks” (S1, p.375). The straps, tube and pressure were also uncomfortable; some felt hot or unable to breathe. PAP was described as a foreign body unable to synchronise with the human body, “like having a Hoover on backwards and someone's shoved the hose in your mouth.” (S3, p.8). Some removed PAP during the night due to discomfort whilst others discontinued altogether.

PAP negatively impacted users’ bodies, causing dry/sore/bleeding airways, congestion, irritated eyes, aerophagia, facial sores/swelling, and back pain. Meanwhile, PAP was reported to be more uncomfortable psychologically. Fears of the machine and mask, being unable to breathe and claustrophobia were barriers. Participants also felt foolish and humiliated by PAP.

PAP was not an ideal solution, especially as participants were already struggling with OSA symptoms, “[The diagnosis] didn’t bother me all that much until I got the machine” (K, p.1725). Some desperately sought alternative solutions, “If there were anything that could be done to be free of that machine, I’d do it right now” (I, p.54). Participants were reluctant to accept a lifelong solution over a cure and expressed anger at the medical profession for not developing something better.

PAP was not always felt to be worth the discomfort and was abandoned, “It’s a no-win battle.” (I, p.54). Some hoped that PAP would reduce symptoms and improve quality of life. However, some did not experience this benefit, or not to the extent they had imagined or experienced from the trial. Others were conflicted; some were unsure of the benefit or their need for PAP and found reasons not to use it. Others struggled to accept the device, experiencing a “love hate relationship” (H, p.145), or were grateful for the benefits but not happy with PAP, despite feeling they shouldn’t complain.

Relationship With Life

The addition of PAP was “extraordinarily intrusive” (B, p.233), impacting on both users and partners. Cleaning PAP was described as “a pain in the butt” (D, p.245). The necessary daily ritual was an obstacle to every day life; participants missed being able to just “go and jump into bed” (G, p.117) and fall asleep reading. The mask was annoying to apply and reapply if the user got up in the night.

Difficulties travelling with PAP restricted freedom. Users have to consider transporting PAP safely and accessing a compatible electricity supply. Some people avoided moving PAP, reducing their independence.

Lastly, PAP is expensive. For some, the cost exceeded their average monthly salary. Participants were “burdened” (J, p.274) by the expense and lack of support from insurance and public health systems. Having to consider the cost of replacing the device if necessary further reduced financial freedom.

Relationship With Self

PAP required users to adapt their identity, often towards one they stigmatised. For some, they shifted towards feeling disabled. The lifelong support was likened to a prosthesis or assistive technology, making

OSA a visible disability. The lifelong nature also made participants feel old and unwell. Some knew older people who used PAP. The device resembled hospital equipment and wearing it at home felt like losing control as a submissive patient, “Makes you think I am sicker, in the ER or a nursing home” (U, p.7). Others struggled to identify as having OSA due to perceptions that OSA only affects overweight men. Women reported feeling less feminine due to snoring and PAP, “we’re supposed to be dainty when we sleep” (I, p.54).

PAP users felt unattractive in the bedroom, a place where some wished to feel desirable. Others “felt ashamed” (L, p.77) or “ridiculous” (F, p.247) and angry with themselves for needing PAP. Moreover, they felt guilty for unconsciously removing PAP during the night, forgetting, or struggling to use it, “I tried and tried and I just couldn’t make the grade.” (H, p.145).

Relationship With Others

Users described being embarrassed and caring what others thought, especially partners, “I have to make sure that all the lights are off, (...) It makes me very, very uncomfortable” (B, p.233). Users worried PAP made them scary or unattractive, “You don’t start a relationship with somebody because of the CPAP.” (E, supplementary material). PAP impeded intimacy and co-sleep with bed partners, deterring use, “It’s had an impact on our relationship; you’ve got a frickin’ snorkel thing across your marriage bed” (I, p.54). Some users “didn’t want anybody to see” (Q, p.323) and kept PAP secret. Others shared their PAP use but experienced stigma and ridicule, feeling they had to join in the mockery of themselves to fit in.

Relationship With Sleep

Some participants felt PAP prevented sleep from being a “refuge from the burden of life” (V2, p.232). For some this was because it is “not natural to wear something to sleep” (J, p.273) and “proper sleep” (S3, p.7) could only be achieved without the restrictions of PAP. PAP also demanded a different sleeping position and sometimes interrupted rather than improved sleep, “I spend a lot of my night doing these little adjustments” (A, p.662).

Adapting To and Using PAP – A Journey Not Destination

This theme illustrates the journey of adapting to PAP and how support is crucial.

Importance of Support and Information

Reports illustrated the importance of professional and personal support to adapting to PAP. The benefit of contact with the PAP community was similar across different opportunities. Participants felt part of an encouraging community whilst they learned from others' experiences and had their difficulties normalised. Experienced users wished to help others, "I would really like to be part of something that might prevent other people from going through what I have" (P, p.189) and did so through being a role model, promoting PAP, and encouraging self-advocacy, "Don't feel that it's your fault. Get it straightened out" (G, p.118).

Some participants found support came from people around them. Working "together as a couple" (U, p.5) to integrate PAP, absence of a negative reaction, and reassurance was described as helpful. Others described a lack of encouragement, assistance and support as being barriers to use, alongside conflicted priorities and partner scepticism, "It's not easy to counter the effect of your wife saying, '[CPAP] is not going to work for you!'" (B, p.233).

Helpful professional relationships involved trust, consideration and dependability. Participants stressed the benefits of a straightforward accessible process, ongoing support, sufficient information, and "the possibility to try the CPAP at the hospital." (E, supplementary data). This support provided relief and facilitated acceptance and integration of PAP. Information on both OSA and PAP was reported to be powerful in equipping people, "gave me a strong motivation and I think I was comfortable and well prepared to meet all possible problems." (D, p.108).

Individualised care and sufficient provision were commonly lacking. Participants struggled to use PAP without information on OSA, PAP and how to access support. Follow up support was often unavailable or inaccessible due to working hours and staff availability. Some found providers unknowledgeable, which led some to view PAP as "just another way for the medical establishment to make money." (P, 188).

“When I first went to get the machine, unfortunately it’s a salesman talking to you.... So I had to sit and listen to an hourlong sales spiel.... I’m going—okay just tell me how to use the machine.... I didn’t even get a manual. I called a few times, and they had to call you back because they are salespeople; you get lost and overlooked.” (F, 246)

Meanwhile, insurance companies were unwilling to pay for PAP creating the impression that some people “just have apnoeas and die” (H, p.143). Participants felt alone and unable to request help. Users recommended that services be personalised and provide more information, coordinated care, and a chance to try different equipment. Follow up support was deemed necessary for empowerment and assistance with inevitable difficulties, “I wanted to know how I was doing. (...) why doesn’t somebody call me and say, ‘You’re doing pretty good, lady. You’re keeping this thing on for eight hours.’” (L, p.78).

Effort Necessary to Adapt

Adapting to PAP was described as “trial and error” (S1, p.375). Trialling the benefits, creative problem solving and “learning by doing” (M, p.1240) occurred in the absence of professional support. Some users sought additional information on PAP through online research, support groups and family and friends. Users became experts in their own care by learning how to maintain, adapt and repair their machines, monitor their OSA and self-advocate, “I am battling the insurance company because they are saying I shouldn’t have one [CPAP].” (F, p.247).

PAP required compromise. The home environment was adapted; from buying a bedside table to drilling a hole in the wall so the machine could live in the next room. Users’ bodies also had to compromise: “I trained myself to sleep on my back and hold the hose with my left hand so it doesn’t move.” (G, p.118). Meanwhile, partners had to compromise alongside users, “This Hoover-head made the wrong choice buying a bed. (...) We literally wake up sore in the morning!”. (O, p.106).

Users also had to “stay with it.”(G, p.118). Perseverance was important to grow accustomed, time is required to establish PAP as routine, “Persevere for a while, and then you’ll get used to it and then you won’t ever want to be without it.” (S3, p.8).

Attitude, Belief and Context

PAP use was initially influenced by mindset but then by the journey of adaptation. Acceptance seemed key to use, mostly through accepting the compromise, “hideous, but you feel more hideous if you don’t use it.” (S1, p.375). Some accepted the compromise through “relief that we were finally going to get something done” (C, p.226). Others were desperate and willing to do and “pay for anything that would help.” (A, p.664). Some reported to “accept it [the CPAP] with love.” (V2, p.230) and encouraged others’ acceptance by telling them about PAP, “I’m not ashamed anymore, (...) I tell as many people as I can” (C, p.226).

Humour was depicted to buffer some discomfort, “My grandchildren have seen me in mine, and I’m not the slightest bit worried...I gave them very clear instructions about ‘grandpa’s elephant nose!’” (H, p.145). This buffering perhaps resembles acceptance, but it might be unhelpful for some, “he tries to make light by cracking jokes, but it doesn’t necessarily make me feel any better” (S2, p.85). Avoidance over acceptance seemed a barrier to use. Some participants felt their OSA wasn’t as bad as others’, that losing weight would be better than PAP, or were sceptical about PAP’s importance, “you just think of it as a snoring thing. You don’t think of it as, I’ve got cancer and I’m going to die” (Q, p.322).

Some believed in PAP, “I was sure that it should work, and it does.” (E, supplementary data) and others were committed regardless, “there was no way around it, it was just getting on with it” (M, p.1240). Many used PAP as protection from negative social, vocational or physical health consequences, such as losing their driver’s license. Others were not motivated for themselves but wanted to benefit others, “If you love her [the partner], use it.” (U, p.7). Positivity, confidence, and the users’ belief in their abilities also helped PAP use. Ultimately, context influenced users’ motivations and attitudes, which were susceptible to change.

PAP Use a Journey Not Destination

Participants portrayed PAP use as an evolving relationship, not an end to suffering. Most papers reported all early experiences to be difficult, regardless of outcome. PAP use was a battle not always won.

Some participants had managed to grow accustomed to PAP despite challenges, and some were still struggling. Even after the battle, PAP use was fluid not fixed; even committed users reported exceptions, “If I am going someplace special, I will just not wear it that night.” (F, p.247). Others seemed uncertain about their commitment and deciding daily felt more comfortable than lifelong commitment. Few people were fully satisfied with PAP. Users described continually evaluating their compromise and potentially changing their minds. Non-users also reported ambivalence, with some reporting big fluctuations in their usage over time.

Meanwhile, PAP experience changed over time. Small changes for the user or machine affected the relationship. Changes in PAP due to repair or replacement required a process of readjustment. Meanwhile, “so many different issues” (H, p.145) affected sleep. Changes in peer group opinion and other health conditions also impacted use. Assessment of ongoing needs was indicated; the benefits of PAP receded for some whilst others were unsure of their continued need for PAP after losing weight.

However, PAP was sold as a destination rather than a journey. Device settings were fixed and not reviewed. As bodies are not fixed entities, users tried to adjust their equipment to fluctuating needs and struggled to use devices that no longer helped. Usage was monitored but not users’ experience or mental wellbeing, “I have to send it [compliance card] to make sure you use it like a big brother; I don’t like being watched.” (F, p.247). Even the information provided portrayed a ‘one size fits all’ solution:

“there wasn’t a lot of personal stuff in there, like people that have actually used machines. So when I was on the net I was just basically looking at people’s experiences with the machines and their own journeys with it.” (Q, p.322)

Participants proved largely autonomous in their care, wished to be more involved in treatment decisions and wanted to work towards personal goals rather than optimal usage, “We [people with OSA] cannot be pigeonholed. Each of us has to be looked at as an individual.” (P. p.191).

Desired Outcomes

Some participants described PAP becoming “a ritual and a new normality, almost like brushing your teeth” (M, p.1240). This seemed a comfortable position, suggesting some users may reach a desirable destination. Some reported, “there aren’t really any difficulties with the machine. It’s really too easy.” (B, p.233). This report’s contrast to others highlights how influential context is, and perhaps how an easy PAP experience is expected, “I don’t understand anybody that doesn’t do good on it because it makes you feel so much better.” (K, p.1726).

Benefits From PAP – Engender Motivation and Positive Relationships With PAP

Most papers reported benefits that motivated use and facilitated a positive relationship with PAP.

PAP Effects on OSA

PAP relieved snoring, apnoeas and daytime sleepiness, bringing OSA “under control” (S1, p.374). Participants described a better quality of sleep that was more satisfying and refreshing for them and their partners, “Now in the mornings, it’s so much easier to get up” (L, p.77). Some hadn’t fully appreciated their symptoms before and noticed a real difference when they didn’t use PAP. Users felt more alert, “I’m safe on the road now” (Q, p.323) and energetic which helped them reduce lifestyle contributors to OSA, “I’m in the gym, losing weight” (C, p.225).

PAP Effects on Wider Life

The benefits generated a “better quality of life” (U, p.5). It was “nice to be able to go to places and not have to worry about falling asleep.” (B, p.233). Physical and psychological wellbeing improved. Participants reported feeling less irritable and anxious and more “able to relax” (T, p.169). Some felt PAP had returned them to their former selves. PAP reportedly “helps the whole house” (C, p.225) through improving sleep, mood and relationship quality. Some couples were able to sleep in the same room again.

Relationship of Improvements to PAP Use

Benefits motivated use, “you get a much better life.” (M, p.1240). Some experienced immediate and notable differences, “I haven’t felt this good in years. It was like night and day; it saved my life.” (G, 117). Maintaining PAP use was harder alongside subtle improvements, unless these matched expectations, “I

wanted to keep trying because he had told me it might take a while, and then I did notice gradual changes.” (F, p.246).

Bonded to PAP

Different bonds motivated PAP use. Some reported to “depend on it” (J, p.276) and would take it when travelling. PAP was trusted to keep users well and provided a sense of hope, “I feel so secure with it” (C, p.225). Others found PAP “soothing” (K, p.1728) and felt thankful for the benefits.

Discussion

The findings highlight the applicability of a biopsychosocial understanding to PAP use. The theme “Journey to PAP” depicts biological influences. Participants largely struggled with OSA symptoms but had difficulty obtaining the diagnosis or wouldn’t seek help; consistent with findings of an average of up to ten years between symptom onset and diagnosis [72, 73]. Limited public and professional awareness presented a barrier. Findings suggest symptom severity influences PAP use more than OSA severity [25]. Perhaps people experiencing greater symptoms are more motivated to overcome barriers to acquire and use PAP.

The theme “Discomfort from and around PAP” emerged from prevalent reports that PAP generates psychological as well as physical discomfort [41, 42], impacting use. PAP use required an often-uncomfortable shift in identity, generating stigma from individual and cultural prejudices. Older age is associated with PAP use [74], potentially reflecting higher acceptability of lifelong treatment in later life. The stigma experienced by PAP users from themselves and others is not well documented [75, 76] and warrants further research as stigma is known to impact other treatments [77–79].

People who have not tried PAP report wanting to avoid reliance [80]. However, users depicted dependence as a positive bond within “Benefits of PAP”, highlighting the role of psychological factors such as attitude and belief within “Adapting to and using PAP”. Early attachment patterns may influence relationships with healthcare services [81] and may similarly affect relationships with PAP, perhaps explaining why dependence is soothing for some and avoided by others. Such psychological influences on PAP use are conceivably complex and require further research.

Benefits were infrequently reported and highlighted the influence of expectation. Some experienced drastic changes from PAP use, which outweighed any discomfort experienced. It is possible that these ideal yet infrequent experiences have informed expectations. Subtle changes were less motivating, highlighting the importance of realistic expectations and ongoing professional input.

The users' social context was also reported to affect PAP use. Support was overwhelmingly cited as important. Most accounts suggested that services provided little initial and ongoing support, meaning PAP use relied on the individual or their personal networks. Information on OSA and PAP emerged as crucial. Research suggests that professionals underestimate the importance of information and overestimate the impact of side effects [82]. These findings suggest that professionals may overemphasise discomfort at the expense of other information, potentially increasing user experience of discomfort through confirmation bias [83]. Moreover, it may reflect professional beliefs, similar to the current findings of user frustration, that PAP is not an ideal solution and warrants further research.

Some included studies enabled participants to connect with other users. Group sessions were recommended as helpful whilst experienced users wanted to help others use PAP. Connecting users is an inexpensive way for services to provide ongoing support. Moreover, the benefit reported of involving people around the user in PAP treatment, particularly considering their role in initially recognising OSA, supports other findings [64, 84]. Again, it is a low-cost solution to utilise existing support networks. Meanwhile, it may provide services the opportunity to understand and mitigate personal relationship difficulties that the current findings, alongside others, suggest hinder PAP use [34, 85].

However, services should not rely on personal networks to support users. Although personal support was largely reported as readily available, participants' PAP usage was still reported as suboptimal, suggesting sufficient professional support is also imperative. The findings also suggested that PAP is sold to users as a destination whilst user experiences conveyed a lifelong journey that is especially difficult in the early stages. To assist this journey, participants described needing ongoing support and wanting to share

decision-making, goals and monitoring around their treatment. The focus on objective PAP use was experienced as impersonal and unhelpful.

The needs highlighted here match The World Health Organisation's 2003 recommendations on working collaboratively with people and their families to support long-term treatment use [86]. The recommendations detail that users should not be blamed for non-optimal use and that service level factors, such as absent holistic ongoing support, have a major effect. However, the PAP literature continues the user blaming narrative, despite the emergence of research discrediting focus on objective measures of use [87–89]. PAP use is considered to threaten the reputation of sleep medicine and the utility of OSA as a diagnosis, making investment towards supporting PAP use crucial [90].

Given the reported role of acceptance, it is thought that Acceptance and Commitment Therapy (ACT) [91] principles may help contextualise PAP use as supportive of user values. ACT is an evidence-based biopsychosocial approach used to support management of other long-term conditions [92]. However, as PAP use is an individual, context dependent, lifelong journey, no supportive or educational interventions will likely be effective for all PAP users at once. Instead, users may benefit from a range of support across their lifetime. Therefore, PAP services should expand the information and support available, making use of a range of evidence-based interventions [52–55, 93, 94] and facilitate collaborative decisions, goals and monitoring between professionals, users and their networks [95].

Despite reflexive efforts to reduce bias within the findings and interpretations, all systematic reviews contain bias, particularly those conducted by one author [96]. Whilst experiences of PAP seemed fairly consistent across different countries and healthcare systems, the White British author may have incorrectly interpreted different cultural experiences. Seven papers contained translated experiences, increasing opportunities for misunderstanding and misrepresentation. Many papers had only recruited current PAP users, potentially reducing the inclusion of more difficult experiences of PAP. Meanwhile, the current review excluded narratives of significant others. Based on the reported role of others in recognising OSA

and supporting PAP use, future research is recommended to include these perspectives to corroborate and enhance the current understandings.

This metasynthesis hoped to address the absence of user's voices within the PAP literature. The findings support a biopsychosocial conceptualisation of PAP use and highlight the limitations of the literature's emphasis on individual factors. Collaborative, person-centred and holistic ongoing support is needed to improve PAP use.

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Accessed 5 Mar 2020

Tables and Figures in Order of Reference in the Paper

Table 1

Full Search Strategy for MEDLINE Database and Database Specific Alternatives

Database: MEDLINE			Search fields
<i>Population</i>	Free text keywords	sleep apnoea OR sleep apnea OR OSA OR hypopnoea OR hypopnea	Title <i>OR</i> abstract
	MeSH terms	“Sleep Apnea, Obstructive”	N/A
<i>OR</i>			
<i>AND</i>			
<i>Exposure</i>	Free text keywords	positive airway pressure OR CPAP OR BiPAP OR (obstructive sleep apnoea OR OSA) N4 (treatment) OR (obstructive sleep apnea OR OSA) N4 (treatment)	Title <i>OR</i> abstract
	MeSH terms	“Continuous positive airway pressure”	N/A
<i>OR</i>			
<i>AND</i>			
<i>Outcome</i>	Free text keywords	experience* OR preference* OR report OR perspective* OR perception* OR influenc* OR barrier* OR facilitator* OR acceptance OR choice* OR attitude* OR adapt* OR cop* OR point of view* OR opinion* OR qualitative OR narrative* OR grounded theory OR focus group OR theme* OR thematic	Title <i>OR</i> abstract
	MeSH terms	“Treatment Adherence and Compliance+”	N/A
<i>Limits applied</i>	Journal article, English language and Human		
Database specific alternatives to above search strategy			
Database	Thesaurus terms used	Limits applied	
PsycINFO	<i>P</i> : “Sleep Apnea”	Academic journals	
	<i>E</i> : None	English language	
	<i>O</i> : “Client Attitudes”	Human	
CINAHL	<i>P</i> : “Sleep Apnea, Obstructive”	Journal article	
	<i>E</i> : “Continuous Positive Airway Pressure”	English language	
	<i>O</i> : “Patient Satisfaction+” OR “Patient Compliance+”	Human	
EMBASE	<i>P</i> : “exp sleep disordered breathing”	Article	
	<i>E</i> : “exp positive and expiratory pressure”	English language	
	<i>O</i> : “exp patient attitude” OR “exp patient compliance”	Human	

* denotes a truncation

+ indicates where a term was exploded

Figure 1

PRISMA Flow Diagram [59]

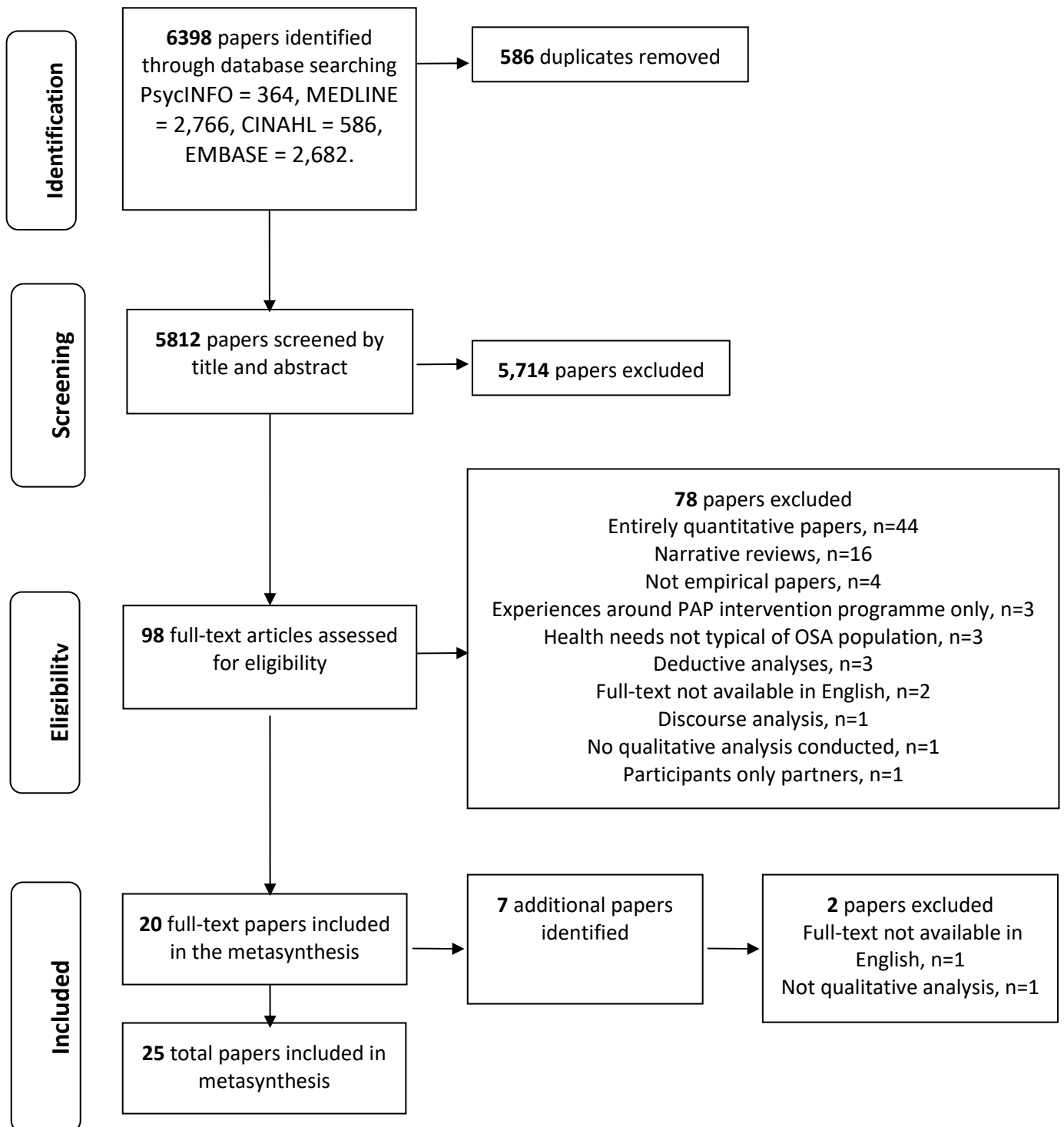


Table 2*Details of Papers Included in The Metasynthesis, Listed in Alphabetical Order*

Assigned letter First author Year Location	Data provided on participants with first-hand experience of PAP					Method of data collection	Method of qualitative analysis	Primary research question(s)
	N	Sex	Average age ^a (range)	Average AHI ^b	Average BMI ^c			
A Almeida [97] 2013 Canada	22	13 male	60 (Not stated)	17.8 - 29.1	Not stated	Focus groups	Thematic analysis	What are the experiences of CPAP and oral appliance users? What are the factors that influence a patient's choice of treatment?
B Ayow [98] 2009 Canada	8	4 male	43.3-48.8 (Not stated)	43 – 45.2	Not stated	Semi- structured interviews	Thematic analysis	What are the perceived factors that facilitate CPAP use? What are the perceived factors that prevent CPAP use and lead to abandonment of treatment?
C Bakker [99] 2014 New Zealand	18	11 male	47 (30-71)	59.1 - 93	Not stated	Focus groups	Thematic analysis	What are Maori, Pacific and New Zealand European patients' experiences with CPAP treatment?
D Broström [100] 2008 Sweden	1	1 male	33	92	40	Semi- structured interview	Phenomenographic	What are the experiences of CPAP treatment of a young male with severe OSA from the couple's perspective?
E Broström [101] 2010 Sweden	23	13 male	59-62 (33-74)	40-44	34-35	Semi- structured interviews	Content analysis	What are the in-depth experiences associated with adherence to CPAP treatment in patients with OSA?

F Dickerson [102] 2007 USA	20	9 male	52.8 (31-72)	Not stated	Not stated	Semi- structured interviews	Heideggerian hermeneutics	What are the experiences of individuals with sleep apnoea who use CPAP devices from diagnosis to 3 months? What is the usefulness and appropriateness of the Calgary sleep apnea quality of life (SAQOL) measurement tool?
G Dickerson [103] 2006 USA	17	12 male	58.4 (40-73)	Not stated	Not stated	Semi- structured interviews	Heideggerian hermeneutics	What are the support group experiences of individuals with OSA who uses CPAP devices?
H Gibson [104] 2018 New Zealand	16	15 male	71 (67-89)	Not stated	Not stated	Focus groups	Thematic analysis	What is the experience of diagnosis and management of OSA for older patients? What are the factors affecting acceptance of the current New Zealand services?
I Henry [105] 2013 USA	12	7 male	49.3 (27-72)	57	Not stated	Semi- structured interviews	Content analysis	What is the significance of gender and partner-reporting in shaping the lay diagnosis, management, and treatment of OSA?
J Hu [106] 2014 Taiwan	22	18 male	Not stated (37-68)	60.3	27.5	Semi- structured interviews	Grounded theory	What are OSA patients' feelings and perceptions in dealing with CPAP therapy?
K Khan [107] 2019 USA	28	12 male	58 (Not stated)	Not stated	35.5	Semi- structured motivational interviews	Thematic analysis	What are OSA patients' preferences, partner experiences, barriers and facilitators to PAP adherence? What is the understanding of the educational content delivered and satisfaction with the multidimensional structured intervention?
L Luyster [108]	15	9 male	56 (Not stated)	Not stated	Not stated	Focus groups	Content analysis	What are both patients' and partners' experiences of CPAP and the facilitators and barriers to

EXPERIENCES OF POSITIVE AIRWAY PRESSURE

1-39

								CPAP use? What are suggestions for a new CPAP user program?
2016 USA								
M Møkleby [109] 2019 Norway	7	5 male	Not stated (36-76)	Not stated	Not stated	Semi- structured interviews	Narrative analysis	How do patients with obstructive sleep apnoea experience and manage their use of CPAP?
N Moreira 2006 UK	2	Not known	Not known	Not known	Not known	Online discussion group	Analytic induction	What is the relationship between sleep and health from a sociological perspective?
O Moreira [110] 2008 UK	Not known	Not known	Not known	Not known	Not known	Online discussion group	Analytic induction	How do users establish and maintain workable relationships between CPAP and other technological elements of the domestic environment?
P Rodgers [111] 2014 USA	82	53 male	52 (21-82)	Not stated	Not stated	Interviews	Grounded theory	What are the experiences of individuals living with obstructive sleep apnoea?
Q Shoukry [112] 2011 Australia	20	15 male	57.5 (20-75)	Not stated	Not stated	Semi- structured interviews	Thematic analysis	What are the experiences of people with OSA, who have sourced their CPAP supply through a pharmacy?
R van de Mortel [113] 2000 Australia	19	15 male	54.8-65.9 (41-75)	Not stated	Not stated	Semi- structured interviews	Grounded theory	How do clients' experiences of sleep studies affect their compliance with therapy?
S1 Ward [75] 2017	12	Not stated	Not stated	Not stated	Not stated	Semi- structured interviews	Grounded theory	What are experiences of living with continuous positive airway pressure?

New Zealand

S2 Ward [114] 2018 New Zealand	12	Not stated	Not stated	Not stated	Not stated	Semi- structured interviews	Grounded theory	What is it like to live with CPAP for sleep apnoea?
S3 Ward [115] 2019 New Zealand	12	Not stated	Not stated	Not stated	Not stated	Semi- structured interviews	Grounded theory	What are experiences of living with CPAP?
T Willman [116] 2012 Sweden	15	8 male	56.8 (41-71)	Not stated	38.5	Semi- structured interviews	Content analysis	What are personal experiences with CPAP in individuals with moderate or severe OSAS and obesity?
U Ye [117] 2017 USA	20	14 male	49.6 (not stated)	24.1	Not stated	Semi- structured interviews	Content analysis	What are couples' experiences with CPAP treatment? What are the facilitators and barriers to incorporating CPAP use into daily life?
V1 Zarhin [90] 2017 Israel	19	11 male	55.5-60.5 (not stated)	Not stated	Not stated	Semi- structured interviews	Grounded theory	What are patients' experiences of CPAP use and nonuse?
V2 Zarhin [80] 2018 Israel	19	11 male	55.5-60.5 (not stated)	Not stated	Not stated	Semi- structured interviews	Grounded theory	What happens to agency in the context of sleep? How is agency exchanged from body to technology in sleep?

^aTwo averages are given when average age is presented for two separate groups (e.g. males and females), not the entire participant cohort.

^bApnoea hypopnea index (AHI) is used as a measure of OSA severity, it indicates the average number of apnoeas (cessation of breathing) and hypopneas (partial cessation of breathing) for >10 seconds per hour of sleep. 5-14 is considered mild, 15-30 moderate and 30+ severe OSA [118].

^cA body mass index (BMI) of above 35 kg/m² is considered a risk indicator for OSA [14].

Table 3*Results of Critical Appraisal*

CASP Question	Paper																								
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S1	S2	S3	T	U	V1	V2
Was there a clear statement of the aims of the research?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Is a qualitative methodology appropriate?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Was the research design appropriate to address the aims of the research?	1	1	0*	1	1	1	0*	1	0*	1	1	1	1	0*	1	1	1	1	1	1	1	1	1	1	0*
Was the recruitment strategy appropriate to the aims of the research?	1	1	1	1	1	0*	1	1	0*	1	0*	1	1	0*	1	0*	1	1	1	1	1	0*	1	1	0*
Was the data collected in a way that addressed the research issue?	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Has the relationship between researcher and participants been adequately considered?	0	0	0	0	0	0	0	1	0	1	0	1	1	0	0	0	0	1	0	0	0	0	0	1	0
Have ethical issues been taken into consideration?	1	1	1	1	1	0*	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Was the data analysis sufficiently rigorous?	1	1	1	1	1	1	1	1	0*	1	1	1	1	0*	1	1	1	1	1	1	1	1	1	1	1
Is there a clear statement of findings?	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Total score	6	6	5	6	6	4	5	7	3	7	5	7	7	3	6	5	6	7	6	6	6	5	6	7	4

Note. A score out of 7 was assigned to each article based on the number of criteria it met beyond the first two screening criteria (which all articles met).

No value was assigned for criteria where the answer was either “no” or “can’t tell”. 1 indicates an answer of “yes”, 0* indicates an answer of “can’t tell” and 0 indicates an answer of “no”.

Table 4*Contribution of Papers to Each Analytical Theme and Subtheme*

Theme/subtheme	Paper																								
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S1	S2	S3	T	U	V1	V2
Journey to PAP	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X
Difficulties before PAP	X	X			X	X	X	X	X	X		X	X			X	X	X	X	X	X	X		X	X
Delays to getting treatment			X		X	X	X	X	X	X	X	X	X			X	X	X	X	X	X		X	X	X
Experiences of assessment and diagnosis	X	X		X	X			X		X			X				X	X	X		X				X
Discomfort from and around PAP	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Relationship with PAP	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X
Relationship with life	X	X	X	X	X	X	X	X	X	X	X	X	X		X		X	X	X			X	X	X	X
Relationship with self		X	X	X	X	X	X	X	X		X	X	X		X	X	X	X	X	X	X		X	X	X
Relationship with others	X	X	X	X		X	X	X	X		X	X	X			X	X		X	X		X	X	X	X
Relationship with sleep	X	X		X	X	X	X	X		X	X	X			X	X		X	X		X		X	X	X
Adapting to and using PAP	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Importance of support		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Attitude, belief, and context	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Effort necessary to adapt	X		X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X		X
PAP use a journey not destination	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X
Desired outcomes		X	X	X		X	X	X		X	X	X	X	X	X		X		X	X	X	X			
Benefits from PAP	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X
PAP effects on OSA		X	X	X	X	X	X	X	X	X	X	X	X		X		X	X	X	X	X	X	X	X	X
PAP effects on wider life	X	X	X	X	X	X	X	X	X	X	X	X	X			X		X	X	X	X	X	X		X
Relationship of improvements to PAP use	X		X	X	X	X	X	X	X	X	X	X	X			X	X	X	X		X	X	X	X	X
Bonded to PAP	X		X	X	X	X	X			X	X	X	X		X		X		X		X	X	X	X	X

Appendix A

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses [59]



PRISMA 2009 Checklist

Section/topic	#	Checklist item	Reported on page #
TITLE			
Title	1	Identify the report as a systematic review, meta-analysis, or both.	1-1
ABSTRACT			
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	1-2
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known.	1-(3-4)
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	1-4
METHODS			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.	1-4
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	1-5
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	1-5
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	1-36
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	1-5
Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	1-6
Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	1-6
Risk of bias in individual studies	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	1-(5-6)
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).	N/A
Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I ²) for each meta-analysis.	1-4, 1-6



PRISMA 2009 Checklist

Section/topic	#	Checklist item	Reported on page #
Risk of bias across studies	15	Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).	1-(5-6)
Additional analyses	16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	N/A
RESULTS			
Study selection	17	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	1-8, 1-37
Study characteristics	18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.	1-7, 1-38-41
Risk of bias within studies	19	Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).	1-7, 1-42
Results of individual studies	20	For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot.	N/A
Synthesis of results	21	Present results of each meta-analysis done, including confidence intervals and measures of consistency.	1-(7-16), 1-43
Risk of bias across studies	22	Present results of any assessment of risk of bias across studies (see Item 15).	1-7, 1-42
Additional analysis	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	N/A
DISCUSSION			
Summary of evidence	24	Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers).	1-(16-18)
Limitations	25	Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias).	1-18
Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	1-19
FUNDING			
Funding	27	Describe sources of funding for the systematic review and other support (e.g., supply of data), role of funders for the systematic review.	N/A

From: Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med 6(7): e1000097. doi:10.1371/journal.pmed1000097

For more information, visit: www.prisma-statement.org.

Appendix B

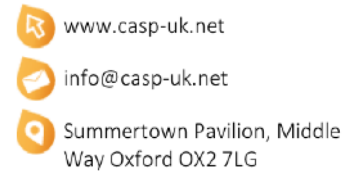
Enhancing Transparency in Reporting the Synthesis of Qualitative Research Criteria [60]

Table 1 Enhancing transparency in reporting the synthesis of qualitative research: the ENTREQ statement

No	Item	Guide and description
1	Aim	State the research question the synthesis addresses.
2	Synthesis methodology	Identify the synthesis methodology or theoretical framework which underpins the synthesis, and describe the rationale for choice of methodology (e.g. <i>meta-ethnography, thematic synthesis, critical interpretive synthesis, grounded theory synthesis, realist synthesis, meta-aggregation, meta-study, framework synthesis</i>).
3	Approach to searching	Indicate whether the search was pre-planned (<i>comprehensive search strategies to seek all available studies</i>) or iterative (<i>to seek all available concepts until they theoretical saturation is achieved</i>).
4	Inclusion criteria	Specify the inclusion/exclusion criteria (e.g. <i>in terms of population, language, year limits, type of publication, study type</i>).
5	Data sources	Describe the information sources used (e.g. <i>electronic databases (MEDLINE, EMBASE, CINAHL, psycINFO, Econlit), grey literature databases (digital thesis, policy reports), relevant organisational websites, experts, information specialists, generic web searches (Google Scholar) hand searching, reference lists</i>) and when the searches conducted; provide the rationale for using the data sources.
6	Electronic Search strategy	Describe the literature search (e.g. <i>provide electronic search strategies with population terms, clinical or health topic terms, experiential or social phenomena related terms, filters for qualitative research, and search limits</i>).
7	Study screening methods	Describe the process of study screening and sifting (e.g. <i>title, abstract and full text review, number of independent reviewers who screened studies</i>).
8	Study characteristics	Present the characteristics of the included studies (e.g. <i>year of publication, country, population, number of participants, data collection, methodology, analysis, research questions</i>).
9	Study selection results	Identify the number of studies screened and provide reasons for study exclusion (e.g. <i>for comprehensive searching, provide numbers of studies screened and reasons for exclusion indicated in a figure/flowchart; for iterative searching describe reasons for study exclusion and inclusion based on modifications to the research question and/or contribution to theory development</i>).
10	Rationale for appraisal	Describe the rationale and approach used to appraise the included studies or selected findings (e.g. <i>assessment of conduct (validity and robustness), assessment of reporting (transparency), assessment of content and utility of the findings</i>).
11	Appraisal items	State the tools, frameworks and criteria used to appraise the studies or selected findings (e.g. <i>Existing tools: CASP, QARI, COREQ, Mays and Pope [25]; reviewer developed tools; describe the domains assessed: research team, study design, data analysis and interpretations, reporting</i>).
12	Appraisal process	Indicate whether the appraisal was conducted independently by more than one reviewer and if consensus was required.
13	Appraisal results	Present results of the quality assessment and indicate which articles, if any, were weighted/excluded based on the assessment and give the rationale.
14	Data extraction	Indicate which sections of the primary studies were analysed and how were the data extracted from the primary studies? (e.g. <i>all text under the headings "results /conclusions" were extracted electronically and entered into a computer software</i>).
15	Software	State the computer software used, if any.
16	Number of reviewers	Identify who was involved in coding and analysis.
17	Coding	Describe the process for coding of data (e.g. <i>line by line coding to search for concepts</i>).
18	Study comparison	Describe how were comparisons made within and across studies (e.g. <i>subsequent studies were coded into pre-existing concepts, and new concepts were created when deemed necessary</i>).
19	Derivation of themes	Explain whether the process of deriving the themes or constructs was inductive or deductive.
20	Quotations	Provide quotations from the primary studies to illustrate themes/constructs, and identify whether the quotations were participant quotations of the author's interpretation.
21	Synthesis output	Present rich, compelling and useful results that go beyond a summary of the primary studies (e.g. <i>new interpretation, models of evidence, conceptual models, analytical framework, development of a new theory or construct</i>).

Appendix C

Critical Appraisal Skills Programme [CASP] Qualitative Checklist [68]



CASP Checklist: 10 questions to help you make sense of a **Qualitative** research

How to use this appraisal tool: Three broad issues need to be considered when appraising a qualitative study:

- ▶ Are the results of the study valid? (Section A)
- ▶ What are the results? (Section B)
- ▶ Will the results help locally? (Section C)

The 10 questions on the following pages are designed to help you think about these issues systematically. The first two questions are screening questions and can be answered quickly. If the answer to both is “yes”, it is worth proceeding with the remaining questions. There is some degree of overlap between the questions, you are asked to record a “yes”, “no” or “can’t tell” to most of the questions. A number of italicised prompts are given after each question. These are designed to remind you why the question is important. Record your reasons for your answers in the spaces provided.

About: These checklists were designed to be used as educational pedagogic tools, as part of a workshop setting, therefore we do not suggest a scoring system. The core CASP checklists (randomised controlled trial & systematic review) were based on JAMA ‘Users’ guides to the medical literature 1994 (adapted from Guyatt GH, Sackett DL, and Cook DJ), and piloted with health care practitioners.

For each new checklist, a group of experts were assembled to develop and pilot the checklist and the workshop format with which it would be used. Over the years overall adjustments have been made to the format, but a recent survey of checklist users reiterated that the basic format continues to be useful and appropriate.

Referencing: we recommend using the Harvard style citation, i.e.: *Critical Appraisal Skills Programme (2018). CASP (insert name of checklist i.e. Qualitative) Checklist. [online] Available at: URL. Accessed: Date Accessed.*

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Paper for appraisal and reference:

Section A: Are the results valid?

1. Was there a clear statement of the aims of the research?

Yes	<input type="checkbox"/>
Can't Tell	<input type="checkbox"/>
No	<input type="checkbox"/>

- HINT: Consider
- what was the goal of the research
 - why it was thought important
 - its relevance

Comments:

2. Is a qualitative methodology appropriate?

Yes	<input type="checkbox"/>
Can't Tell	<input type="checkbox"/>
No	<input type="checkbox"/>

- HINT: Consider
- If the research seeks to interpret or illuminate the actions and/or subjective experiences of research participants
 - Is qualitative research the right methodology for addressing the research goal

Comments:

Is it worth continuing?

3. Was the research design appropriate to address the aims of the research?

Yes	<input type="checkbox"/>
Can't Tell	<input type="checkbox"/>
No	<input type="checkbox"/>

- HINT: Consider
- if the researcher has justified the research design (e.g. have they discussed how they decided which method to use)

Comments:



4. Was the recruitment strategy appropriate to the aims of the research?

Yes	<input type="checkbox"/>
Can't Tell	<input type="checkbox"/>
No	<input type="checkbox"/>

- HINT: Consider
- If the researcher has explained how the participants were selected
 - If they explained why the participants they selected were the most appropriate to provide access to the type of knowledge sought by the study
 - If there are any discussions around recruitment (e.g. why some people chose not to take part)

Comments:

5. Was the data collected in a way that addressed the research issue?

Yes	<input type="checkbox"/>
Can't Tell	<input type="checkbox"/>
No	<input type="checkbox"/>

- HINT: Consider
- If the setting for the data collection was justified
 - If it is clear how data were collected (e.g. focus group, semi-structured interview etc.)
 - If the researcher has justified the methods chosen
 - If the researcher has made the methods explicit (e.g. for interview method, is there an indication of how interviews are conducted, or did they use a topic guide)
 - If methods were modified during the study. If so, has the researcher explained how and why
 - If the form of data is clear (e.g. tape recordings, video material, notes etc.)
 - If the researcher has discussed saturation of data

Comments:



6. Has the relationship between researcher and participants been adequately considered?

Yes	<input type="checkbox"/>
Can't Tell	<input type="checkbox"/>
No	<input type="checkbox"/>

- HINT: Consider
- If the researcher critically examined their own role, potential bias and influence during (a) formulation of the research questions (b) data collection, including sample recruitment and choice of location
 - How the researcher responded to events during the study and whether they considered the implications of any changes in the research design

Comments:

Section B: What are the results?

7. Have ethical issues been taken into consideration?

Yes	<input type="checkbox"/>
Can't Tell	<input type="checkbox"/>
No	<input type="checkbox"/>

- HINT: Consider
- If there are sufficient details of how the research was explained to participants for the reader to assess whether ethical standards were maintained
 - If the researcher has discussed issues raised by the study (e.g. issues around informed consent or confidentiality or how they have handled the effects of the study on the participants during and after the study)
 - If approval has been sought from the ethics committee

Comments:



8. Was the data analysis sufficiently rigorous?

Yes	<input type="checkbox"/>
Can't Tell	<input type="checkbox"/>
No	<input type="checkbox"/>

- HINT: Consider
- If there is an in-depth description of the analysis process
 - If thematic analysis is used. If so, is it clear how the categories/themes were derived from the data
 - Whether the researcher explains how the data presented were selected from the original sample to demonstrate the analysis process
 - If sufficient data are presented to support the findings
 - To what extent contradictory data are taken into account
 - Whether the researcher critically examined their own role, potential bias and influence during analysis and selection of data for presentation

Comments:

9. Is there a clear statement of findings?

Yes	<input type="checkbox"/>
Can't Tell	<input type="checkbox"/>
No	<input type="checkbox"/>

- HINT: Consider whether
- If the findings are explicit
 - If there is adequate discussion of the evidence both for and against the researcher's arguments
 - If the researcher has discussed the credibility of their findings (e.g. triangulation, respondent validation, more than one analyst)
 - If the findings are discussed in relation to the original research question

Comments:



Section C: Will the results help locally?

10. How valuable is the research?

HINT: Consider

- If the researcher discusses the contribution the study makes to existing knowledge or understanding (e.g. do they consider the findings in relation to current practice or policy, or relevant research-based literature
- If they identify new areas where research is necessary
- If the researchers have discussed whether or how the findings can be transferred to other populations or considered other ways the research may be used

Comments:

Appendix D

Submission Guidelines (Instructions for Authors) for Sleep and Breathing

Instructions for Authors

Types of Articles

SLBR publishes articles in different categories:

- Original research – with a maximum length of 3000 words, 8 figures and/or tables, and not more than 30 references. Abstracts (mandatory) must be structured and have a maximum length of 250 words.
- Editorials – with a maximum length of 1500 words, 2 figures and/or tables, and not more than 10 references.
- Review and series articles – with a maximum length of 5000 words, 5 figures and/or tables, and not more than 150 references. Abstracts (mandatory) have a maximum length of 250 words.
- Short communications – with a maximum length of 1,500 words, and 4 figures and/or tables. Abstracts (mandatory) have a maximum length of 250 words. Short communications must focus on timely and significant findings. Sleep and Breathing is not currently considering the publication of case reports.
- Letters to the editor - with a maximum length of 1200 words, 1 figure and/or table, and not more than 5 references.

Please note:

- Case Reports – the journal will implement an open call for case reports in the future, however please note that currently Sleep and Breathing does not consider case reports. Authors may wish to consider submitting their case reports to the **Journal of Medical Case Reports** or to **SN Comprehensive Clinical Medicine**.
- Abstracts for Original Articles and Short Communications must be 150 to 250 words in length and structured with the following sections: Purpose (stating the main purpose and research question); Methods; Results; Conclusions.

Meta-analyses and systematic reviews

Must follow PRISMA guidelines (interventional research) , or MOOSE guidelines (observational studies). Authors must confirm that their manuscript adheres to the relevant guidelines during the submission stage. Manuscripts deemed not to adhere to the guidelines will be returned to the author immediately.

Editorial Procedure

If you have any questions please contact:

- **Editors-in-Chief**

Arn H. Eliasson (USA and Rest of World)

aheliasson@aol.com

Thomas Penzel (Europe)

thomas.penzel@charite.de

- **Managing Editor**

Diana Epstein

Sleep_Breath@di-ep.com

Manuscript Submission

Manuscript Submission

Submission of a manuscript implies: that the work described has not been published before; that it is not under consideration for publication anywhere else; that its publication has been approved by all co-authors, if any, as well as by the responsible authorities – tacitly or explicitly – at the institute where the work has been carried out. The publisher will not be held legally responsible should there be any claims for compensation.

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Online Submission

Please follow the hyperlink “Submit online” on the right and upload all of your manuscript files following the instructions given on the screen.

Please ensure you provide all relevant editable source files. Failing to submit these source files might cause unnecessary delays in the review and production process.

Title page

Title Page

Please use this **template title page** for providing the following information.

The title page should include:

- The name(s) of the author(s)
- A concise and informative title
- The affiliation(s) of the author(s), i.e. institution, (department), city, (state), country
- A clear indication and an active e-mail address of the corresponding author
- If available, the 16-digit ORCID of the author(s)

If address information is provided with the affiliation(s) it will also be published.

For authors that are (temporarily) unaffiliated we will only capture their city and country of residence, not their e-mail address unless specifically requested.

Abstract

Please provide a structured abstract of 150 to 250 words which should be divided into the following sections:

- Purpose (stating the main purposes and research question)
- Methods
- Results
- Conclusion

For life science journals only (when applicable)

Trial registration number and date of registration

Trial registration number, date of registration followed by “retrospectively registered”

Keywords

Please provide 4 to 6 keywords which can be used for indexing purposes.

Declarations

All manuscripts must contain the following sections under the heading 'Declarations'.

If any of the sections are not relevant to your manuscript, please include the heading and write 'Not applicable' for that section.

To be used for non-life science journals

Funding (information that explains whether and by whom the research was supported)

Conflicts of interest/Competing interests (include appropriate disclosures)

Availability of data and material (data transparency)

Code availability (software application or custom code)

Authors' contributions (optional: please review the submission guidelines from the journal whether statements are mandatory)

To be used for life science journals + articles with biological applications

Funding (information that explains whether and by whom the research was supported)

Conflicts of interest/Competing interests (include appropriate disclosures)

Ethics approval (include appropriate approvals or waivers)

Consent to participate (include appropriate statements)

Consent for publication (include appropriate statements)

Availability of data and material (data transparency)

Code availability (software application or custom code)

Authors' contributions (optional: please review the submission guidelines from the journal whether statements are mandatory)

Please see the relevant sections in the submission guidelines for further information as well as various examples of wording. Please revise/customize the sample statements according to your own needs.

Text

Text Formatting

Manuscripts should be submitted in Word.

- Use a normal, plain font (e.g., 10-point Times Roman) for text.
- Use italics for emphasis.
- Use the automatic page numbering function to number the pages.
- Do not use field functions.
- Use tab stops or other commands for indents, not the space bar.
- Use the table function, not spreadsheets, to make tables.
- Use the equation editor or MathType for equations.
- Save your file in docx format (Word 2007 or higher) or doc format (older Word versions).

Manuscripts with mathematical content can also be submitted in LaTeX.

[LaTeX macro package \(Download zip, 188 kB\)](#)

Headings

Please use no more than three levels of displayed headings.

Abbreviations

Abbreviations should be defined at first mention and used consistently thereafter.

Footnotes

Footnotes can be used to give additional information, which may include the citation of a reference included in the reference list. They should not consist solely of a reference

citation, and they should never include the bibliographic details of a reference. They should also not contain any figures or tables.

Footnotes to the text are numbered consecutively; those to tables should be indicated by superscript lower-case letters (or asterisks for significance values and other statistical data). Footnotes to the title or the authors of the article are not given reference symbols.

Always use footnotes instead of endnotes.

Acknowledgments

Acknowledgments of people, grants, funds, etc. should be placed in a separate section on the title page. The names of funding organizations should be written in full.

Scientific style

Please always use internationally accepted signs and symbols for units (SI units).

References

Citation

Reference citations in the text should be identified by numbers in square brackets. Some examples:

1. Negotiation research spans many disciplines [3].
2. This result was later contradicted by Becker and Seligman [5].
3. This effect has been widely studied [1-3, 7].

Reference list

The list of references should only include works that are cited in the text and that have been published or accepted for publication. Personal communications and unpublished works should only be mentioned in the text. Do not use footnotes or endnotes as a substitute for a reference list.

The entries in the list should be numbered consecutively.

- Journal article

Gamelin FX, Baquet G, Berthoin S, Thevenet D, Nourry C, Nottin S, Bosquet L (2009) Effect of high intensity intermittent training on heart rate variability in prepubescent children. *Eur J Appl Physiol* 105:731-738. <https://doi.org/10.1007/s00421-008-0955-8>

Ideally, the names of all authors should be provided, but the usage of “et al” in long author lists will also be accepted:

Smith J, Jones M Jr, Houghton L et al (1999) Future of health insurance. *N Engl J Med* 341:325–329

- Article by DOI

Slifka MK, Whitton JL (2000) Clinical implications of dysregulated cytokine production. *J Mol Med*. <https://doi.org/10.1007/s001090000086>

- Book

South J, Blass B (2001) *The future of modern genomics*. Blackwell, London

- Book chapter

Brown B, Aaron M (2001) The politics of nature. In: Smith J (ed) *The rise of modern genomics*, 3rd edn. Wiley, New York, pp 230-257

- Online document

Cartwright J (2007) Big stars have weather too. IOP Publishing PhysicsWeb. <http://physicsweb.org/articles/news/11/6/16/1>. Accessed 26 June 2007

- Dissertation

Trent JW (1975) *Experimental acute renal failure*. Dissertation, University of California

Always use the standard abbreviation of a journal’s name according to the ISSN List of Title Word Abbreviations, see

[ISSN.org LTWA](http://ISSN.org/LTWA)

If you are unsure, please use the full journal title.

For authors using EndNote, Springer provides an output style that supports the formatting of in-text citations and reference list.

[EndNote style \(Download zip, 4 kB\)](#)

Authors preparing their manuscript in LaTeX can use the bibtex file spbasic.bst which is included in Springer's LaTeX macro package.

Tables

- All tables are to be numbered using Arabic numerals.
- Tables should always be cited in text in consecutive numerical order.
- For each table, please supply a table caption (title) explaining the components of the table.
- Identify any previously published material by giving the original source in the form of a reference at the end of the table caption.
- Footnotes to tables should be indicated by superscript lower-case letters (or asterisks for significance values and other statistical data) and included beneath the table body.



Chapter 2: Empirical Paper

Impact of Obstructive Sleep Apnoea for People with a Bipolar Disorder Diagnosis

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Doctorate in Clinical Psychology

2020

Prepared for submission to the Journal of Affective Disorders

Word count: 5,570 excluding title page, abstract, tables, figures, references and appendices.

Abstract: 250 words

3 tables and 5 figures are included in this paper

Abstract

Background

One quarter of people with a bipolar disorder (BD) diagnosis may have obstructive sleep apnoea (OSA), which may exacerbate, or be misattributed to, difficulties diagnosed as BD. Little is known about how OSA manifests when people also have a BD diagnosis. This study investigated whether people with suspected-OSA and a BD diagnosis experience more sleep and affect instability when “inter-episode” compared to people with a BD diagnosis alone.

Methods

The study utilised ecological momentary assessment. Participants were screened for signs of OSA and seven were tested overnight. Eighteen participants (twelve with suspected-OSA) wore an actigraph for two weeks whilst completing an affect questionnaire twice daily. Measures of instability were calculated using the mean squared successive difference and probability of acute change indices.

Results

No statistically significant differences were found other than reduced sleep efficiency in the suspected-OSA group ($d=-1.15$). The suspected-OSA group were diagnosed younger on average and proportionately more with a type 1 BD diagnosis. Only 48% of the intended sample was recruited due to the COVID-19 pandemic. However, high data capture was achieved.

Limitations

Due to the small sample, the findings must be interpreted with caution.

Conclusions

The findings suggest OSA may further reduce sleep efficiency, and exacerbate the longer wake after sleep onset with increased instability, previously observed for people with a BD diagnosis when “inter-episode”. However, OSA may constrain total sleep time instability. A strong rationale remains for future research to enhance clinical recognition and treatment of OSA for people with a BD diagnosis.

Key words: Obstructive sleep apnea; bipolar disorder; circadian rhythms; affect; actigraphy; instability.

Impact of Obstructive Sleep Apnoea for People with a Bipolar Disorder Diagnosis

Obstructive sleep apnoea (OSA) involves repetitive upper airway collapse during sleep and is believed to affect 9-38% of the general population (Senaratna et al., 2017). The reduced airflow and blood oxygen levels disrupt sleep, causing fatigue and daytime sleepiness and are linked to low mood and chronic health difficulties (Chervin, 2000; El-Ad and Lavie, 2005; Jordan et al., 2014; Shamsuzzaman et al., 2003). OSA may be six to twelve times more prevalent in people with a bipolar disorder (BD) diagnosis, meaning that approximately a quarter of people with a BD diagnosis may have OSA (Kelly et al., 2013; Steier et al., 2014; Stubbs et al., 2016). Similarly, around 20% of people with a diagnosis of OSA have been found to meet diagnostic criteria for BD or other mood difficulties (BaHammam et al., 2016; Schröder and O'Hara, 2005; Sharafkhaneh et al., 2005).

People with OSA and people with a BD diagnosis often share difficulties of reduced quality of life, difficulties socialising, reduced cognitive abilities and heightened emotional responses (“affect lability”; Beebe and Gozal, 2002; Henry et al., 2008; Kelly et al., 2013). Therefore, it is believed that OSA may either be misdiagnosed as BD or exacerbate difficulties considered to be BD (Pandi-Perumal et al., 2020). Meanwhile, prescribed pharmaceutical interventions may also increase the risk and severity of OSA in people with a BD diagnosis through causing sedation and weight gain (Gupta and Simpson, 2015; Kelly et al., 2013).

Little is known about the relationship between OSA, sleep and mood for people with a BD diagnosis, impeding clinical recognition and management. The little literature surrounding the potential impact of OSA for people with a BD diagnosis only comprises of case reports, which do not present a consistent picture (Blazer, 1981; Fleming et al., 1985; Strakowski et al., 1991; Szaulińska et al., 2017). Whilst the high co-morbidity between OSA and mood difficulties have informed routine evaluations of mood within assessment and treatment for OSA (Hamilton and Chai-Coetzer, 2019; National Institute for Health and Care Excellence (NICE), 2015), OSA is not routinely considered when assessing and supporting people with a BD diagnosis (NICE, 2014; Pandi-Perumal et al., 2020; Schröder and O'Hara, 2005). Therefore, research investigating the

relationship between OSA and experiences diagnosed as BD is important to inform clinical recognition, particularly given the difficulties accessing sleep laboratory assessments (Flemons et al., 2004).

People with a BD diagnosis are believed to be more vulnerable to circadian rhythm dysregulation than others in the general population (Alloy et al., 2017; Frank et al., 2000; Takaesu, 2018). The majority of psychological and pharmacological interventions for BD target circadian rhythms either directly or indirectly (Geddes and Miklowitz, 2013). For example, Interpersonal and Social Rhythms Therapy (IPSRT; Frank et al., 2000) uses a biopsychosocial approach to support people with a BD diagnosis to regulate their sleep-wake cycle and mood stability to increase functioning. However, these interventions do not yet account for OSA potentially affecting a quarter of people with a BD diagnosis. OSA can deregulate circadian rhythms through disrupting the sleep cycle (Noda et al., 1998; Pandi-Perumal et al., 2020), further demonstrating the need to ascertain the relationship between OSA and difficulties diagnosed as BD.

Sleep disturbance is a characteristic of periods of acutely elevated and low mood experienced by people with a BD diagnosis (Belmaker, 2004; Grande et al., 2016; Harvey et al., 2009). Research has also found that up to 70% of people with a BD diagnosis not currently experiencing acutely high or low mood (“inter-episode”) still exhibit clinically relevant sleep disturbance. People with a BD diagnosis were measured to have lower sleep efficiency and longer periods awake after sleep onset, with more instability around this, compared to controls (Gershon et al., 2012; Harvey et al., 2005; Sylvia et al., 2012). Crucially, increased instability in sleep and affect (emotional reaction), and more extreme experiences of negative affect, have also been consistently observed in this population when “inter-episode” (Depue, 1981; Gershon et al., 2012; Gershon and Eidelman, 2015; Harvey et al., 2005; Havermans et al., 2010; Henry et al., 2008; Knowles et al., 2007; Lovejoy and Steuerwald, 1995; Sylvia et al., 2012). However, less consistent evidence is available around the heightened experience of positive affect (Havermans et al., 2010; Knowles et al., 2007; Lovejoy and Steuerwald, 1995).

Heightened affect instability and intensity are considered defining characteristics of mood difficulties such as BD (Geddes and Miklowitz, 2013; Grande et al., 2016; Jahng et al., 2008). These fluctuations are

believed to be due to disrupted and variable circadian rhythms, even whilst “inter-episode”, leading to further acute mood difficulties due the bi-directional relationship between sleep and mood (Geddes and Miklowitz, 2013; Grandin et al., 2006; Harvey et al., 2009; Konjarski et al., 2018; Pandi-Perumal et al., 2020; Takaesu et al., 2018). Conceivably, the presence of OSA is likely to increase this “inter-episode” affect instability through OSA’s impact on circadian rhythms, potentially further impacting on longer-term mood experiences. Investigating the sleep and affect instability present for people with a BD diagnosis when they are “inter-episode” is considered important as this instability may maintain and trigger further difficulties (Gershon et al., 2012; Melo et al., 2017; Saunders et al., 2013; Scollon et al., 2003). Therefore, measurement of sleep variables at this time, alongside investigation of affect instability through ecological momentary assessment (EMA; Shiffman et al., 2008), is an appropriate way to begin to understand how OSA may impact people with a BD diagnosis.

This study aimed to investigate sleep and affect instability of people with a BD diagnosis and suspected-OSA. Specifically, the study intended to answer whether people with suspected-OSA and a BD diagnosis demonstrate more instability in sleep characteristics and positive and negative affect when “inter-episode” than those with a diagnosis of BD alone. The research hypothesis predicted that people with suspected OSA and a BD diagnosis would experience more sleep and affect instability and greater extremes of negative and positive affect change.

Method

Design

We conducted an EMA study to evaluate potential differences in instability of quantitative sleep and affect measures between a group of participants with a BD diagnosis and suspected-OSA and a group with a BD diagnosis alone. Each participant wore an actigraph (a watch-like device that measures movement) for two weeks (15 consecutive nights) whilst completing a questionnaire on affect twice daily for 14 days. There is no consensus on the length of measurement necessary to accurately capture sleep variables (Aili et al., 2017; Knutson et al., 2007). As night to night variability in sleep characteristics is high, even in the general

population (Dillon et al., 2014; Wohlgemuth et al., 1999), two weeks of data collection was considered appropriate to balance accuracy of sleep measurement with participant commitment. Meanwhile, twice daily EMA of affect for this period heightened the ecological validity around capturing affect instability (Trull et al., 2008).

The study took place across England, United Kingdom. Approval was obtained from the National Health Service (NHS) ethics committee and Health Research Authority (reference: 19/SC/0487) and all participants provided informed and written consent to participate. Recruitment and data collection began in November 2019 and had to conclude in March 2020 due to restrictions around the COVID-19 pandemic (Bavel et al., 2020). Participants who completed the study were entered into a prize draw.

Materials

REDCap (Research Electronic Data Capture; Harris et al., 2019), a secure online software platform licenced by Lancaster University, was used to host online study information and to collect the research data. However, participants were also provided with paper versions of study materials where preferred.

Participants initially provided demographic information via a questionnaire informed by the Duke Structured Interview Schedule for Sleep Disorders (DSI; Edinger et al., 2004), a very detailed sleep assessment tool (Taylor et al., 2018) containing demographic questions relevant to sleep. These questions produced baseline data and informed participant screening. For instance, information was collected on prescribed medications. It was anticipated that there would be no significant difference between groups in terms of medication as it is the first line treatment for difficulties diagnosed as BD (NICE, 2014). Therefore, attempting to recruit participants with a diagnosis of BD not taking medication, or attempting to control for medication, was likely to be unfeasible and unrepresentative (Harvey et al., 2009, 2005).

Participants were asked to complete a further three questionnaires to characterise groups. The Epworth Sleepiness Scale (ESS; Johns, 1991), a measure of daytime sleepiness which people with OSA have been found to score significantly more highly on, and the Pittsburgh Sleep Quality Index (PSQI; Buysse et al., 1989) are two of the most frequently used subjective measures of sleep quality (Buysse et al., 2008).

Although these measures have not been found to be predictive of OSA alone (Nishiyama et al., 2014), each has previously been used to characterise groups with confirmed OSA (Tufik et al., 2010; Vana et al., 2013) but not for those with a BD diagnosis (Soreca et al., 2015). Participants also completed the 7 Up 7 Down Inventory (Youngstrom et al., 2013; internal reliability: .83 for 'mania' and .95 for 'depression') as it is a brief measure of the severity of experiences relating to a diagnosis of BD. Fourteen participants completed these initial questionnaires online whilst five chose to complete paper copies.

Sections A, C and I-J of the Mini International Psychiatric Interview (MINI; Sheehan, 2016) were administered during a telephone screening to ensure participants met current criteria for a BD diagnosis (American Psychiatric Association, 2013), were between episodes of extreme mood, and did not meet criteria for alcohol or substance misuse.

To determine groups, participants also completed the STOP-Bang (Chung et al., 2016) questionnaire. The OSA section of Structured Clinical Interview for DSM-5 Sleep Disorders (SCISD; Taylor et al., 2018) was also administered during the telephone screen. Participants who scored ≥ 2 (clinical criteria) on the SCISD (Taylor et al., 2018; reliability: .73) and ≥ 3 on the STOP-Bang (Chung et al., 2016, 2008; sensitivity: 84%-100% and specificity: 56%-37% for detecting mild-severe OSA) met criteria for the suspected-OSA group. A subset of these participants (those who lived in the North West of England) were invited to undergo an overnight OSA test using a WatchPAT™ 200U (Itamar Medical, 2015) oximeter in their own home. Whilst the gold standard assessment for OSA is polysomnography (Jordan et al., 2014), evidence also supports the use of an oximeter in detecting OSA (Mulgrew et al., 2007; Yuceege et al., 2013).

GENEActiv™ Original (Activinsights, 2015) actigraphs were used to collect accelerometry data to then estimate total sleep time, sleep efficiency and wake after sleep onset. Actigraphy has been found to facilitate the estimation of these sleep variables with reasonable accuracy (Martin and Hakim, 2011). The GGIR package in R was used to estimate sleep variables from the actigraph data (van Hees et al., 2020).

Participants also provided subjective estimates of their sleep onset and wake times throughout the data collection period. The Positive and Negative Affect Scale (PANAS; Watson et al., 1988) was used to

capture affect twice a day (after waking and before 1pm, and after 1pm and before sleep). Participants were asked to rate how they felt in that moment against the ten positive and ten negative affect items (0-4; *very slightly or not at all - extremely*). The PANAS has been shown to have good psychometric properties and has been used in the previous research measuring affect instability in participants with a diagnosis of BD (Gershon et al., 2012; Gershon and Eidelman, 2015; Lovejoy and Steuerwald, 1995).

Participants

Participants contacted the first author directly in response to an advertisement shared through local services, Twitter and the Spectrum Centre for Mental Health Research mailing list. Participants had to have a self-reported BD diagnosis and meet current diagnostic criteria as screened for using sections A and C of the MINI (Sheehan, 2016). Participants also needed to live in the United Kingdom and be aged between 30 and 65. This age range intended to capture people most at risk of OSA (Jordan et al., 2014; NICE, 2015; Stubbs et al., 2016), whilst minimising the presence of other extraneous sleep variables known to increase with age (Crowley, 2011; Edwards et al., 2010). People living in an environment or with a medical condition likely to disrupt sleep (e.g. traumatic brain injury, neurodegenerative condition or substance addiction (Hasler et al., 2012; Lee and Thomas, 2011; Ouellet et al., 2015)) were excluded at the screening stage.

We aimed to recruit a total of 40 participants (20 with suspected-OSA and 20 without). This aim was informed by participant cohort sizes in previous relevant studies (Gershon et al., 2012; Gershon and Eidelman, 2015), balanced with pragmatic considerations. Studies utilising EMA require fewer participants to achieve statistical power compared to cross-sectional design studies (Lu et al., 2013) yet there is no agreed method of calculating the necessary participant cohort size required to achieve statistical power (Scherbaum and Ferrerter, 2009).

Analysis

To address the hypotheses, we aggregated daily sleep and affect data from across the data collection period to calculate means, medians and instability. Instability was calculated using the mean square of successive differences (MSSD) index whilst the probability of acute change (PAC) index was used to detect

extreme changes in affect variables. MSSD and PAC are recommended measures as they account for both variability and temporal dependency across a time series and have been found to capture affective instability better than other indices (Jahng et al., 2008). Moreover, MSSD is recommended for use in calculating affect instability for people with mood cycling condition diagnoses such as BD (Ebner-Priemer et al., 2009) and has been used in prior relevant research (Gershon et al., 2012; Gershon and Eidelman, 2015). To operationalise PAC, both one and two standard deviations from the sample mean of affect scores were used as cut points to define acute change in PAC calculations.

The data was eyeballed using box plots and line graphs. Independent t-tests were used to compare means, MSSD and PAC indices between groups and Cohen's d effect sizes were calculated. The Wilcoxon signed-rank test was used as a sensitivity analysis to confirm statistically significant t-test findings as the data was generated from a small sample. Analyses were conducted using SPSS version 26 (IBM, 2019) and R (R Core Team, 2013).

Results

Nineteen people (10 female; mean age = 49.26) consented to participate and 18 (9 female; mean age = 49.56) completed the study. One set of actigraph data could not be retrieved due to circumstances around the COVID-19 pandemic (Bavel et al., 2020). Twelve participants (6 female; mean age = 46.92) met criteria for the suspected-OSA group. Two people in this group reported existing diagnoses of OSA but that they were not currently using treatment. Seven people in the OSA group, without previous diagnoses of OSA, underwent the overnight oximeter test. Due to the recruitment period being shorter than intended, just under 50% of the intended participant cohort size was successfully recruited.

Demographics and Baseline Clinical Data

Exploration of demographic and baseline clinical data was approached descriptively so as not to attempt to draw statistical inferences from such a small cohort (Grimes and Schulz, 2002). As can be seen in Table 1, 50% of participants in both groups identified as female, and the other half as male. The majority of participants (72%) overall reported to either be retired, currently unable to work or that they were a carer.

Fewer of the suspected-OSA group proportionally were currently working despite being younger on average. Proportionally more participants suspected of having OSA had type 1 or unspecified BD diagnoses whereas half of the non-OSA group had type 2 BD diagnoses. The suspected-OSA group reported having their BD diagnoses for longer, suggesting they received their diagnoses earlier in life as this group were also younger on average. Participants in the suspected-OSA group also endorsed more past and present sleep disturbances on average (e.g. night terrors), in addition to signs of OSA, had a higher average PSQI score and proportionally more (75% vs. 50%) met the PSQI criteria (>5) for being “poor sleepers” (Buysse et al., 1989). Despite this, more suspected-OSA participants had a current bed partner than participants in the non-OSA group. Suspected-OSA participants had a higher average ESS score but the average scores for both groups registered within the same scoring category of “higher normal daytime sleepiness” (Johns, 1991), with only 17% of participants in each group scoring above the clinical range (>10). All but one participant was taking at least one medication relating to a psychiatric diagnosis.

Insert Table 1 here

Oximeter Test

From the seven overnight oximeter tests, five Apnoea Hypopnea Index (AHI; mean = 20.16; range = 1.5 - 53) and all Respiratory Disturbance Index (RDI; mean = 24.33; range = 5.8 - 56) readings met clinical OSA criteria (AHI or RDI ≥ 5 ; Guilleminault and Bassiri, 2005; NHS, 2019). Therefore, the presence of OSA was supported either by an oximeter test or a self-reported existing diagnosis for 82% of the suspected-OSA group.

Sleep Data

Actigraph data was successfully captured for 99.16% of the data collection period across 17 participants as two actigraphs only captured 13 days of data. Statistical comparisons were possible within sleep data due to the quantity of data points captured. As can be seen in Table 2, only one significant difference was found; sleep efficiency (total sleep time/time spent in bed) was significantly lower in the suspected-OSA group with the difference reflecting a large effect size ($d=-1.15$; Wilcoxon signed-rank test conducted for sensitivity: $Z=53, p=.05$).

Although not statistically significant, the suspected-OSA group slept for less time on average but demonstrated less mean instability (MSSD) in total sleep time, although the median was higher in the suspected-OSA group (Figure 1). These group differences reflected medium and small effect sizes respectively. As can be seen in Figure 2, the suspected-OSA group also spent more time awake after sleep onset, meaning they woke up more often and/or woke up for longer periods during the night, and demonstrated more instability around this. These group differences both reflected large effect sizes. Meanwhile, notably larger ranges in the data were observed from the suspected-OSA group for these variables.

Insert Table 2 and Figures 1 & 2 here

Meanwhile, in addition to a significantly smaller average, participants in the OSA group also demonstrated a much greater range in mean sleep efficiency across the data collection period compared to the non-OSA group (Figure 3).

Insert Figure 3 here

Affect data

Participants completed 97% of the twice-daily questionnaires, and only 1.3% of these were not fully completed. Nine participants completed the questionnaires online, which prevented retrospective recordings of missed affect measurements. Ten preferred to complete the questionnaire within a paper booklet and were asked to not record missed affect measurements retrospectively.

Again, statistical comparisons were possible due to the quantity of data captured. None of the findings regarding differences in positive or negative affect were statistically significant although group differences mostly reflected medium to large effect sizes (Table 3). The non-OSA group recorded greater instability and greater extremes of affect change for both positive and negative affect. As can be seen in Figure 4, the suspected-OSA group reported a greater range of positive affect scores whilst the non-OSA group reported a greater range of negative affect scores.

Insert Table 3 and Figure 4 here

As can be seen in Figure 5, the findings of greater overall instability and extremes of affect change in the non-OSA group were likely to have been influenced by one participant demonstrating extreme instability

in their affect data (graphs depicting the positive affect scores for this participant and the participant who demonstrated the least positive affect instability can be compared in Appendix A, noting the difference in the y axes). These data points were not removed due to a preference to present all data captured due to the small sample and the possibility that the data reflects genuine levels of affect instability rather than recording error.

Insert Figure 5 here

Discussion

To our knowledge, this is the first study utilising EMA to study sleep and affect instability between groups of people with a BD diagnosis with and without suspected-OSA. It was predicted that people with suspected OSA and a BD diagnosis would experience more sleep and affect instability and greater extremes of negative and positive affect change. Notably, recruitment was limited by the COVID-19 pandemic (Bavel et al., 2020) and so conclusions from the study need to be considered with caution.

Contrary to predictions, greater instability was found in total sleep time (albeit reflecting a small effect size) and in positive and negative affect (medium-large effect sizes) for the non-OSA group. This group also demonstrated greater extremes of affect change (differences reflecting medium to large effect sizes). None of these differences were statistically significant. Although also not statistically significant, the suspected-OSA group demonstrated greater instability in wake after sleep onset (large effect size), and statistically significant lower levels of sleep efficiency with the difference reflecting a large effect size ($d = -1.15$).

The suspected-OSA group demonstrating significantly reduced sleep efficiency means participants in this group spent less time asleep relative to the time they spent in bed. This group also slept for less time on average and spent more time awake after sleep onset; although the differences were not statistically significant, these differences reflect large effect sizes. It is conceivable that sleep efficiency is likely to be reduced for people with OSA by the frequent awakenings caused by apnoeas (Broström et al., 2007; Jordan et al., 2014; Redline et al., 2004). However, there is a lack of research around this. Some findings suggest even those with severe OSA may be considered to have typical sleep efficiency, and that this doesn't change with OSA treatment (Batoool-Anwar et al., 2014; Loredó et al., 1999). Other findings suggest that OSA

severity is somewhat linked to reductions in sleep efficiency, increases in wake after sleep onset, and reductions in slow wave and rapid eye movement sleep (Redline et al., 2004).

Meanwhile, less sleep efficiency and total sleep time for people with OSA are linked to the absence of excessive daytime sleepiness (EDS) (Mediano et al., 2007; Roure et al., 2008). Although the mechanisms behind this are currently unknown, it is suspected that increased sleep efficiency and sleep time may be a consequence of EDS. The baseline ESS (Johns, 1991) scores captured suggested that EDS was not characteristic of the suspected-OSA group. Whilst EDS is common in populations with OSA, it is not invariably present, with prevalence findings ranging from 15.5- 87.2% (Mediano et al., 2007; Seneviratne and Puvanendran, 2004; Young et al., 1993). Therefore, it is possible that a suspected-OSA group with higher levels of EDS may not have exhibited significantly reduced sleep efficiency. Whilst it is conceivable that the presence of OSA may exacerbate circadian rhythm abnormalities in people with a BD diagnosis, further research is required to determine how this may manifest.

The findings may provide preliminary evidence that the presence of OSA exacerbates the reduced sleep efficiency and longer wake after sleep onset, with more instability, previously observed in people with a BD diagnosis (Gershon et al., 2012; Harvey et al., 2005; Sylvia et al., 2012). More people in the suspected-OSA group met PSQI criteria for being “poor sleepers” (Buysse et al., 1989) in addition to demonstrating more mean time spent awake after sleep onset and greater instability in this. However, whilst reduced mean time asleep and increased mean time awake after sleep onset was expected in the suspected-OSA group, due to apnoeas causing frequent awakenings (Broström et al., 2007; Jordan et al., 2014; Redline et al., 2004), more instability in average total sleep time in the non-OSA group (albeit reflecting a small effect size) was contrary to predictions. This finding could provide preliminary evidence to suggest that the presence of OSA may in fact restrict rather than exacerbate instability in total sleep time. Although the median for instability in total sleep time was higher in the suspected-OSA group, a much smaller range in instability was observed. Perhaps the presence of apnoeas constrains total sleep time such that people with OSA and a BD diagnosis consistently sleep for a certain amount of time, which is less than those without OSA. Meanwhile, differing

lengths of time in bed would result in the predicted increased instability in time spent awake after sleep onset observed in this group. If these preliminary findings were found to be replicable, it would be significant to tailoring interventions intending to stabilise circadian rhythms for people with BD and OSA. Therefore, further research with a larger cohort is necessary.

Although involving a similarly small number of people with OSA and a BD diagnosis, Krane-Gartiser et al. (2016) categorised six people with a BD diagnosis, who also happened to have moderate OSA, as demonstrating “stable” circadian rhythms when “inter-episode” based on actigraphy data. Meanwhile, three other people with a BD diagnosis, who also happened to have moderate OSA, were categorised in the “unstable” group. The study found circadian instability to be significantly related to mood instability, in addition to younger age. Their participant groupings suggest that not all people with a BD diagnosis, particularly those in the age range of the current study, may demonstrate circadian instability when “interepisode”. Moreover, OSA may not exacerbate circadian instability for people with a BD diagnosis. Their findings could link to the current study’s findings of no significant differences in instability being detected between groups. However, Krane-Gartiser et al. (2016) also acknowledge a small sample size, in addition to a short data collection period (1 week), as limitations to application of their findings, highlighting the need for further research.

The current findings are also consistent with previous findings of high levels of sleep disturbance in individuals with a BD diagnosis, even between periods of acute mood experience (e.g. Harvey et al., 2005). The average PSQI score for both groups was above 5, with 75% of the suspected-OSA group and 50% of the non-OSA group meeting this criteria, which is considered indicative of clinically relevant sleep disturbance in general populations (Buysse et al., 1989).

This study’s findings do not suggest that affect instability is exacerbated by the presence of OSA when affect is measured using the PANAS. Greater affect instability and extremes of affect change were present in the non-OSA group, contrary to predictions. However, the study should be replicated with a larger sample to investigate this further, which would allow for enhanced methodology (see future directions). If

OSA exacerbates circadian rhythm abnormalities through disrupting the sleep cycle, impacting on sleep variables in the ways observed, this will conceivably exacerbate the increased affect instability identified in people with a BD diagnosis (Gershon et al., 2012; Gershon and Eidelman, 2015; Lovejoy and Steuerwald, 1995; Pandi-Perumal et al., 2020). Indeed, Gershon et al., (2012) found greater coupling of negative affect with sleep variables, specifically wake after sleep onset, for people with a BD diagnosis. Meanwhile, total sleep time was not found to significantly couple with affect variables. These findings are not consistent with those of the current study, indicating the need for further research.

The suspected-OSA group yielded a much greater range of average positive affect scores across the data collection period compared to the non-OSA group. However, the non-OSA group showed greater instability of positive affect with a large effect size. Therefore, despite the greater range of positive affect scores within the suspected-OSA group, scores in this group were detected to have a higher dependency on previous scores, suggesting a more stable experience of affect. If this finding were to be replicated this could be an avenue that warrants further research towards understanding how OSA may affect people with a BD diagnosis.

Statistical comparisons of baseline demographic and clinical data between groups were not feasible due to the small cohort size. However, observations from eyeballing the data suggest that the suspected-OSA group received their BD diagnoses earlier in life than the non-OSA group. Earlier recognition of difficulties is linked to more life-long difficulties and co-morbidities (Joslyn et al., 2016; Suominen et al., 2007). Meanwhile, a greater proportion of the suspected-OSA group were diagnosed with a type 1 BD diagnosis, which is also associated with a higher severity of difficulties (Belmaker, 2004). Therefore, these preliminary observations should inform future research as they may suggest that difficulties diagnosed as BD present earlier and more severely in people who also have OSA. Alternatively, suspected-OSA may have resulted from longer exposure to potentially higher doses of medication (Gupta and Simpson, 2015; Kelly et al., 2013). Future research benefitting from larger cohorts should compare medication history between those with OSA and those without.

Limitations and Strengths

The small resultant sample limits the generalisability of the findings. Meanwhile, participants did not all complete the study during the same 14-day period. It is therefore possible that the changing climate around the COVID-19 pandemic (Bavel et al., 2020) may have acted as a confounding variable as some participants, primarily in the suspected-OSA group, needed to shield or remain at home more towards the end of the wider data collection period. Increased anxiety is also known to impact sleep and affect variables (Egloff et al., 2006; Spoormaker and Van Den Bout, 2005). One participant also reported a family illness affecting them during the two weeks they were contributing data. These unavoidable idiosyncrasies in circumstance are likely to have had more of a confounding effect on the findings in such a small cohort, particularly as it is anticipated that people with a BD diagnosis are more affectively reactive to environmental stressors (Myin-Germeys et al., 2003). Lastly, whilst the PANAS (Watson et al., 1988) has been used previously in EMA studies with people with a BD diagnosis (Gershon et al., 2012; Gershon and Eidelman, 2015; Lovejoy and Steuerwald, 1995), it is arguably a limited measure comprising only 20 items, necessitated by the trade-off between breadth of data collection and participant burden (Gershon and Eidelman, 2015).

However, the current study is the first to investigate the impact of OSA on people with a BD diagnosis. This was also the first study to utilise the PAC index to investigate extremes of affect change in this population. The indices of instability used determined the data's independence from timing and previous and subsequent data. The study provides further evidence of the feasibility of EMA methodology in this area as all participants successfully wore an actigraph for two weeks and completion of twice-daily affect measures was very high, potentially facilitated by participants being given the option to complete these measures on paper or electronically. A further methodological strength was addressing the low levels of specificity achieved using the STOP-Bang (Chung et al., 2016, 2008) assessment for suspected-OSA through also utilising an oximeter as an objective measure. The overnight oximeter test supported the validity of the criteria used to identify participants with suspected-OSA.

Clinical implications

Despite the acknowledged limitations, the findings suggest OSA may in some way contribute to difficulties diagnosed as BD presenting earlier and more severely. Furthermore, OSA may constrain total sleep time, potentially impacting on the effectiveness of many interventions intending to regulate circadian rhythms, such as IPSRT (Frank et al., 2000). Given the high prevalence of OSA for people with a BD diagnosis, it is of great importance that research and practice advances to enhance recognition of OSA in this population so that it can be appropriately managed in the context of other difficulties. Positive airway pressure (PAP), the first-line treatment for OSA (Engleman et al., 2002), is generally not well tolerated (Weaver and Grunstein, 2008). Conceivably, the difficulties around PAP use are likely to be further exacerbated by the emotional instability experienced by people with a BD diagnosis without sufficient evidence-based support. If tolerated, CPAP treatment is effective (Giles et al., 2006) and therefore may reduce difficulties experienced by people with OSA and a diagnosis of BD.

Future directions

The current study has highlighted many relevant avenues for future research to inform research and clinical practice. In addition to avenues already mentioned, the current methodology could be enhanced in the following ways. Based on the current study's high levels of data capture, it may be possible to utilise a more detailed measure of affect. The PANAS-X (extended version; Watson and Clark, 1994) has been used to enhance the measurement of negative affect through creating subscales for hostility, fear and sadness (Jahng et al., 2011). Future studies with larger cohorts could utilise similarly enhanced affect measurement to formulate the impact of sleep on affect instability utilising statistical multilevel modelling (Jahng et al., 2008). Furthermore, future studies could advance understanding around the high occurrence of OSA in people with a BD diagnosis through comparing participant body mass index, in addition to a more detailed medication history than the current study. Meanwhile, future replications should record any major life occurrences during data collection so they can be controlled for during analyses. Lastly, a further improvement on the current design would be to test for the absence as well as the presence of OSA.

Although the overnight oximeter test corroborated the suspected presence of OSA, due to limited resources, no participants in the non-OSA group were tested to objectively explore this difference between the groups.

In conclusion, the study aimed to investigate any difference in sleep and affect instability, and extremes of affect change, between a group suspected of having OSA and a group with a BD diagnosis alone. The only significant difference between groups was reduced sleep efficiency in the suspected-OSA group, which reflected a large effect size. Whilst the small resultant sample size limits the interpretations and conclusions that can be drawn from this study, there remains a strong clinical rationale for future replications and further research in the area to inform clinical practice.

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Tables and Figures in Order of Reference in the Paper

Table 1

Baseline Demographic and Clinical Data

Categorical variable, N	Suspected-OSA group (n=12)	Non-OSA group (n=6)
Female sex	6	3
BD type 1 diagnosis	6	1
BD type 2 diagnosis	2	3
Unspecified BD diagnosis	4	2
Diagnosed 2-5 years ago	0	1
Diagnosed 6-10 years ago	4	1
Diagnosed 11-15 years ago	2	2
Diagnosed 16+ years ago	6	2
Taking psychiatric medication:	11	6
Antidepressant medication	6	4
Antiepileptic medication	5	2
Antipsychotic medication	8	5
Currently working	3	2
Bed partner (partner/roommate in separate room)	5 (1)	1 (0)
Continuous variable, Mean, (SD)	Suspected-OSA group (n=12)	Non-OSA group (n=6)
Age	46.92 (7.73)	54.83 (9.62)
ESS ^a total score	7.92 (3.37)	6.50 (4.59)
PSQI ^b total score	8.92 (4.70)	7.17 (3.19)
Total current sleep problems identified from DSI ^c	1.92 (3.12)	.17 (.41)
Total past sleep problems identified from DSI ^c	3.83 (3.69)	2.00 (3.46)
7 up total score	10.17 (3.16)	11.17 (5.12)
7 down total score	10.25 (6.05)	12.50 (8.17)

Note. SD= standard deviation.

^aEpworth Sleepiness Scale (Johns, 1991).

^bPittsburgh Sleep Quality Index (Buysse et al., 1989).

^cDuke Structured Interview Schedule for Sleep Disorders (Edinger et al., 2004).

Table 2

Sleep Data and Measures of Instability by Grouping

Sleep variable, Mean (SD) <i>median</i>	Suspected-OSA group (n=11)	Non-OSA group (n=6)	Statistical comparison, t	Cohen's <i>d</i>
Minutes slept				
Mean	321.84 (58.85) <i>316.98</i>	363.59 (70.08) <i>364.34</i>	1.31	-.62
MSSD ^a	15998.14 (11575.62) <i>14946.98</i>	18064.91 (13519.47) <i>12439.54</i>	.33	-.16
Minutes awake				
Mean	141.93 (53.68) <i>148.69</i>	98.22 (37.35) <i>102.46</i>	1.76	.85
MSSD	8638.52 (5418.81) <i>7804.14</i>	4361.50 (3624.96) <i>3485.29</i>	1.72	.83
Sleep efficiency				
Mean	.71 (.08) <i>.71</i>	.80 (.06) <i>.79</i>	2.40*	-1.15

Note. SD=standard deviation, * indicates p<.05

^aMSSD can be expressed in minutes by calculating the square root (rMSSD; e.g. MSSD=14400, rMSSD=120 minutes). For interpretation, total instability is indicated when MSSD=2SD² (Neumann et al., 1941).

Figure 1

Box Plots Depicting Mean and MSSD for Total Sleep Time Between Groups

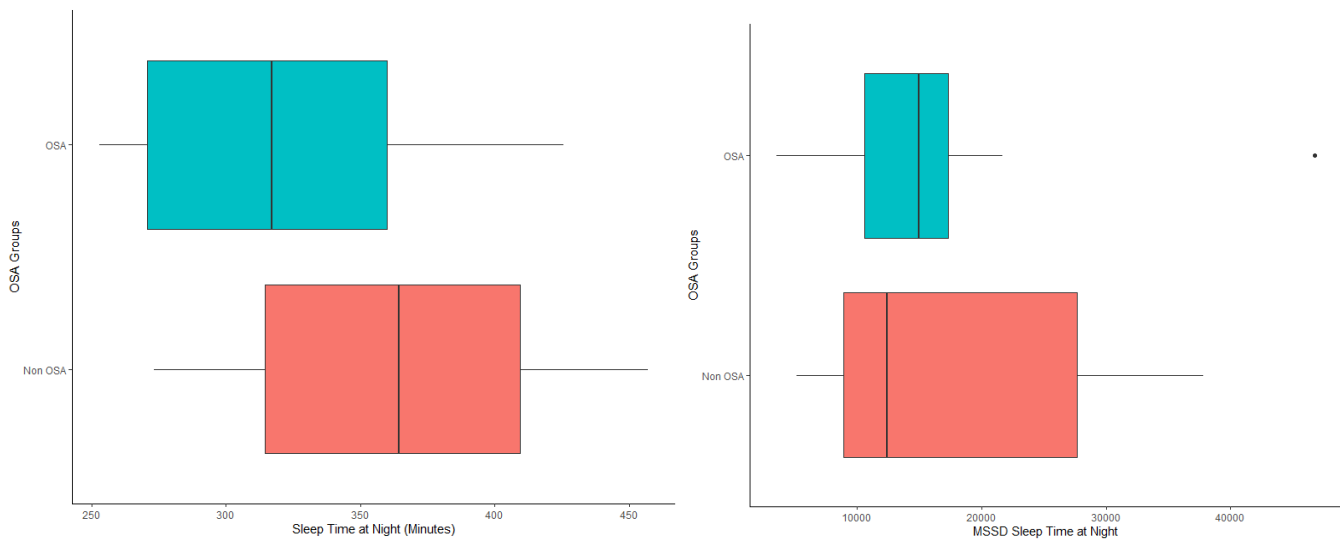


Figure 2

Box Plots Depicting Mean and MSSD for Time Spent Awake after Sleep Onset Between Groups

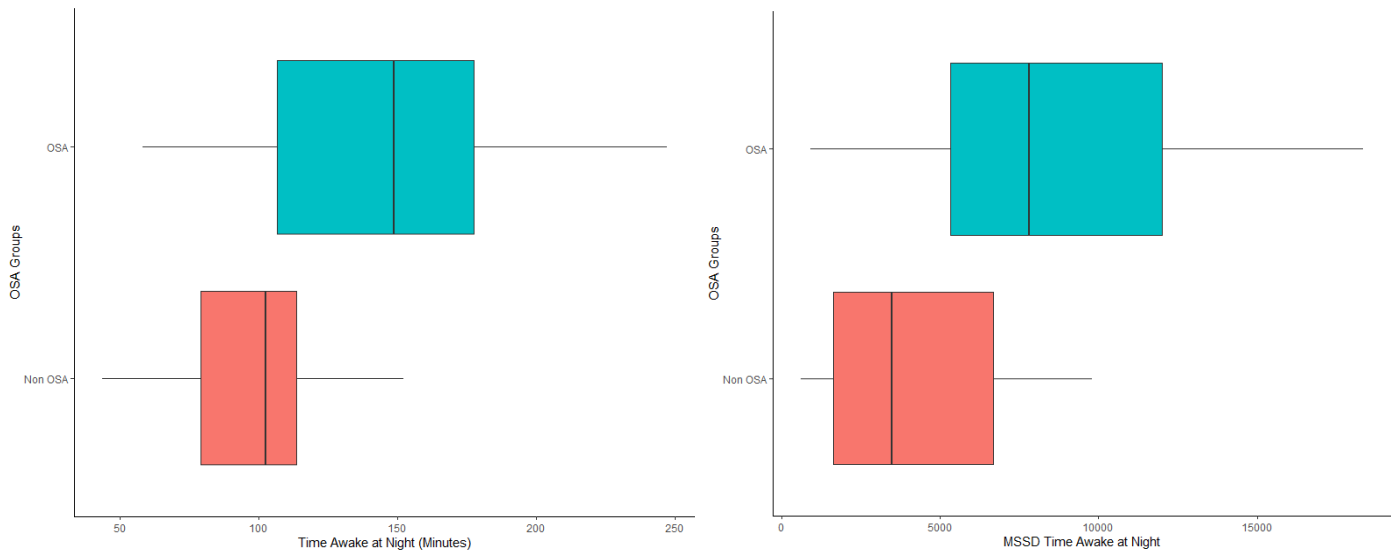
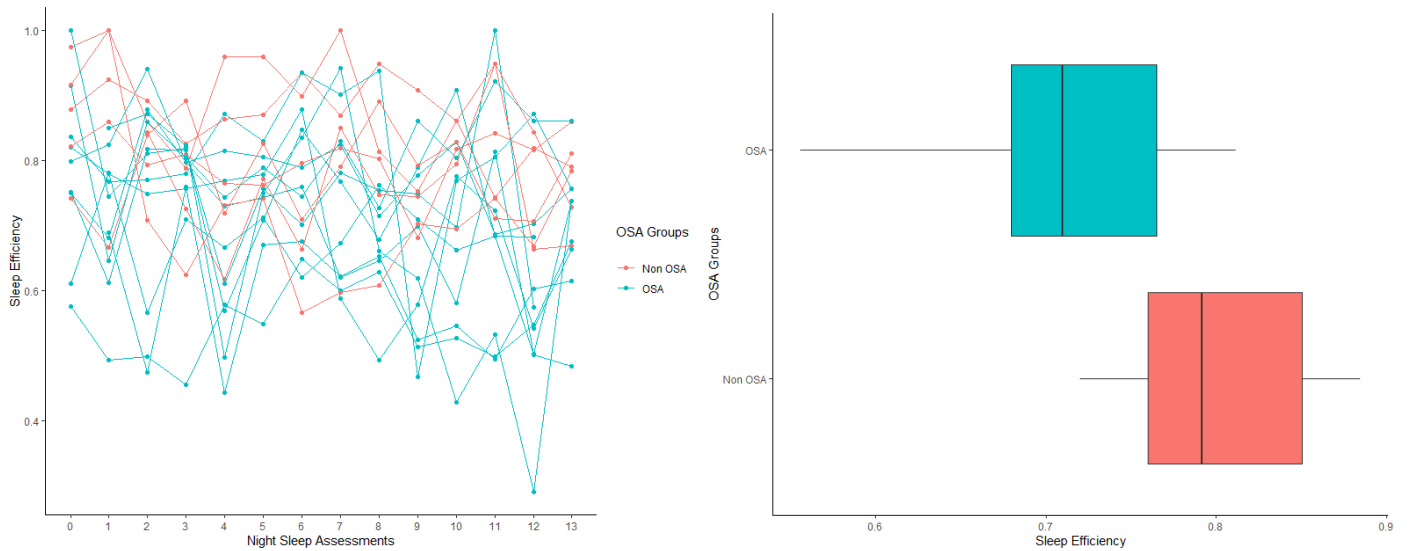


Figure 3

Line Graph Depicting Individual Sleep Efficiency^a and Box Plot Depicting Mean Sleep Efficiency



^asleep efficiency=total sleep time/time spent in bed

Table 3

Affect Data and Measures of Instability by Grouping

Affect variable, Mean (SD) median	Suspected-OSA group (n=12)	Non-OSA group (n=6)	Statistical comparison, t	Cohen's <i>d</i>
Positive affect				
Mean	12.30 (7.68) 10.28	13.29 (6.50) 12.05	.27	-.13
MSSD ^a	45.31 (29.40) 41.07	93.84 (95.83) ^{b1} 49.79	1.65	-.76
PAC (1SD)	.14 (.07) .17	.22 (.12) .19	1.80	-.84
PAC (2SD)	.03 (.03) .00	.07 (.09) .04	1.43	-.66
Negative affect				
Mean	2.67 (1.85) 2.36	5.16 (3.55) 4.21	1.99	-.92
MSSD	13.13 (12.60) 7.28	32.64 (38.87) ^{b2} 20.52	1.62	-.75
PAC (1SD)	.15 (.11) .15	.20 (.10) .19	.93	-.44
PAC (2SD)	.06 (.08) .04	.09 (.09) .08	.72	-.34

Note. SD=standard deviation, * indicates p<.05

^aMSSD can be interpreted by calculating the square root (rMSSD; e.g. MSSD=49, rMSSD=7 points), if =2SD around the mean, this indicates total independence in the series (Neumann et al., 1941).

^{b1-2}high SD due to very high instability recorded by one participant (see Figure 5 and Appendix A). If participant removed ^{b1}mean=55.45 and ^{b2}mean=17.62 (insignificant differences between groups remain).

Figure 4

Line Graphs Depicting Individual Scores of Positive and Negative Affect

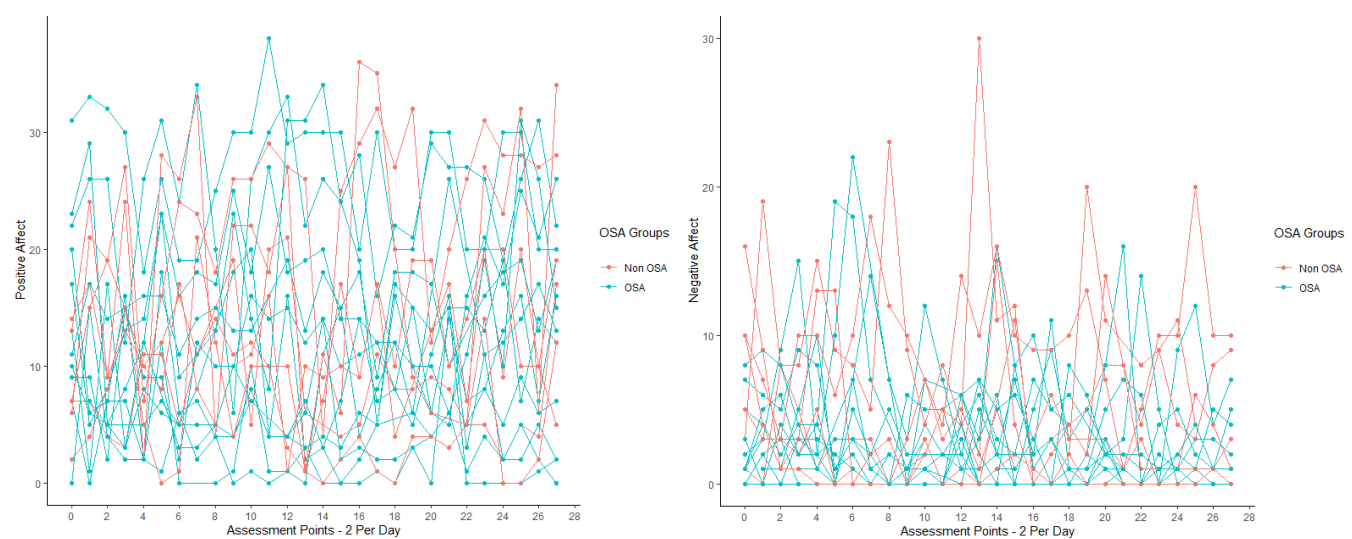
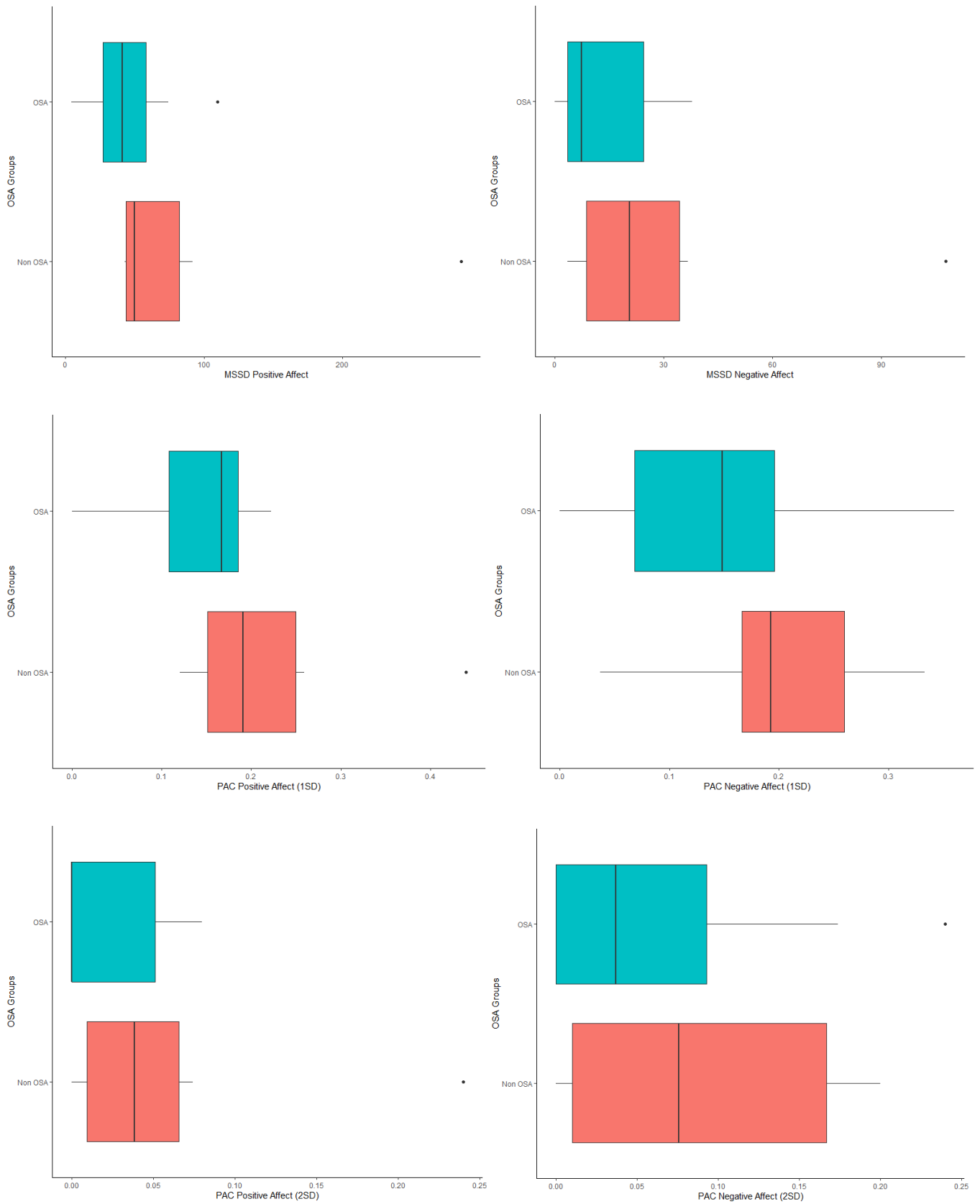


Figure 5

Box Plots Depicting MSSD and PAC for Mean Positive and Negative Affect Between Groups



Appendix A

Figure A1

Line Graph Depicting the Individual Positive Affect Scores for the Participant who Demonstrated the Highest Affect Instability

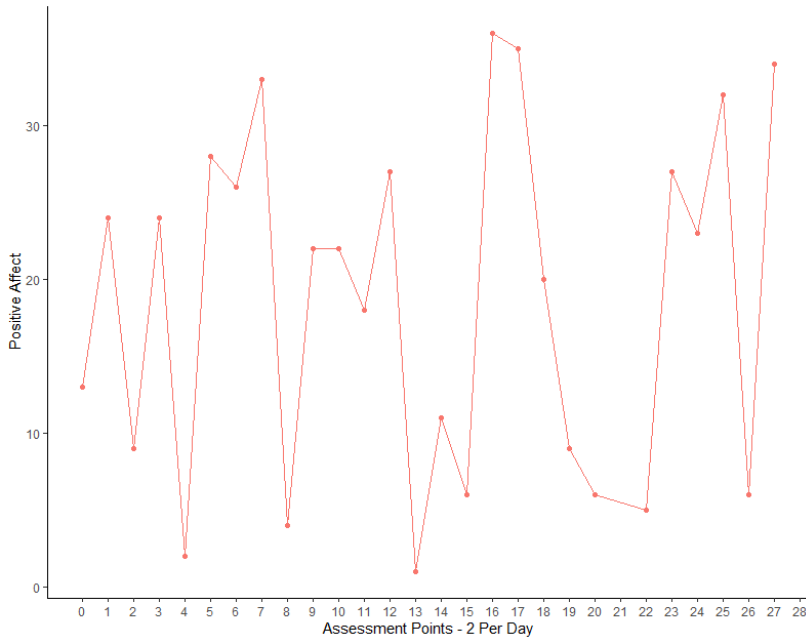
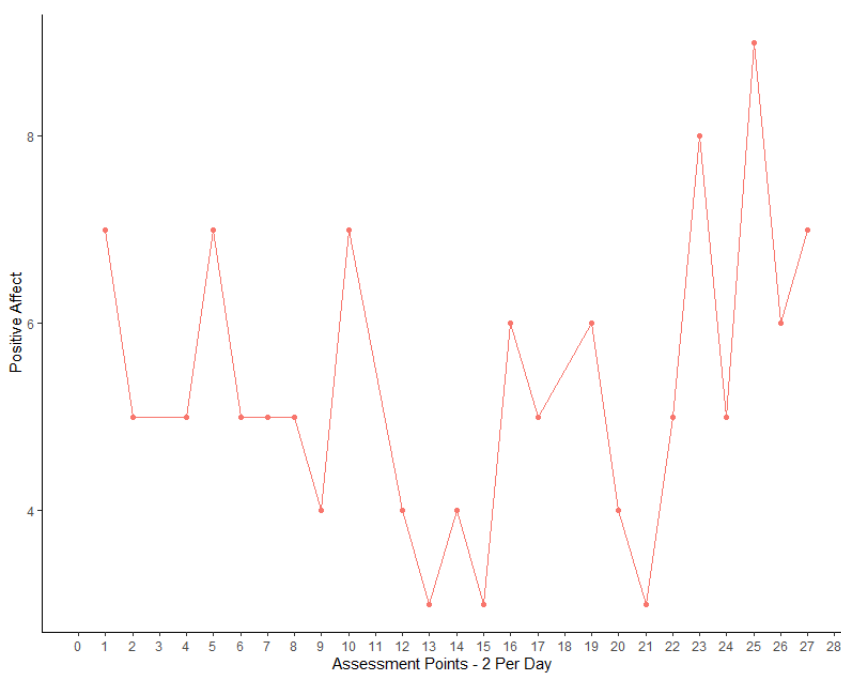


Figure A2

Line Graph Depicting the Individual Positive Affect Scores for the Participant who Demonstrated the Least Affect Instability



Appendix B

Submission Guidelines (Guide for Authors) for Journal of Affective Disorders

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Chapter 3: Critical Appraisal

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The subjects of both the empirical paper and systematic literature review were motivated by the wider clinical issue of the impact of sleep arguably being under-recognised in both research and clinical practice. This issue is discussed here in relation to the clinical applications of the thesis findings. The research is perhaps particularly timely given the anticipated release of a new clinical guidance from the National Institute for Health and Care Excellence (2020) around obstructive sleep apnoea (OSA), which has been delayed until further notice due to the COVID-19 pandemic (Bavel et al., 2020).

This critical appraisal also contains further considerations around the research project that informed the empirical paper of this thesis. Further evaluation of the study and discussion of the ethical considerations that arose for the author during its completion are presented. Therefore, a summary of the findings from both the empirical paper research study and systematic literature review are presented below before discussion around the following topics: evaluation of the empirical research project, ethical challenges and considerations surrounding the empirical project, and the clinical issue of sleep.

Empirical Paper Summary

This study aimed to investigate whether people with suspected-OSA and a bipolar disorder (BD) diagnosis experience more sleep and affect instability when “inter-episode” compared to people with a BD diagnosis alone. Ecological momentary assessment was used across a two-week data collection period to evaluate potential differences between groups in instability of quantitative sleep and affect measures. The groups were not found to significantly differ other than suspected-OSA group demonstrating reduced sleep efficiency. As only 48% of the intended sample was successfully recruited, much exploration of the data was approached descriptively. The findings may provide preliminary evidence to suggest that OSA may in some way contribute to difficulties diagnosed as BD presenting earlier and more severely. Furthermore, and contrary to predictions, OSA may constrain instability in total sleep time. Despite the limitations presented by the small resultant sample size, the protocol achieved high data capture and the findings highlight many relevant avenues for future research to inform clinical practice.

Systematic Literature Review Summary

The aim of the review was to synthesise user experience of PAP to address the notable absence of users' voices in the literature and to inform how PAP usage could be improved. PAP is the first-line treatment of OSA (Engleman et al., 2002) but sub-optimal use continues to be a major challenge to effective treatment. Although extensive quantitative research has been conducted into factors that impact PAP use, it is estimated that at least half of users do not use it as prescribed (Weaver and Grunstein, 2008). Meanwhile, the individual, societal and financial impacts of untreated OSA make effective treatment a priority (Knauert et al., 2015; Tarasiuk and Reuveni, 2013). Therefore, a systematic review and metasynthesis of qualitative experiences of using PAP was warranted. Twenty-five papers reporting on global, but largely Western, research were appraised and included. The findings highlighted existing barriers to PAP use at a healthcare service level, the need for a biopsychosocial approach and that long-term person-centred support is necessary to enhance PAP use.

Evaluation of the Empirical Research Project

The research project was the first study to investigate the impact of OSA on people with a BD diagnosis with the intention of informing enhanced awareness, assessment and treatment. Although the scope of the findings was unfortunately limited due to time constraints and the COVID-19 pandemic, a strong clinical rationale for further research remains. The author hopes that the preliminary findings from the current study will inform such efforts.

One contribution of the study is a study protocol that yielded high levels of data capture. All participants wore an actigraph for a total of 14 days (15 nights). Moreover, all except one participant contributed to completing 97% of the twice-daily questionnaires and only 1.3% of these were not fully completed. Of course the individual reasons for the commitment shown by participants should not be reduced to the effectiveness of a protocol. However, participants were invited to give feedback on their experience of the study, the results of which suggested that a structure of "checking in" on feelings twice a day was experienced as helpful. Moreover, despite suggestions that the Positive and Negative Affect Scale (PANAS; Watson et al., 1988) may be too lengthy for participants to complete frequently and/or over long

periods (Gershon and Eidelman, 2015; Thompson, 2007), participants reported that they did not find the measure too onerous. Furthermore, the option to complete the PANAS electronically via an email link, enabling participants to complete it on their preferred device, was cited as convenient for participants. It seems important to note that the majority of participants did not have employment responsibilities throughout the data collection period, which may have facilitated data capture. However, these informal findings support the feasibility of high data capture through replicating the protocol, or perhaps even through enhancing affect measurement. For instance, the PANAS-X (extended version; Watson and Clark, 1994), which comprises of an additional 40 items to the PANAS, has been used to enhance the measurement of negative affect through creating subscales for hostility, fear and sadness (Jahng et al., 2011). Utilising a similar methodology to this in future research with a larger cohort would not only enable use of more complex analytical models to further explore the relationship between sleep and affect instability, but respond to feedback. Participants reported that they did not always feel their current feelings could be fully captured by the 20 feelings included in the PANAS (Watson et al., 1988), particularly when they were feeling low or sad. Moreover, some participants wished to be able to provide qualitative information on their identified reason(s) for their current feelings. Providing this opportunity to participants in future replications would somewhat, albeit analytically challenging, enable controlling for the impact of extraneous life events during the data collection period when not doing so was identified as a limitation of the current study.

A further perceived strength of the protocol was the multiple opportunities to develop a rapport with participants. Firstly, due to the relative complexity of the study, a video version of the participant information sheet was made available online (<https://youtu.be/yFb1jPqsvso>) to convey details of the study in an accessible and engaging manner. Additionally, it was hoped that participants might feel more of a connection with the study and the chief investigator, increasing participant uptake. The author, and chief investigator, found the video facilitative of adding enthusiasm and engagement to the recruitment process. Secondly, all participants were screened over the phone, providing a further opportunity to develop a rapport. Lastly, the chief investigator personally delivered and collected the overnight test equipment, and

actigraphs in some cases, to participants who lived in the North West of England. It is believed that these opportunities to develop a rapport with participants may also have contributed to the high data capture through participants feeling connected to the study. Indeed, participant feedback included positive comments about the information video, interactions with the chief investigator and enjoyment of taking part in the study. The author also felt these interactions with participants added an aspect of human connection to the study. Participants were found to be very passionate about “putting BD on the map” in terms of research, increasing awareness of the link between OSA and a BD diagnosis, and keen to discuss this with similarly motivated people. The author gained the impression that this was an area in which participants had wanted to see increased awareness for some time, leading to them being highly motivated to participate. It is recommended that similar opportunities for rapport building with participants be maintained in future replications. However, the time commitment this will require if intending to recruit a larger sample is also worth considering.

Necessary considerations for future replications also include recruitment strategy and necessary ethical approval procedures. The current study received ethical approval through the National Health Service (NHS) and Health Research Authority so the study could be advertised through a local mental health service commissioned specifically for people with a BD diagnosis, in addition to other methods. It was considered that the increased recruitment opportunities arising from advertising the study through the NHS would compensate for any reduction in the length of the possible recruitment period resulting from the more detailed ethical approval procedure. However, only one participant was successfully recruited through advertisement in local services, the reason for which is unclear. All other participants responded to an email advert sent to the Spectrum Centre for Mental Health Research mailing list. No participants were recruited through advertisement via social media. This finding suggests that potential research participants in this population are most successfully recruited when they have previously expressed an interest in participating in research. Moreover, the majority of participants’ pre-existing interest in participating in research may also have contributed to the high levels of data capture.

Finally, participant responses in the current research potentially highlighted a need for future research to carefully consider the interpretation of the last question on the STOP-Bang questionnaire (Chung et al., 2016) if using to screen for risk of OSA. Participants are asked if their gender is male as affirmative answers to this question have been linked to a higher risk of OSA (Chung et al., 2016, 2008). Previous research has not differentiated biological sex with gender identification due to the terms gender and sex being used synonymously (Jordan et al., 2014; Pillar et al., 2000). However, one participant in the current study provided different answers to the question around sex included in the demographic questionnaire and the gender question of the STOP-Bang. Fortunately, this participant's group allocation would not have been altered by different interpretations of the gender question on the STOP-Bang questionnaire and so further consideration was not required in this instance. However, as biological sex and gender identity are not synonymous (Unger, 1979), future research should ensure to clarify the intended interpretation of this question for standardisation.

Ethical Challenges and Considerations Arising from the Research Study

The following ethical considerations arose for the author when undertaking the study that also should be considered prior to replications. The author noticed that although participants had provided informed consent, it sometimes felt uncomfortable administering the Mini International Psychiatric Interview (MINI; Sheehan, 2016) over the telephone upon speaking to participants for the first time due to the sensitive nature of the questions. All participants but one chose to conduct the screening interview over the phone, and the one attempt to videoconference was unsuccessful and phone had to be used instead. However, it was considered that conducting the screening interview over videoconference might enable a faster development of a comfortable rapport with clients. On the other hand, although participants were assured they did not need to answer all questions if they did not feel comfortable to do so, only one participant conveyed discomfort at answering some of the questions. In this instance, the participant described the questions in section I of the MINI as vague and difficult to answer, which was being used to ensure participants' alcohol intake was not likely to be affecting their sleep. The author noticed a reluctance to ask participants all the

questions in sections I if participants had answered “yes” to I1 (“In the past 12 months, have you had 3 or more alcoholic drinks, - within a 3 hour period, - on 3 or more occasions?”) but “no” to the first few questions in the next section, I2 (e.g. “During the times when you drank alcohol, did you end up drinking more than you planned when you started?” and “On the days that you drank, did you spend substantial time obtaining alcohol, drinking, or recovering from the effects of alcohol?”). The author reflected that culturally, an affirmative answer to I1 is likely to be considered a social norm, yet then being asked a further 12 follow up questions may challenge this norm, potentially generating discomfort for participants. No potential participants had to be excluded based on the outcome of the screening process. Therefore future replications may instead consider simply asking participants if they have a diagnosis of, or consider themselves to have, a substance use difficulty, or if they consider their substance use will likely impact their sleep during the data collection period. Alternatively, to ensure scientific rigour, researchers can assure participants of the standardised nature of the screen and that every question needs to be asked regardless of previous answers in some cases.

The author was also aware of “pulls” towards the position of a clinician over a researcher during the telephone screen. As discussed above, the administration of the MINI (Sheehan, 2016) involved asking participants for sensitive information that was sometimes accompanied by understandable levels of distress. These situations required the author to use their clinical skills in sitting with and containing distress. However, it was noted that these skills and the instinct that accompanies them, e.g. not to move the conversation away from difficult emotions, often juxtaposed with the research agenda of continuing with the screening questions. Therefore, some telephone screenings were much lengthier than others to allow for what felt like an appropriate balance of these positions and skills in order to maintain rapport with participants.

Moreover, the author also noticed discomfort around informing participants in the suspected-OSA group that they were considered likely to have OSA, particularly when the oximeter results supported this. It was stipulated in the participant information sheet that the author was not qualified to diagnose OSA and

participants in the suspected-OSA group were provided with a letter detailing the results of the screening questionnaires, and oximeter results if applicable, which they were advised to share with their GP. As the results did not constitute a diagnosis, the author did not initially consider the communication of the oximeter results, and began sending these to participants via email. However, the author reflected that this may be difficult news for some participants to receive and considered that it may have been more sensitive to ask participants if they would prefer the results to be initially delivered via phone call or email. On the other hand, no participants appeared to become distressed by the results, as far as this could be ascertained, as many seemed relieved to have evidence that supported their suspicions that they could have OSA. The author also reflected on their clinical role rarely involving providing diagnoses, or information suggestive of a diagnosis, which may have generated a discomfort for the author not shared by participants.

Notably, a couple of participants were concerned that they had OSA and expressed surprise and disappointment when they did not meet the criteria for the suspected-OSA group. For instance, one participant was experiencing waking up in the night and not breathing, yet did not endorse any further signs of OSA. These participants were also offered GP letters with their screening results and were advised to consult with their GP if they were concerned. These experiences suggested to the author that participants were perhaps more likely to take part in the study if they suspected they had OSA, and perhaps hoped that the study may confirm their suspicions and facilitate formal investigation by their GP. Research has found that access to sleep clinic assessments of OSA in the UK is incredibly limited (Flemons et al., 2004). Moreover, the thematic synthesis conducted as part of this thesis revealed that GPs can have limited awareness of OSA, limiting the accessibility of referrals to sleep clinics. The author had noticed being surprised at recruiting more people meeting the criteria for the suspected-OSA group, as they had expected around the estimated 25% of people with a BD diagnosis (Stubbs et al., 2016) to meet the criteria. However, anecdotal information from participants supported the finding from the thematic synthesis; the study potentially provided participants with recognition of their potential OSA that they were struggling to receive elsewhere. This advantage provided by the study may explain why more participants with suspected-OSA

were recruited. These findings are therefore worth bearing in mind when recruiting for future replications as it is possible that there is less incentive for people who do not suspect they have OSA.

Providing reimbursement that reflects the time commitment requested of participants may reduce the imbalance in incentive to take part for people with and without suspected-OSA, in addition to facilitating recruitment generally. The author noticed feeling very uncomfortable asking participants for the necessary time commitment for the study without being able to offer representative reimbursement. Most participants appeared eager to contribute their time because they were committed to furthering research in the area. Only one participant raised the issue of the imbalance between participant time and the only reimbursement being a prize draw for a £50 Amazon voucher. However, this participant was happy to participate when the limited funding for the study was explained. It is therefore difficult to know if recruitment outcomes would have been altered by more proportionate participant reimbursement but it is hoped that future replications may not have to rely so much on participant's personal motivation and commitment to the subject.

The last ethical consideration that arose for the author was noticing an imbalance in disclosure between themselves and some participants. Both the paper and electronic versions of the PANAS appeared to lead some participants to wish to contextualise their scores with the author. Some participants enclosed letters within the paper diary, offering more information about their personal circumstances. Meanwhile others, who were providing their responses online, sent emails or texts to the researcher to contextualise their scores that day, as though they anticipated the author was receiving and interpreting the scores live. These experiences made the author reflect on the potential perceived intimacy of the design for some participants and that this requires sensitive consideration and management. For instance, one participant continued to contact the author intermittently after their data collection period to provide updates on their wellbeing, reflect on their perceived value of the study and enquire about progress towards the study's findings. The author wondered if this was perhaps due to the participant feeling a loss following perceived disclosure and interest in their feelings twice a day for two weeks, or due to the context of the COVID-19 pandemic lockdown (Bavel et al., 2020) and the participant's understandable interest in how this had affected the

study. These increased interactions from what the study design intends may also result from the rapport established between researcher and participants. It is felt that it is therefore important to assure participants in future replications that PANAS scores are not interpreted individually and therefore do not need to be contextualised in the hopes this will prevent unnecessary effort and disclosure on behalf of participants.

The Clinical Issue of Sleep

The topics of both the empirical paper and systematic literature review were informed by the current clinical issue that the contribution of sleep to clinical presentations is under recognised in both research and practice. Sleep difficulties, OSA and insomnia being the most common, are believed to be some of the most prevalent complaints in primary health care settings (Chai-Coetzer et al., 2015; Morin and Benca, 2012; Morphy et al., 2007; Shochat et al., 1999). Meanwhile, sleep difficulties have been linked to most mental health difficulties (Baglioni et al., 2016), a plethora of physical health conditions (Barone and Menna-Barreto, 2011; Shamsuzzaman et al., 2003; Shi et al., 2018) and have even been found to mediate the impact of socioeconomic status on wellbeing (Demakakos et al., 2008). However, it is recognised that sleep complaints are under recognised and poorly understood by healthcare professionals worldwide (Fuhrman et al., 2012; Gibson, 2004; Kapur et al., 2002; Tufan et al., 2017; Wilson et al., 2019).

This lack of awareness is perhaps unsurprising given the extremely limited training on sleep difficulties provided. Romiszewski et al. (2020) found that an average of only 3.2 hours were dedicated to teaching around sleep during UK medical courses and that sleep is not considered a core topic. Meanwhile, coverage of sleep and sleep difficulties during clinical psychology training is similarly limited, despite the role of psychology in treating sleep difficulties now being recognised as integral (Meltzer et al., 2009). The author became aware of this gap in teaching provision during their own training, alongside noticing a reluctance of their supervisors to support them to work with clients around their sleep on clinical placements.

It is the author's perception that as sleep is a universal human need, with recommended human sleep time comprising over a third human lifetimes (Hirshkowitz et al., 2015), the clinical significance of poor sleep is hugely under considered and under researched. Indeed, as there is still much that scientific enquiry is

yet to conclude about the purpose of sleep (Eidelman, 2002), perhaps this leads to the general avoidance of the topic in clinical fields. However, it can be argued that our understandings around mental health are far less established than the conclusion that a lack of quality sleep detracts both physical and mental health (Baglioni et al., 2016; Barone and Menna-Barreto, 2011; Grandner, 2012; Shamsuzzaman et al., 2003; Shi et al., 2018). Meanwhile, as the field of “sleep medicine” is arguably still in its infancy due to being under recognised and under resourced for many years (Romiszewski et al., 2020), the existing literature is predominantly medical. Therefore, the author was motivated to contribute research to further clinical recognition and management of sleep difficulties whilst also promoting the value of psychological principles in the area.

The thematic synthesis and empirical paper have generated both formal and informal findings that can inform clinical psychological practice. The thematic synthesis highlighted the importance of biopsychosocial understandings to improving PAP use. Therefore, psychological skills and understandings could be utilised at an individual and consultation level to achieve this. As current guidance around PAP does not detail psychological consultation or input (National Institute for Health and Care Excellence, 2008), this is an area of practice that needs to be targeted through further recognition and research. Anecdotally, the author is aware that very few (~40) clinical psychologists are commissioned to work into UK sleep clinics. Moreover, whilst the majority of sleep clinics are specifically commissioned to assess and treat respiratory sleep disorders, such as OSA, these services have even less psychological input than others.

Meanwhile, informal findings from the empirical project, as detailed above, support the findings from the thematic synthesis that people with suspected OSA can struggle to have their symptoms recognised and formally assessed. Furthermore, only two out of twelve people identified as having suspected-OSA had previously received investigation and a diagnosis. One of the participants with an existing diagnosis even reported that they had received their diagnosis following taking part in previous research around OSA. Therefore, there is certainly the clinical implication that OSA is under recognised in people with a BD diagnosis. Psychological practice can seek to improve recognition of OSA through biopsychosocial

assessment and formulation, which should include an individual's experiences of sleep. Meanwhile, biopsychosocial formulation can then inform holistic understandings and psychological intervention around the incorporation of PAP into people's lives as indicated by the results of the thematic synthesis. The identified difficulties around PAP use are likely to be further exacerbated by the emotional instability experienced by people with a BD diagnosis. It is notable that both participants who had previously received a diagnosis of OSA reported to be no longer using PAP, although the reasons for this were unexplored.

Finally, it is hoped that the findings provide evidence that it is not beneficial for sleep to be a "specialist" subject and only dealt with by specialist services that are very difficult to access (Flemons et al., 2004). The author feels the findings of the thesis suggest that it would be more beneficial for clinicians to have the skills and understanding to integrate knowledge of sleep as part of holistic formulation to inform appropriate intervention.

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Health Research Authority

South Central - Oxford C Research Ethics Committee

Level 3, Block B
Whitefriars Building
Lewins Mead
Bristol
BS1 2NT

Please note: This is the favourable opinion of the REC only and does not allow you to start your study at NHS sites in England until you receive HRA Approval

25 September 2019

Miss Amy Brown
Trainee Clinical Psychologist
Lancashire Care NHS Foundation Trust
Department of Clinical Psychology
Division of Health Research
Lancaster University
LA1 4YW

Dear Miss Brown

Study title:	Impact of obstructive sleep apnoea for people with a bipolar disorder diagnosis
REC reference:	19/SC/0487
Protocol number:	N/A
IRAS project ID:	240867

The Proportionate Review Sub-committee of the South Central - Oxford C Research Ethics Committee reviewed the above application on 20 September 2019.

Ethical Opinion

On behalf of the Committee, the sub-committee gave a favourable ethical opinion of the above research on the basis described in the application form, protocol and supporting documentation, subject to the conditions specified below.

Conditions of the Favourable Opinion

The REC favourable opinion is subject to the following conditions being met prior to the start of

the study.

Number	Condition
1	Increase the prominence of the information resource on OSA 2. When advising participants to attend their GP, suggest that the researcher ensures that the person has appropriate information to show to the GP about the study. This may take the form of a GP letter.

Number	Recommendation
1	Omit any mention of the Samaritans.

You should notify the REC once all conditions have been met (except for site approvals from host organisations) and provide copies of any revised documentation with updated version numbers. Revised documents should be submitted to the REC electronically from IRAS. The REC will acknowledge receipt and provide a final list of the approved documentation for the study, which you can make available to host organisations to facilitate their permission for the study. Failure to provide the final versions to the REC may cause delay in obtaining permissions.

Confirmation of Capacity and Capability (in England, Northern Ireland and Wales) or NHS management permission (in Scotland) should be sought from all NHS organisations involved in the study in accordance with NHS research governance arrangements. Each NHS organisation must confirm through the signing of agreements and/or other documents that it has given permission for the research to proceed (except where explicitly specified otherwise).

Guidance on applying for HRA and HCRW Approval (England and Wales)/ NHS permission for research is available in the Integrated Research Application System.

For non-NHS sites, site management permission should be obtained in accordance with the procedures of the relevant host organisation.

Sponsors are not required to notify the Committee of management permissions from host organisations.

Registration of Clinical Trials

It is a condition of the REC favourable opinion that all clinical trials are registered on a publicly accessible database. For this purpose, clinical trials are defined as the first four project categories in IRAS project filter question 2. For [clinical trials of investigational medicinal products \(CTIMPs\)](#), other than adult phase I trials, registration is a legal requirement.

Registration should take place as early as possible and within six weeks of recruiting the first research participant at the latest. Failure to register is a breach of these approval conditions, unless a deferral has been agreed by or on behalf of the Research Ethics Committee (see here for more information on requesting a deferral:

<https://www.hra.nhs.uk/planning-and-improving-research/research-planning/research-registration-research-project-identifiers/>

As set out in the UK Policy Framework, research sponsors are responsible for making information about research publicly available before it starts e.g. by registering the research

project on a publicly accessible register. Further guidance on registration is available at: <https://www.hra.nhs.uk/planning-and-improving-research/research-planning/transparency-responsibilities/>

You should notify the REC of the registration details. We routinely audit applications for compliance with these conditions.

Publication of Your Research Summary

We will publish your research summary for the above study on the research summaries section of our website, together with your contact details, no earlier than three months from the date of this favourable opinion letter. Should you wish to provide a substitute contact point, make a request to defer, or require further information, please visit:

<https://www.hra.nhs.uk/planning-and-improving-research/application-summaries/research-summaries/>

It is the responsibility of the sponsor to ensure that all the conditions are complied with before the start of the study or its initiation at a particular site (as applicable).

After ethical review: Reporting requirements

The attached document “After ethical review – guidance for researchers” gives detailed guidance on reporting requirements for studies with a favourable opinion, including:

- Notifying substantial amendments
- Adding new sites and investigators
- Notification of serious breaches of the protocol
- Progress and safety reports
- Notifying the end of the study, including early termination of the study
- Final report

The latest guidance on these topics can be found at <https://www.hra.nhs.uk/approvals-amendments/managing-your-approval/>.

Ethical review of research sites

The favourable opinion applies to all NHS sites taking part in the study, subject to management permission being obtained from the NHS/HSC R&D office prior to the start of the study (see “Conditions of the favourable opinion”).

Approved Documents

The documents reviewed and approved were:

<i>Document</i>	<i>Version</i>	<i>Date</i>
Copies of advertisement materials for research participants [Twitter adverts]	Version 0.1	28 June 2019
Copies of advertisement materials for research participants [Poster advert]	Version 0.1	28 June 2019
Covering letter on headed paper [Cover letter for paper questionnaire]	Version 0.1	28 June 2019

Evidence of Sponsor insurance or indemnity (non NHS Sponsors only) [Evidence of sponsor indemnity insurance]	Version 0.1	18 July 2019
Instructions for use of medical device [Actigraph manual]	Version 0.1	28 June 2019
Instructions for use of medical device [Oximeter manual]	Version 0.1	28 June 2019
IRAS Application Form [IRAS_Form_28082019]		28 August 2019
IRAS Application Form XML file [IRAS_Form_28082019]		28 August 2019
IRAS Checklist XML [Checklist_28082019]		28 August 2019
Letter from sponsor [Sponsorship letter]	Version 0.1	13 August 2019
Non-validated questionnaire [Paper demographics questionnaire]	Version 0.1	28 June 2019
Other [Instructions for participants around calculating BMI for STOP-Bang questionnaire]	Version 0.1	28 June 2019
Other [Online questionnaire emails]	Version 0.1	28 June 2019
Other [Paper questionnaire booklet (PANAS questionnaires)]	Version 0.1	28 June 2019
Participant consent form [Paper participant consent form]	Version 0.1	28 June 2019
Participant information sheet (PIS) [Paper participant information sheet]	Version 0.1	28 June 2019
Research protocol or project proposal [Research protocol]	Version 0.1	28 June 2019
Summary CV for Chief Investigator (CI) [Summary CV for CI]	Version 0.1	28 June 2019
Summary CV for supervisor (student research) [Prof Steven Jones CV]	Version 1	28 June 2019
Summary CV for supervisor (student research) [Dr Guillermo Perez Algorta CV]	Version 1	28 June 2019
Validated questionnaire [Epworth Sleepiness Scale (paper copy)]	Version 1	28 June 2019
Validated questionnaire [STOP-Bang Questionnaire (paper copy)]	Version 1	28 June 2019
Validated questionnaire [Pittsburgh Sleep Quality Index (paper copy)]	Version 1	28 June 2019
Validated questionnaire [The 7 Up 7 Down Inventory (paper copy)]	Version 1	28 June 2019
Validated questionnaire [Paper questionnaire booklet (PANAS questionnaires)]		28 June 2019

Membership of the Proportionate Review Sub-Committee

The members of the Sub-Committee who took part in the review are listed on the attached sheet.

Statement of compliance

The Committee is constituted in accordance with the Governance Arrangements for Research Ethics Committees and complies fully with the Standard Operating Procedures for Research Ethics Committees in the UK.

User Feedback

The Health Research Authority is continually striving to provide a high quality service to all applicants and sponsors. You are invited to give your view of the service you have received and the application procedure. If you wish to make your views known please use the feedback form available on the HRA website:

<http://www.hra.nhs.uk/about-the-hra/governance/quality-assurance/>

HRA Learning

We are pleased to welcome researchers and research staff to our HRA Learning Events and online learning opportunities– see details at:

<https://www.hra.nhs.uk/planning-and-improving-research/learning/>

With the Committee’s best wishes for the success of this project.

19/SC/0487

Please quote this number on all correspondence

Yours sincerely



PP
Dr Linda Cartwright
Alternate Vice Chair

Email: [Redacted]

Enclosures: List of names and professions of members who took part in the review

“After ethical review – guidance for researchers”

Copy to: Ms Becky Gordon

South Central - Oxford C Research Ethics Committee

Attendance at PRS Sub-Committee of the REC meeting on 20 September 2019

Committee Members:

<i>Name</i>	<i>Profession</i>	<i>Present</i>	<i>Notes</i>
Mr David Carpenter (Co-optee)	Retired Social Scientist	Yes	
Dr Linda Cartwright (Alternate Vice Chair and Meeting Chair)	Retired Consultant Epidemiologist	Yes	
Mrs Vivienne Laurie (Vice Chair)	Barrister	Yes	

Also in Attendance:

<i>Name</i>	<i>Position (or reason for attending)</i>
Miss Charlotte Ferris	Approvals Officer



Health Research Authority

South Central - Oxford C Research Ethics Committee

Level 3, Block B
Whitefriars Building
Lewins Mead
Bristol
BS1 2NT

Please note: This is an acknowledgement letter from the REC only and does not allow you to start your study at NHS sites in England until you receive HRA Approval

02 October 2019

Miss Amy Brown
Department of Clinical Psychology
Division of Health Research
Lancaster University
LA1 4YW

Dear Miss Brown

Study title: Impact of obstructive sleep apnoea for people with a bipolar disorder diagnosis
REC reference: 19/SC/0487
Protocol number: N/A
IRAS project ID: 240867

Thank you for your letter of 26 September 2019. I can confirm the REC has received the documents listed below and that these comply with the approval conditions detailed in our letter dated 25 September 2019

Documents Received

The documents received were as follows:

<i>Document</i>	<i>Version</i>	<i>Date</i>
GP/consultant information sheets or letters [Letter to show to GP]	Version 0.1	26 September 2019
IRAS Checklist XML [Checklist_26092019]		26 September 2019
Other [Conditions of favourable opinion and response table]	Version 0.1	26 September 2019

Participant information sheet (PIS) [Paper participant information sheet]	Version 0.2	26 September 2019
Research protocol or project proposal [Research protocol]	Version 0.2	26 September 2019

Approved Documents

The final list of approved documentation for the study is therefore as follows:

<i>Document</i>	<i>Version</i>	<i>Date</i>
Copies of advertisement materials for research participants [Twitter adverts]	Version 0.1	28 June 2019
Copies of advertisement materials for research participants [Poster advert]	Version 0.1	28 June 2019
Covering letter on headed paper [Cover letter for paper questionnaire]	Version 0.1	28 June 2019
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Validated questionnaire [The 7 Up 7 Down Inventory (paper copy)]	Version 1	28 June 2019
Validated questionnaire [Paper questionnaire booklet (PANAS questionnaires)]		28 June 2019

You should ensure that the sponsor has a copy of the final documentation for the study. It is the sponsor's responsibility to ensure that the documentation is made available to R&D offices at all participating sites.

19/SC/0487

Please quote this number on all correspondence

Yours sincerely



Charlotte Ferris
Approvals Officer

E-mail: [REDACTED]

Copy to: Miss Amy Brown
Ms Beverley Lowe, Lancashire Care NHS Foundation Trust



Miss Amy Brown
Trainee Clinical Psychologist
Lancashire Care NHS Foundation Trust
Department of Clinical Psychology
Division of Health Research
Lancaster University
LA1 4YW

17 October 2019

Dear Miss Brown

**HRA and Health and Care
Research Wales (HCRW)
Approval Letter**

Study title: Impact of obstructive sleep apnoea for people with a bipolar disorder diagnosis

IRAS project ID: 240867

Protocol number: N/A

REC reference: 19/SC/0487

Sponsor Lancaster University

I am pleased to confirm that [HRA and Health and Care Research Wales \(HCRW\) Approval](#) has been given for the above referenced study, on the basis described in the application form, protocol, supporting documentation and any clarifications received. You should not expect to receive anything further relating to this application.

Please now work with participating NHS organisations to confirm capacity and capability, in line with the instructions provided in the "Information to support study set up" section towards the end of this letter.

How should I work with participating NHS/HSC organisations in Northern Ireland and Scotland?

HRA and HCRW Approval does not apply to NHS/HSC organisations within Northern Ireland and Scotland.

If you indicated in your IRAS form that you do have participating organisations in either of these devolved administrations, the final document set and the study wide governance report (including this letter) have been sent to the coordinating centre of each participating nation. The relevant national coordinating function/s will contact you as appropriate.

ETHICS DOCUMENTATION

Please see [IRAS Help](#) for information on working with NHS/HSC organisations in Northern Ireland and Scotland.

How should I work with participating non-NHS organisations?

HRA and HCRW Approval does not apply to non-NHS organisations. You should work with your non-NHS organisations to [obtain local agreement](#) in accordance with their procedures.

What are my notification responsibilities during the study?

The document “*After Ethical Review – guidance for sponsors and investigators*”, issued with your REC favourable opinion, gives detailed guidance on reporting expectations for studies, including:

- Registration of research
- Notifying amendments
- Notifying the end of the study

The [HRA website](#) also provides guidance on these topics, and is updated in the light of changes in reporting expectations or procedures.

Who should I contact for further information?

Please do not hesitate to contact me for assistance with this application. My contact details are below.

Your IRAS project ID is **240867**. Please quote this on all correspondence.

Yours sincerely,

Thomas Fairman
HRA Approvals Manager

Email: [REDACTED]

Copy to: *Ms Becky Gordon (Sponsor Contact)*

ETHICS DOCUMENTATION

List of Documents

The final document set assessed and approved by HRA and HCRW Approval is listed below.

<i>Document</i>	<i>Version</i>	<i>Date</i>
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Information to support study set up

The below provides all parties with information to support the arranging and confirming of capacity and capability with participating NHS organisations in England and Wales. This is intended to be an accurate reflection of the study at the time of issue of this letter.

Types of participating NHS organisation	Expectations related to confirmation of capacity and capability	Agreement to be used	Funding arrangements	Oversight expectations	HR Good Practice Resource Pack expectations
<p>All participating PIC organisations will perform the same research activities therefore there is only one site type.</p>	<p>Organisations will not be required to formally confirm capacity and capability, and research activities may begin 35 days after provision of the local information pack, provided the following conditions are met.</p> <ul style="list-style-type: none"> • You have contacted participating NHS organisations (see below for details) • The NHS organisation has not provided a reason as to why they cannot participate • The NHS organisation has not requested additional time to confirm. <p>You may start the research prior to the above deadline if the PIC organisation positively confirms that the research may proceed.</p>	<p>The sponsor should ensure that appropriate agreements are put in place with participating PIC organisations. The HRA recommend use of the non-commercial model PIC agreement, which can be found at https://www.myresearchproject.org.uk/help/hlpsitespecific.aspx#PIC</p>	<p>No application for external study funding has been made.</p>	<p>The Chief Investigator will be responsible for all research activities performed at participating PIC organisations</p>	<p>As a non-commercial study undertaken by local staff, it is unlikely that letters of access or honorary research contracts will be applicable.</p> <p>Where arrangements are not already in place, researchers undertaking any of the research activities listed in A18 of the IRAS form would be expected to obtain a Letter of Access.</p>

ETHICS DOCUMENTATION

Other information to aid study set-up and delivery

This details any other information that may be helpful to sponsors and participating NHS organisations in England and Wales in study set-up.

The applicant has indicated that they do not intend to apply for inclusion on the NIHR CRN Portfolio.

Partner Organisations:

Health Research Authority, England

NHS Research Scotland

HSC Research & Development, Public Health Agency, Northern Ireland

NIHR Clinical Research Network, England

NISCHR Permissions Co-ordinating Unit, Wales

4-15

ETHICS DOCUMENTATION

Notification of Non-Substantial/Minor Amendments(s) for NHS Studies

This template **must only** be used to notify NHS/HSC R&D office(s) of amendments, which are **NOT** categorised as Substantial Amendments.

If you need to notify a Substantial Amendment to your study then you MUST use the appropriate Substantial Amendment form in IRAS.

Instructions for using this template

- For guidance on amendments refer to <http://www.hra.nhs.uk/research-community/during-your-research-project/amendments/>
- This template should be completed by the CI and optionally authorised by Sponsor, if required by sponsor guidelines.
- This form should be submitted according to the instructions provided for NHS/HSC R&D at <http://www.hra.nhs.uk/research-community/during-your-research-project/amendments/which-review-bodies-need-to-approve-or-be-notified-of-which-types-of-amendments/>. If you do not submit your notification in accordance with these instructions then processing of your submission may be significantly delayed.

1. Study Information

Full title of study:	Impact of obstructive sleep apnoea for people with a bipolar disorder diagnosis
IRAS Project ID:	240867
Sponsor Amendment Notification number:	
Sponsor Amendment Notification date:	
Details of Chief Investigator:	
Name [first name and surname]	Amy Brown
Address:	Department of Clinical Psychology, Division of Health Research, Lancaster University
Postcode:	LA1 4YW
Contact telephone number:	[REDACTED]
Email address:	[REDACTED]
Details of Lead Sponsor:	
Name:	[REDACTED]
Contact email address:	[REDACTED]
Details of Lead Nation:	
Name of lead nation <i>delete as appropriate</i>	England
If England led is the study going through CSP? <i>delete as appropriate</i>	No
Name of lead R&D office:	[REDACTED]

Partner Organisations:

Health Research Authority, England

NIHR Clinical Research Network, England

NHS Research Scotland

NISCHR Permissions Co-ordinating Unit, Wales

HSC Research & Development, Public Health Agency, Northern Ireland

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ETHICS DOCUMENTATION

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Partner Organisations:

Health Research Authority, England

NHS Research Scotland

HSC Research & Development, Public Health Agency, Northern Ireland

NIHR Clinical Research Network, England

NISCHR Permissions Co-ordinating Unit, Wales

2. Summary of amendment(s)

This template **must only** be used to notify NHS/HSC R&D office(s) of amendments, which are **NOT** categorised as Substantial Amendments.

If you need to notify a Substantial Amendment to your study then you MUST use the appropriate Substantial Amendment form in IRAS.

No.	Brief description of amendment <i>(please enter each separate amendment in a new row)</i>	Amendment applies to <i>(delete/ list as appropriate)</i>		List relevant supporting document(s), including version numbers <i>(please ensure all referenced supporting documents are submitted with this form)</i>		R&D category of amendment <i>(category A, B, C) For office use only</i>
		Nation	Sites	Document	Version	
1	<p>Addition of Lancashire & South Cumbria NHS Foundation Trust as a research site.</p> <p>This is following liaison with [REDACTED] who have advised that the advertisement activities described on the IRAS form to be conducted through [REDACTED] (formerly [REDACTED]) Community Mental Health Team constitutes the activity of a research site rather than a PIC.</p>	England	[REDACTED]			
2						
3						
4						
5						

[Add further rows as required]

Partner Organisations
 Health Research Authority, England
 NHS Research Scotland
 HSC Research & Development, Public Health Agency, Northern Ireland

NIHR Clinical Research Network, England
 NISCHR Permissions Co-ordinating Unit, Wales

3. Declaration(s)

Declaration by Chief Investigator

- I confirm that the information in this form is accurate to the best of my knowledge and I take full responsibility for it.
- I consider that it would be reasonable for the proposed amendment(s) to be implemented.

Signature of Chief Investigator:



Print name: Amy Brown

Date: 18th October 2019

Optional Declaration by the Sponsor's Representative (as per Sponsor Guidelines)

The sponsor of an approved study is responsible for all amendments made during its conduct.

The person authorising the declaration should be authorised to do so. There is no requirement for a particular level of seniority; the sponsor's rules on delegated authority should be adhered to.

- I confirm the sponsor's support for the amendment(s) in this notification.

Signature of sponsor's representative:

Print name:.....

Post:

Organisation:.....

Date:.....

Notification of Non-Substantial/Minor Amendments(s) for NHS Studies

This template **must only** be used to notify NHS/HSC R&D office(s) of amendments, which are **NOT** categorised as Substantial Amendments.

If you need to notify a Substantial Amendment to your study then you MUST use the appropriate Substantial Amendment form in IRAS.

Instructions for using this template

- For guidance on amendments refer to <http://www.hra.nhs.uk/research-community/during-your-research-project/amendments/>
- This template should be completed by the CI and optionally authorised by Sponsor, if required by sponsor guidelines.
- This form should be submitted according to the instructions provided for NHS/HSC R&D at <http://www.hra.nhs.uk/research-community/during-your-research-project/amendments/which-review-bodies-need-to-approve-or-be-notified-of-which-types-of-amendments/>. If you do not submit your notification in accordance with these instructions then processing of your submission may be significantly delayed.

1. Study Information

Full title of study:	Impact of obstructive sleep apnoea for people with a bipolar disorder diagnosis
IRAS Project ID:	240867
Sponsor Amendment Notification number:	
Sponsor Amendment Notification date:	
Details of Chief Investigator:	
Name [first name and surname]	Amy Brown
Address:	Department of Clinical Psychology, Division of Health Research, Lancaster University
Postcode:	LA1 4YW
Contact telephone number:	[REDACTED]
Email address:	[REDACTED]
Details of Lead Sponsor:	
Name:	[REDACTED]
Contact email address:	[REDACTED]
Details of Lead Nation:	
Name of lead nation <i>delete as appropriate</i>	England
If England led is the study going through CSP? <i>delete as appropriate</i>	No
Name of lead R&D office:	[REDACTED]

Partner Organisations:

Health Research Authority, England

NIHR Clinical Research Network, England

NHS Research Scotland

NISCHR Permissions Co-ordinating Unit, Wales

HSC Research & Development, Public Health Agency, Northern Ireland

ETHICS DOCUMENTATION

Partner Organisations:
 Health Research Authority, England
 NHS Research Scotland
 HSC Research & Development, Public Health Agency, Northern Ireland

NIHR Clinical Research Network, England
 NISCHR Permissions Co-ordinating Unit, Wales

2. Summary of amendment(s)

This template **must only** be used to notify NHS/HSC R&D office(s) of amendments, which are **NOT** categorised as Substantial Amendments.

If you need to notify a Substantial Amendment to your study then you MUST use the appropriate Substantial Amendment form in IRAS.

No.	Brief description of amendment <i>(please enter each separate amendment in a new row)</i>	Amendment applies to <i>(delete/ list as appropriate)</i>		List relevant supporting document(s), including version numbers <i>(please ensure all referenced supporting documents are submitted with this form)</i>		R&D category of amendment <i>(category A, B, C)</i> <i>For office use only</i>
		Nation	Sites	Document	Version	
1	Inclusion criteria to be expanded to people living across the UK and to people aged up to 65.	England	All sites			
2						
3						
4						
5						

[Add further rows as required]

3. Declaration(s)

Declaration by Chief Investigator

- I confirm that the information in this form is accurate to the best of my knowledge and I take full responsibility for it.
- I consider that it would be reasonable for the proposed amendment(s) to be implemented.

Signature of Chief Investigator:



Print name: Amy Brown

Date: 28th November 2019

Optional Declaration by the Sponsor's Representative (as per Sponsor Guidelines)

The sponsor of an approved study is responsible for all amendments made during its conduct.

The person authorising the declaration should be authorised to do so. There is no requirement for a particular level of seniority; the sponsor's rules on delegated authority should be adhered to.

- I confirm the sponsor's support for the amendment(s) in this notification.

Signature of sponsor's representative:

Print name:.....

Post:

Organisation:.....

Date:.....

Welcome to the Integrated Research Application System

IRAS Project Filter

The integrated dataset required for your project will be created from the answers you give to the following questions. The system will generate only those questions and sections which (a) apply to your study type and (b) are required by the bodies reviewing your study. Please ensure you answer all the questions before proceeding with your applications.

Please complete the questions in order. If you change the response to a question, please select 'Save' and review all the questions as your change may have affected subsequent questions.

Please enter a short title for this project (maximum 70 characters)
Obstructive sleep apnoea and a bipolar disorder diagnosis. Version 0.1

1. Is your project research?

Yes No

2. Select one category from the list below:

- Clinical trial of an investigational medicinal product
- Clinical investigation or other study of a medical device
- Combined trial of an investigational medicinal product and an investigational medical device
- Other clinical trial to study a novel intervention or randomised clinical trial to compare interventions in clinical practice
- Basic science study involving procedures with human participants
- Study administering questionnaires/interviews for quantitative analysis, or using mixed quantitative/qualitative methodology
- Study involving qualitative methods only
- Study limited to working with human tissue samples (or other human biological samples) and data (specific project only)
- Study limited to working with data (specific project only)
- Research tissue bank
- Research database

If your work does not fit any of these categories, select the option below:

Other study

2a. Will the study involve the use of any medical device without a CE Mark, or a CE marked device which has been modified or will be used outside its intended purposes?

Yes No

2b. Please answer the following question(s):

- a) Does the study involve the use of any ionising radiation? Yes No
- b) Will you be taking new human tissue samples (or other human biological samples)? Yes No
- c) Will you be using existing human tissue samples (or other human biological samples)? Yes No

d) Will the study involve any other clinical procedures with participants (e.g. MRI, ultrasound, physical examination)?

Yes No

3. In which countries of the UK will the research sites be located? *(Tick all that apply)*

- England
- Scotland
- Wales
- Northern Ireland

3a. In which country of the UK will the lead NHS R&D office be located:

- England
- Scotland
- Wales
- Northern Ireland
- This study does not involve the NHS

4. Which applications do you require?

- IRAS Form
- Confidentiality Advisory Group (CAG)
- Her Majesty's Prison and Probation Service (HMPPS)

Most research projects require review by a REC within the UK Health Departments' Research Ethics Service. Is your study exempt from REC review?

Yes No

5. Will any research sites in this study be NHS organisations?

Yes No

5a. Are all the research costs and infrastructure costs (funding for the support and facilities needed to carry out research e.g. NHS Support costs) for this study provided by a NIHR Biomedical Research Centre, NIHR Collaboration for Leadership in Health Research and Care (CLAHRC), NIHR Patient Safety Translational Research Centre or Medtech and In Vitro Diagnostic Cooperative in all study sites?

Please see information button for further details.

Yes No

Please see information button for further details.

5b. Do you wish to make an application for the study to be considered for NIHR Clinical Research Network (CRN) Support and inclusion in the NIHR Clinical Research Network Portfolio?

Please see information button for further details.

Yes No

The NIHR Clinical Research Network provides researchers with the practical support they need to make clinical studies

happen in the NHS e.g. by providing access to the people and facilities needed to carry out research "on the ground".

If you select yes to this question, you must complete a NIHR Clinical Research Network (CRN) Portfolio Application Form (PAF) immediately after completing this project filter question and before submitting other applications. Failing to complete the PAF ahead of other applications e.g. HRA Approval, may mean that you will be unable to access NIHR CRN Support for your study.

6. Do you plan to include any participants who are children?

Yes No

7. Do you plan at any stage of the project to undertake intrusive research involving adults lacking capacity to consent for themselves?

Yes No

Answer Yes if you plan to recruit living participants aged 16 or over who lack capacity, or to retain them in the study following loss of capacity. Intrusive research means any research with the living requiring consent in law. This includes use of identifiable tissue samples or personal information, except where application is being made to the Confidentiality Advisory Group to set aside the common law duty of confidentiality in England and Wales. Please consult the guidance notes for further information on the legal frameworks for research involving adults lacking capacity in the UK.

8. Do you plan to include any participants who are prisoners or young offenders in the custody of HM Prison Service or who are offenders supervised by the probation service in England or Wales?

Yes No

9. Is the study or any part of it being undertaken as an educational project?

Yes No

Please describe briefly the involvement of the student(s):
Please note that in this application the student is purposefully listed as the chief investigator in this study. This is because the student is an experienced care practitioner undertaking doctoral-level study while employed by a health care provider, and in such circumstances the UK Policy Framework for Health and Social Care explicitly permits students to take the chief investigator role (p17 of the Framework contains this specific provision).

9a. Is the project being undertaken in part fulfilment of a PhD or other doctorate?

Yes No

10. Will this research be financially supported by the United States Department of Health and Human Services or any of its divisions, agencies or programs?

Yes No

11. Will identifiable patient data be accessed outside the care team without prior consent at any stage of the project (including identification of potential participants)?

Yes No

ETHICS DOCUMENTATION

**Integrated Research Application System
Application Form for Basic science study involving procedures with human participants**

IRAS Form (project information)

Please refer to the E-Submission and Checklist tabs for instructions on submitting this application.

The Chief Investigator should complete this form. Guidance on the questions is available wherever you see this symbol displayed. We recommend reading the guidance first. The complete guidance and a glossary are available by selecting [Help](#).

Please define any terms or acronyms that might not be familiar to lay reviewers of the application.

Short title and version number: (maximum 70 characters - this will be inserted as header on all forms)
Obstructive sleep apnoea and a bipolar disorder diagnosis. Version 0.1

Please complete these details after you have booked the REC application for review.

REC Name:

REC Reference Number: **Submission date:**

PART A: Core study information

1. ADMINISTRATIVE DETAILS

A1. Full title of the research:
Impact of obstructive sleep apnoea for people with a bipolar disorder diagnosis

A2-1. Educational projects

Name and contact details of student(s):

Student 1	
	Title Forename/Initials Surname
	Miss Amy Brown
Address	Department of Clinical Psychology Division of Health Research Lancaster University
Post Code	LA1 4YW
E-mail	[REDACTED]
Telephone	[REDACTED]
Fax	0

Give details of the educational course or degree for which this research is being undertaken:
Name and level of course/ degree:
Doctorate in Clinical Psychology

Name of educational establishment:
Lancaster University

Name and contact details of academic supervisor(s):

Academic supervisor 1

Title Forename/Initials Surname
Dr Guillermo Perez Algorta
Address Spectrum Centre and Department of Clinical Psychology
Division of Health Research
Lancaster University
Post Code LA1 4YW
E-mail [REDACTED]
Telephone [REDACTED]
Fax 0

Academic supervisor 2

Title Forename/Initials Surname
Professor Steven Jones
Address Spectrum Centre
Division of Health Research
Lancaster University
Post Code LA1 4YW
E-mail [REDACTED]
Telephone [REDACTED]
Fax 0

Please state which academic supervisor(s) has responsibility for which student(s):
Please click "Save now" before completing this table. This will ensure that all of the student and academic supervisor details are shown correctly.

Student(s)	Academic supervisor(s)
Student 1 Miss Amy Brown	<input checked="" type="checkbox"/> Dr Guillermo Perez Algorta <input checked="" type="checkbox"/> Professor Steven Jones

A copy of a current CV for the student and the academic supervisor (maximum 2 pages of A4) must be submitted with the application.

A2-2. Who will act as Chief Investigator for this study?

- Student
- Academic supervisor
- Other

A3-1. Chief Investigator:

	Title Forename/Initials Surname
	Miss Amy Brown
Post	Trainee Clinical Psychologist
Qualifications	MSci Psychology and Psychological Practice
ORCID ID	0000 0002 6768 4692
Employer	[REDACTED]
Work Address	Department of Clinical Psychology Division of Health Research Lancaster University
Post Code	LA1 4YW
Work E-mail	[REDACTED]
* Personal E-mail	[REDACTED]
Work Telephone	[REDACTED]
* Personal Telephone/Mobile	[REDACTED]
Fax	0

** This information is optional. It will not be placed in the public domain or disclosed to any other third party without prior consent.*

A copy of a current CV (maximum 2 pages of A4) for the Chief Investigator must be submitted with the application.

A4. Who is the contact on behalf of the sponsor for all correspondence relating to applications for this project?

This contact will receive copies of all correspondence from REC and HRA/R&D reviewers that is sent to the CI.

	Title Forename/Initials Surname
	Ms Becky Gordon
Address	Head of Research Quality and Policy
	Lancaster University
Post Code	LA1 4YW
E-mail	[REDACTED]
Telephone	[REDACTED]
Fax	0

A5-1. Research reference numbers. Please give any relevant references for your study:

Applicant's/organisation's own reference number, e.g. R & D (if available):	N/A
Sponsor's/protocol number:	N/A
Protocol Version:	0.1
Protocol Date:	28/06/2019
Funder's reference number (enter the reference number or state not applicable):	N/A
Project website:	http://www.tinyurl.com/OSA-BDresearch/

Registry reference number(s):

The UK Policy Framework for Health and Social Care Research sets out the principle of making information about research publicly available. Furthermore: Article 19 of the World Medical Association Declaration of Helsinki adopted in 2008 states that "every clinical trial must be registered on a publicly accessible database before recruitment of the first subject"; and the International Committee of Medical Journal Editors (ICMJE) will consider a clinical trial for publication only if it has been registered in an appropriate registry. Please see guidance for more information.

International Standard Randomised Controlled Trial Number (ISRCTN):

ClinicalTrials.gov Identifier (NCT number):

Additional reference number(s):

Ref.Number	Description	Reference Number
N/A		N/A

A5-2. Is this application linked to a previous study or another current application?

Yes No

Please give brief details and reference numbers.
N/A

2. OVERVIEW OF THE RESEARCH

To provide all the information required by review bodies and research information systems, we ask a number of specific questions. This section invites you to give an overview using language comprehensible to lay reviewers and members of the public. Please read the guidance notes for advice on this section.

A6-1. Summary of the study. Please provide a brief summary of the research (maximum 300 words) using language easily understood by lay reviewers and members of the public. Where the research is reviewed by a REC within the UK Health Departments' Research Ethics Service, this summary will be published on the Health Research Authority (HRA) website following the ethical review. Please refer to the question specific guidance for this question.

Obstructive sleep apnoea (OSA) is a sleeping difficulty where the throat muscles relax and block airflow. The sleeper's brain comes out of a deep sleep to restart breathing between five and thirty times an hour, causing extreme tiredness and low mood during the day. Research in the general population suggests that OSA is related to reduced quality of life and mood difficulties. Whilst OSA is estimated to affect 2-4 people out of 100 in the UK general population, as many as one in four of people with a bipolar disorder (BD) diagnosis may have OSA. BD is a diagnostic term that can be used to describe experiencing fluctuating mood, experiencing very low periods (often termed "depressive") and extremely elevated, euphoric periods (often termed "manic"). It is believed that people with a BD diagnosis experience fluctuations in mood due to also having irregular sleep-wake patterns. OSA is likely to further disrupt sleep-wake patterns for people with a BD diagnosis, however, no research to date has investigated this. This study intends to look at the relationship between OSA and sleep and affect (short-term mood experience) variability for people who also have a BD diagnosis. People with a BD diagnosis will be invited to participate, one group without suspected OSA and one group with. The study will look to confirm that a smaller group of people within the suspected OSA group do show symptoms that could be diagnosed as OSA. Information about participants' sleep (measured by a watch-like device and self-report) and affect (measured by self-report) will be collected on a daily basis across a fortnight. Comparisons will be made between the groups. It is predicted that people with suspected OSA will experience more variability in sleep and affect and will experience more extreme affect changes compared to the group without suspected OSA.

A6-2. Summary of main issues. Please summarise the main ethical, legal, or management issues arising from your study and say how you have addressed them.

Not all studies raise significant issues. Some studies may have straightforward ethical or other issues that can be identified and managed routinely. Others may present significant issues requiring further consideration by a REC, HRA, or other review body (as appropriate to the issue). Studies that present a minimal risk to participants may raise complex organisational or legal issues. You should try to consider all the types of issues that the different reviewers may need to consider.

Ethical issues

1. Confidentiality

The research team will not have access to potential participant's personal details without their consent (e.g. prior agreement to be on a mailing list). Potential participants recruited through NHS services will be approached by a member of their existing care team and participants will need to respond to the research advert before any direct correspondence with the research team will be able to take place.

2. Risks, burdens and benefits to participants

Whilst it is considered that the study should pose little to no risk to participants, contact numbers and websites are provided to participants in case of distress.

It is hoped that a benefit of the study is that it may support people of moderate to high risk of OSA to recognise this and to seek advice from their GP. When participants are identified as having suspected OSA, they will be made aware of this and encouraged to see their GP.

It is recognised that the study requires a twice-daily commitment from participants for two weeks in addition to completing screening measures. Completion of all twice-daily measures during the two weeks is not mandatory and all participants who wear the actigraph for two weeks (15 nights) and complete at least the first morning questionnaire will be entered into the prize draw.

3. Risk to researcher

The chief investigator will need to visit people at home to deliver and explain how to use the oximeter and deliver actigraphs. The [REDACTED] lone worker policy will be followed in order to ensure the safety of the chief investigator. This will involve a risk assessment of each visit based on information gathered during the participant screening process, time and location of the visit etc. The details of the visit (e.g. date, time, location) will be shared with one of the two supervisors within the research team who will act as a "buddy" for this visit. The chief investigator will always carry a fully charged mobile phone during visits. The chief investigator will telephone or text the supervisor of the team when the visit is concluded. If this telephone call/text does not take place beyond a reasonable agreed time, the "buddy" will attempt to contact the chief investigator via telephone and text. If contact with the chief investigator cannot be made within a reasonable time frame, the police will be contacted.

4. Risk to equipment

The equipment being provided to participants is expensive. Where actigraphs are posted this will be done using signed for delivery using a private courier. Participants will be asked to confirm that they are prepared to take care of the equipment and return it at the end of the data collection period. However, it is a recognised risk that equipment may be damaged or lost. In the event that equipment is damaged or lost, participants will be assured that this is a recognised risk and their participation will not necessarily be affected. The study has access to 40 actigraphs in total but it is the intention that not all actigraphs will be used at once to ensure that there are replacements available to participants in the event of the equipment not working or accidental loss or damage. Participants will not be held liable for any unintended loss or damage of the equipment.

5. Data storage

All electronic data will be stored on the secure university server for the duration of the project. This will include the secure web data collection application, REDCap, which is accessible via the university and are deemed to meet the university's requirements for secure storage. Paper data (e.g. consent forms, questionnaires) will be stored in a secure locked location on the University premises.

3. PURPOSE AND DESIGN OF THE RESEARCH

A7. Select the appropriate methodology description for this research. *Please tick all that apply:*

- Case series/ case note review
- Case control
- Cohort observation
- Controlled trial without randomisation
- Cross-sectional study
- Database analysis
- Epidemiology
- Feasibility/ pilot study
- Laboratory study
- Metanalysis
- Qualitative research

- Questionnaire, interview or observation study
- Randomised controlled trial
- Other (please specify)

A10. What is the principal research question/objective? *Please put this in language comprehensible to a lay person.*

Do sleep characteristics (e.g. time spent asleep) and affect vary more for people with suspected obstructive sleep apnoea and a bipolar disorder diagnosis compared to those with a bipolar disorder diagnosis alone?

Do people with suspected obstructive sleep apnoea and a bipolar disorder diagnosis experience greater acute (sudden) affect changes compared to those with BD alone?

A11. What are the secondary research questions/objectives if applicable? *Please put this in language comprehensible to a lay person.*

Are the groups of participants identified as having suspected obstructive sleep apnoea significantly different from each other in terms of demographic information and on their answers to questionnaires on sleep quality, daytime sleepiness and mood?

A12. What is the scientific justification for the research? *Please put this in language comprehensible to a lay person.*

Obstructive sleep apnoea (OSA) is a sleeping difficulty where the throat muscles relax and block airflow. The sleeper's brain comes out of a deep sleep to restart breathing between five and thirty times an hour, causing extreme tiredness and low mood during the day.

OSA is believed to be six to twelve times more common for people with a bipolar disorder (BD) diagnosis, which would mean that approximately one in four (1/4) people with a BD diagnosis have OSA. When people are assessed for OSA, NICE guidance states that people should be asked about their mood. However, NICE guidance does not currently suggest that people with a BD diagnosis should be asked about their risk of OSA.

Not much is known about how having OSA as well as a BD diagnosis might affect people. The disruption to the sleep cycle that OSA causes very likely disrupts the body's daily rhythms in terms of hormone release. This effect is likely to impact people with a BD diagnosis more as people with a BD diagnosis are believed to be more vulnerable to a disruption in their body's daily rhythms. However, the only research that seems to be available are separate observations of individual people which report different things. Therefore, research into how OSA impacts people with a BD diagnosis is important to for clinical guidelines and practice.

The proposed study aims to look at how different sleep and affect (short-term experience of mood) are across a two week period between a group of people with a BD diagnosis and suspected OSA and a group with a BD diagnosis alone.

A13. Please summarise your design and methodology. *It should be clear exactly what will happen to the research participant, how many times and in what order. Please complete this section in language comprehensible to the lay person. Do not simply reproduce or refer to the protocol. Further guidance is available in the guidance notes.*

Design

It is predicted that a group of people with suspected OSA and a BD diagnosis will experience more differences in their sleep and affect across the two weeks and bigger differences in how they feel from one point to the next, compared to a group of people with a bipolar disorder diagnosis alone. Testing this hypothesis will involve measuring the differences between two groups of people with a BD diagnosis, one group with suspected OSA and one without. It is hoped that this will help further understanding of how OSA can be recognised more easily in people with a bipolar disorder diagnosis so that suitable treatment can be provided.

Participants

It is intended that 20 people with a BD diagnosis and suspected OSA and 20 people with a diagnosis of BD alone will be recruited. It is the aim to recruit this many participants as it is similar to the number of participants in previous studies that have used a similar design to investigate the relationship between sleep and affect variability with people with a BD diagnosis, and this number will provide enough power to extract a robust conclusion.

All participants will need to report that they have received a BD (or manic depression) diagnosis and not be currently experiencing a period of extreme mood (i.e. not experiencing "mania" or "depression", often termed "euthymia"). Participants will be asked about their current and past mood using the Mini International Psychiatric Interview in Step 2 of the study (see below) to ensure that these requirements are met.

All participants will be aged between 30 and 60 years old. This chosen age range is intended to capture the demographic identified as most at risk of OSA to maximise recruitment, whilst minimising the risk of other things that affect sleep, such as sleep fragmentation, the risk of which is known to increase with age.

Participants will be recruited from the North West due to the locality of the chief investigator and the research protocol involving the need to visit a subset of participants at home. Furthermore, restricting the geographical area of recruitment may minimise costs of posting sleep measurement equipment, as it may be possible to deliver some devices personally.

Method

Step 1

Participants can consent to take part online using a laptop or desktop computer, or using a paper consent form that will be posted to them (with a stamped envelope to return) if they email the chief investigator requesting this.

Participants who consent to take part will be invited to answer some demographic and screening questions which ensure that participants meet the requirements for the study. Participants will also be invited to answer 4 questionnaires (STOP-Bang Questionnaire, Pittsburgh Sleep Quality Index, Epworth Sleepiness Scale and 7 Up 7 Down Inventory). Participants' answers to one of these questionnaires (STOP-Bang) will help assign participants to either the suspected obstructive sleep apnoea or the bipolar disorder diagnosis only group, and provide some information about these groups that can be compared at the analysis stage. Answering all the questions should take around 20 minutes in total. Participants can complete these questionnaires in their own time online using a laptop or desktop computer or on paper forms that will be posted to them with a stamped envelope to return.

Step 2

Participants will be contacted by the chief investigator either by email or phone (depending on what the participant responded in Step 1). This will be to arrange a telephone interview with the chief investigator at a time that is convenient for the participant.

Where possible, telephone interviews will be conducted over Zoom (<https://www.zoom.us/>) or Skype to minimise telephone costs. Zoom is a video call software like Skype that doesn't require a participants to have a login for. A video call will allow face to face contact with participants, if they are happy to use the video function, which will enable the chief investigator to be more aware of any signs of distress from the participant during the interview and be able to adapt the process accordingly. Skype calls can be conducted if participants would prefer this to Zoom. If participants would prefer to be contacted by telephone, the interview will be conducted using a landline telephone in a private room at Lancaster University. These interviews will be offered during the day or early evening to fit around participants' commitments.

During the telephone interview, participants may be asked about answers that they provided to questions during Stage 1 if their answers suggest they do not meet the requirements for the study. All participants will be interviewed using a structured interview tool (Mini International Psychiatric Interview) to further ensure that they meet the requirements for the study. If a participant's responses during Step 1 indicate that they drink alcohol and/or take non-prescribed substances, questions from the relevant sections of the interview tool will also be asked about participants' alcohol and/or drug use. Participants will also be interviewed using the Structured Clinical Interview for DSM-5 Sleep Disorders to contribute to their group allocation. Participants will also be invited to ask any questions about the study that they may have. Telephone interviews should take no longer than 45 minutes.

The chief investigator will then contact participants using their preferred method of contact, either to make arrangements for Step 3 of the study or to explain that the responses they have given suggest that they do not meet the requirements to continue participating in the study. Everyone who is not able to continue participating in the study will be invited to leave an email or postal address to be sent a non-scientific report of the study once the study is completed, and will be invited to withdraw the information they have provided up until this point. People continuing to participate will be told which group they have been assigned to based on their responses.

Step 3

Nine participants in the suspected OSA group who are geographically closest to Lancaster University will be invited to undergo an overnight test using a piece of equipment called an oximeter. This is a device that can be worn overnight to

test for OSA. It measures oxygen levels in the blood using a infrared light via a tube placed over one finger, and snoring using a microphone.

If the participants who are geographically closest to Lancaster University decline, then the next closest participants will be invited to undergo the test if possible. For participants who undergo the overnight test, the chief investigator will deliver the oximeter to the participant's home, at a time suitable for them, and provide instructions on how to operate it. The chief investigator will then leave the oximeter with the participant and return the next day to collect it at a convenient time for the participant.

The overnight test is optional for nine participants in the suspected OSA group only. This is due to a shortage of equipment.

All participants will receive a watch like device called an actigraph, which they will be asked to wear for two weeks (15 nights). Actigraphs will either be delivered by the chief investigator (following a risk assessment and in accordance with the [redacted] Lone Worker Policy) or posted to a pick up location convenient for the participant. The actigraph tracks movement and is able to predict when the participant is awake and asleep. During these two weeks, participants will be asked to complete a short questionnaire on how they are feeling (Positive and Negative Affect Scale) twice a day. Participants can complete these questionnaires online using a laptop or desktop computer, a mobile phone or tablet or using a paper questionnaire booklet. If participants choose to complete the questionnaires online, they will be sent an email twice a day with a link to each questionnaire. As part of the morning questionnaire, participants will also be asked three questions about their sleep the night before. Answering each questionnaire, including the three sleep questions, should take participants around two minutes to complete.

Once participants have worn their actigraphs for two weeks (15 nights), the chief investigator will contact them using their preferred method of contact to arrange either collection or free postage of the actigraph from where they collected it (depending on how they received the actigraph).

Experts by experience

Consultation from experts by experience suggested that participants would understand what the study was asking of them from reading the information sheet. The information sheet was improved following consultation with experts by experience by adding expected timings to each of the steps.

A14-1. In which aspects of the research process have you actively involved, or will you involve, patients, service users, and/or their carers, or members of the public?

- Design of the research
- Management of the research
- Undertaking the research
- Analysis of results
- Dissemination of findings
- None of the above

Give details of involvement, or if none please justify the absence of involvement.

A panel of three experts by experience (people with a bipolar disorder or manic depression diagnosis), organised through the Spectrum Centre at Lancaster University, were consulted on the advertisement materials, participant information sheet and methodology of the study. The advertisement materials and participant information sheet have been adapted according to feedback. This involved specifying more clearly the expected time commitment of participants in each step and highlighting the benefits that participating in research can have. All three experts by experience felt that the design of the methodology of the study was acceptable and that they would participate in the study if they met the requirements.

4. RISKS AND ETHICAL ISSUES

RESEARCH PARTICIPANTS

A15. What is the sample group or cohort to be studied in this research?

Select all that apply:

- Blood
- Cancer
- Cardiovascular
- Congenital Disorders
- Dementias and Neurodegenerative Diseases
- Diabetes
- Ear
- Eye
- Generic Health Relevance
- Infection
- Inflammatory and Immune System
- Injuries and Accidents
- Mental Health
- Metabolic and Endocrine
- Musculoskeletal
- Neurological
- Oral and Gastrointestinal
- Paediatrics
- Renal and Urogenital
- Reproductive Health and Childbirth
- Respiratory
- Skin
- Stroke

Gender: Male and female participants

Lower age limit: 30 Years

Upper age limit: 60 Years

A17-1. Please list the principal inclusion criteria (list the most important, max 5000 characters).

Aged between 30 and 60 years old.
Live in North West England.
Report a diagnosis of BD (or manic depression).
Report to being between periods of extreme mood.

A17-2. Please list the principal exclusion criteria (list the most important, max 5000 characters).

If participants:

- work night shifts
- regularly travel overseas
- are currently jet-lagged
- are likely to be disturbed at night (e.g. live with a child under 1 year old)
- have had a brain injury
- have a neurodegenerative condition (e.g. dementia or Parkinson's)
- have received treatment for obstructive sleep apnoea and no longer have symptoms
- drink alcohol or caffeine or take drugs in a way that may impact on sleep
- are taking part in a drug trial

- are unable to move most of their body

RESEARCH PROCEDURES, RISKS AND BENEFITS

A18. Give details of all non-clinical intervention(s) or procedure(s) that will be received by participants as part of the research protocol. These include seeking consent, interviews, non-clinical observations and use of questionnaires.

Please complete the columns for each intervention/procedure as follows:

1. Total number of interventions/procedures to be received by each participant as part of the research protocol.
2. If this intervention/procedure would be routinely given to participants as part of their care outside the research, how many of the total would be routine?
3. Average time taken per intervention/procedure (minutes, hours or days)
4. Details of who will conduct the intervention/procedure, and where it will take place.

Intervention or procedure	1	2	3	4
Complete consent form and initial questionnaires	1		20 minutes	Can be completed online or on paper at participant's homes in their own time.
Conversation to arrange telephone interview	1		5 minutes	Chief investigator will contact participant via email or phone depending on their preference.
Telephone interview	1		30-45 minutes	Chief investigator will contact participant over Zoom, Skype or phone depending on their preference at a time that is convenient for the participant.
Conversation to confirm possibility of further participation, group allocation and to arrange delivery of the actigraph. Nine participants will be invited to undergo the overnight test.	1		10 minutes	Chief investigator will contact participant via email or phone depending on their preference.
Wear actigraph	1		14 days	Chief investigator will deliver or post to participant. Participants asked to wear actigraph at all times.
Complete questionnaires (2 per day for 14 days)	28		2 minutes	Can be completed online using computer/tablet/phone or on paper.
Opportunity to give feedback	1		0-5 minutes	Can be completed online or paper - opportunity at the end of the last of the twice daily questionnaires.
Conversation to arrange return of the actigraphs and offer a non-scientific report of the study	1		5 minutes	Chief investigator will contact participant via email or phone depending on their preference.
Contact to arrange receiving prize from prize draw (one participant only)	0-1		5 minutes	Chief investigator will contact participant via email or phone depending on their preference.

A21. How long do you expect each participant to be in the study in total?

Participants will be involved in the study for approximately 4 weeks. This includes the 2 week observation period and a total of 2 weeks of time either side for Steps 1 and 2 to be conducted and arrange to return of the actigraphs.

Participants who request a non-scientific report of the findings will receive this from the chief investigator at the end of the study, which could be as long as 1 year after consenting to participate in the study. This also applies to the participant who wins the prize draw.

A22. What are the potential risks and burdens for research participants and how will you minimise them?

For all studies, describe any potential adverse effects, pain, discomfort, distress, intrusion, inconvenience or changes to lifestyle. Only describe risks or burdens that could occur as a result of participation in the research. Say what steps would be taken to minimise risks and burdens as far as possible.

There is a risk that participants may become distressed if they learn they are suspected of having obstructive sleep apnoea. Participants will be provided with resources that they can use in the event of distress at the end of the participant information sheet. Moreover, participants who are suspected of having obstructive sleep apnoea will be advised to see their GP. These participants will also be told they are suspected of having obstructive sleep apnoea by the chief investigator who is trained and experienced in managing distress in others and who will receive supervision from an experienced clinical researcher in the field. The benefits to participants that present with this risk is that participants may learn (following a visit to their GP and potential referral to a sleep clinic) that they have obstructive sleep apnoea which can be treated and this may reduce their mood difficulties. Moreover, participants are being made aware of the risk factors of obstructive sleep apnoea and therefore how they may be able to prevent or reduce their risk of obstructive sleep apnoea through life style changes. These risks and benefits were corroborated in consultation with experts by experience who felt it was valuable to learn about obstructive sleep apnoea and whether you potentially have the condition.

The study involves a long time commitment (two weeks) and twice-daily input from participants, which may become a burden on participants. To minimise this, it is not compulsory that participants complete every questionnaire. Participants are asked to not complete missed questionnaires at a later date and online links to questionnaires expire after a set number of hours. Participants can also withdraw from the study at any time and email the chief investigator if they would like to withdraw their data, which will be possible up until the point that data analysis has begun. Data analysis will not begin for at least 10 days following the last participant completing/withdrawing from the study so all participants will have at least 10 days to withdraw their data before analysis should they wish to. All participants who wear the actigraph for two weeks (15 nights) and complete at least the first morning questionnaire will be entered into a prize draw for a £50 Amazon voucher. The benefit to participating in the research includes the opportunity to be entered into the prize draw. Moreover, consultation with experts by experience emphasised the benefit of participating as potentially benefitting to improving people's lives if obstructive sleep apnoea can be better recognised for people with a bipolar disorder diagnosis.

There is a risk of a breach of confidentiality as personal data will be collected. This risk will be minimised as far as possible by personal data being stored separately from all other data either in a locked cabinet or on the university secure network. Participant personal contact details will be kept for 6 months following the study finishing and they will then be deleted or destroyed.

A24. What is the potential for benefit to research participants?

Participants may become aware of their risk of obstructive sleep apnoea and visit their GP about this or make positive lifestyle changes to reduce their risk.

All participants may become more aware of any links between their sleep and their mood which may prove helpful in predicting and even preventing re-occurrences of periods of extreme mood.

All participants regardless of their level of participation will be offered a non-scientific report of the study's findings.

All participants who wear the actigraph for two weeks (15 nights) and complete at least the first morning questionnaire will be entered into a prize draw for a £50 Amazon voucher.

RECRUITMENT AND INFORMED CONSENT

In this section we ask you to describe the recruitment procedures for the study. Please give separate details for different study groups where appropriate.

A27-1. How will potential participants, records or samples be identified? Who will carry this out and what resources will be used? For example, identification may involve a disease register, computerised search of GP records, or review of medical records. Indicate whether this will be done by the direct healthcare team or by researchers acting under arrangements with the responsible care organisation(s).

Some potential participants who are currently accessing services within [REDACTED] around their bipolar disorder (or manic depression diagnosis), and who meet the inclusion criteria of the study, will be told about the study by a member of their existing care team. Alternatively they may see a poster advertisement on the

service premises. No details of potential participants will be passed to the research team by anyone other than the participant themselves. To take part in the study participants will need to visit the study website or email the chief investigator.

Other potential participants who are on the Spectrum Connect mailing list (through previous involvement with the Spectrum Centre and Lancaster University) will be sent an advert for the research study. Again, participants will need to visit the study website or email the chief investigator to take part in the study. The same applies for potential participants who see the study advertised on social media.

A27-2. Will the identification of potential participants involve reviewing or screening the identifiable personal information of patients, service users or any other person?

Yes No

Please give details below:

Clinicians currently involved in the care of potential participants will signpost participants to the study, if appropriate. These clinicians work within a service in the North West of England specifically for people with a BD diagnosis and so they will be already be aware of potential participants' diagnosis and age.

In most cases, the research team will not have access to the personal information of potential participants until the participants either contact the chief investigator via email or consent to take part online.

The only exception to this is the use of the Spectrum Connect mailing list which will be used to advertise the study. However, this list is comprised of the email addresses of people who have given their consent to be contacted about upcoming research projects in this way and the list will not be used to identify potential participants according to the inclusion criteria of this study.

A28. Will any participants be recruited by publicity through posters, leaflets, adverts or websites?

Yes No

If Yes, please give details of how and where publicity will be conducted, and enclose copy of all advertising material (with version numbers and dates).

Poster adverts will be placed in the premises of [REDACTED] Community Mental Health Team sites.

An email advertisement will be sent out to people who are on the Spectrum Connect mailing list (following previous involvement with the Spectrum Centre and Lancaster University).

The study will also be advertised through a professional dedicated Twitter account created specifically to advertise the study (https://twitter.com/OSA_BDresearch), which will not be used for any other purpose. The account page redirects any potential participants to the study's webpage.

A29. How and by whom will potential participants first be approached?

Some potential participants will be approached about the study by a member of their existing care team within [REDACTED] Community Mental Health Team (CMHT).

Potential participants on the Spectrum Connect mailing list will be approached via email using the dedicated Spectrum Centre email address.

Other potential participants will not be directly approached and may see the study advertised on social media or on a poster within [REDACTED] CMHT services.

In all cases interested potential participants will be directed to contact the chief investigator directly or to visit the study website.

A30-1. Will you obtain informed consent from or on behalf of research participants?

Yes No

If you will be obtaining consent from adult participants, please give details of who will take consent and how it will be done, with details of any steps to provide information (a written information sheet, videos, or interactive material). Arrangements for adults unable to consent for themselves should be described separately in Part B Section 6, and for children in Part B Section 7.

If you plan to seek informed consent from vulnerable groups, say how you will ensure that consent is voluntary and fully informed.

Potential participants will have access to a written and video version of the participant information sheet. Participants will also be able to email the chief investigator to ask any questions they may have before consenting to take part.

Participants can complete an online or paper consent form, if they choose to, in their own time and this will not be done in the presence of anyone from the research team.

If you are not obtaining consent, please explain why not.

N/A

Please enclose a copy of the information sheet(s) and consent form(s).

A30-2. Will you record informed consent (or advice from consultees) in writing?

Yes No

A31. How long will you allow potential participants to decide whether or not to take part?

Potential participants will have from when they first find out about the study until six weeks before analysis needs to begin to decide whether or not to take part (currently estimated as April 2020 but this could change depending on the success of recruitment). Advertisement within services and active advertisement over Twitter will stop eight weeks before analysis needs to begin to allow participants at least two weeks to decide whether or not to take part.

A32. Will you recruit any participants who are involved in current research or have recently been involved in any research prior to recruitment?

Yes
 No
 Not Known

If Yes, please give details and justify their inclusion. If Not Known, what steps will you take to find out?

Participants who are currently taking part in a drug trial are not able to take part in the study in case the medication they are taking unknowingly impacts on sleep, a question about this is included in the initial demographics and screening questionnaire that participants are asked to complete in Step 1 of the study. However, there are not considered to be any design or safety considerations if participants are taking part in other research alongside this study so this will be the participant's choice.

A33-1. What arrangements have been made for persons who might not adequately understand verbal explanations or written information given in English, or who have special communication needs?(e.g. translation, use of interpreters)

Participants need to be able to read and answer a questionnaire in English by themselves or with support to take part in this study. Due to length and time commitment of this study, it is unfortunately not possible for someone from the research team to support participants to answer twice-daily questionnaires and so participants with their own support who are not able to read and answer a questionnaire in English will not be able to take part.

The participant information sheet is written in simple English and a video version is also available for participants who find this more accessible than reading the lengthy information sheet.

The online software (REDCap) that hosts the online materials allows participants to adjust the size of the font and provides an audio version of all written information. Participants can also be sent a paper version of the participant information sheet in large font if required.

A35. What steps would you take if a participant, who has given informed consent, loses capacity to consent during the study? Tick one option only.

- The participant and all identifiable data or tissue collected would be withdrawn from the study. Data or tissue which is not identifiable to the research team may be retained.
- The participant would be withdrawn from the study. Identifiable data or tissue already collected with consent would be retained and used in the study. No further data or tissue would be collected or any other research procedures carried out on or in relation to the participant.
- The participant would continue to be included in the study.
- Not applicable – informed consent will not be sought from any participants in this research.
- Not applicable – it is not practicable for the research team to monitor capacity and continued capacity will be assumed.

Further details:

The participant information sheet details that if participants become unwell during the study and they are considered to lose capacity to consent to continue to take part, they will be withdrawn from the study but their data collected up until that point will be kept.

If you plan to retain and make further use of identifiable data/tissue following loss of capacity, you should inform participants about this when seeking their consent initially.

CONFIDENTIALITY

In this section, personal data means any data relating to a participant who could potentially be identified. It includes pseudonymised data capable of being linked to a participant through a unique code number.

Storage and use of personal data during the study

A36. Will you be undertaking any of the following activities at any stage (including in the identification of potential participants)? (Tick as appropriate)

- Access to medical records by those outside the direct healthcare team
- Access to social care records by those outside the direct social care team
- Electronic transfer by magnetic or optical media, email or computer networks
- Sharing of personal data with other organisations
- Export of personal data outside the EEA
- Use of personal addresses, postcodes, faxes, emails or telephone numbers
- Publication of direct quotations from respondents
- Publication of data that might allow identification of individuals
- Use of audio/visual recording devices
- Storage of personal data on any of the following:
 - Manual files (includes paper or film)
 - NHS computers
 - Social Care Service computers
 - Home or other personal computers
 - University computers
 - Private company computers
 - Laptop computers

Further details:

A37. Please describe the physical security arrangements for storage of personal data during the study?

Personal data on paper will be kept in a locked cabinet in a locked office on university premises that can only be accessed by members of the research team.

Electronic personal data will be kept securely on the university secure network and only members of the research team will have access to this.

A38. How will you ensure the confidentiality of personal data? Please provide a general statement of the policy and procedures for ensuring confidentiality, e.g. anonymisation or pseudonymisation of data.

All personal data will be kept confidential in accordance with the NHS Code of Confidentiality, EU General Data Protection Regulation (GDPR) and the UK's Data Protection Act 2018. Published data will not be identifiable.

A40. Who will have access to participants' personal data during the study? Where access is by individuals outside the direct care team, please justify and say whether consent will be sought.



Only members of the research team will have access to participants' personal data during the study, and this will only be any information provided by the participants themselves. Primarily it will only be the chief investigator accessing and using participants' personal data in order to communicate with participants but supervisors within the research team will also have access in case they need to contact participants in the absence of the chief investigator.

Storage and use of data after the end of the study

A41. Where will the data generated by the study be analysed and by whom?

Data will be analysed by the research team based at Lancaster University and stored on the university's secure server. Analysed data will not be identifiable.

A42. Who will have control of and act as the custodian for the data generated by the study?

	Title	Forename/Initials	Surname
	Dr	Guillermo	Perez Algorta
Post	Lecturer in Mental Health and Health Researcher		
Qualifications	PhD.		
Work Address	Department of Clinical Psychology Division of Health Research Lancaster University		
Post Code	LA1 4YW		
Work Email			
Work Telephone			
Fax	0		

A43. How long will personal data be stored or accessed after the study has ended?

- Less than 3 months
- 3 – 6 months
- 6 – 12 months
- 12 months – 3 years

Over 3 years

If longer than 12 months, please justify:

Consent forms will be stored for 10 years. All other personal data will be destroyed within 6 months of the study completion unless participants have requested a non-scientific report of the study findings, in which case their contact details will be retained for as long as necessary in order to send them this.

A44. For how long will you store research data generated by the study?

Years: 10

Months: 0

A45. Please give details of the long term arrangements for storage of research data after the study has ended. Say where data will be stored, who will have access and the arrangements to ensure security.

Paper data (e.g. questionnaires) will be kept for 10 years in a secure locked location, with only access from research team members.

Electronic data will be kept for 10 years on the secure university network. Again, this will only be accessible to the research team.

This is in accordance with Lancaster University's policies.

INCENTIVES AND PAYMENTS

A46. Will research participants receive any payments, reimbursement of expenses or any other benefits or incentives for taking part in this research?

Yes No

If Yes, please give details. For monetary payments, indicate how much and on what basis this has been determined.
There will be a prize draw for a £50 Amazon voucher for all participants who wear the actigraph for two weeks (15 nights) and complete at least the first morning questionnaire.

A47. Will individual researchers receive any personal payment over and above normal salary, or any other benefits or incentives, for taking part in this research?

Yes No

A48. Does the Chief Investigator or any other investigator/collaborator have any direct personal involvement (e.g. financial, share holding, personal relationship etc.) in the organisations sponsoring or funding the research that may give rise to a possible conflict of interest?

Yes No

NOTIFICATION OF OTHER PROFESSIONALS

A49-1. Will you inform the participants' General Practitioners (and/or any other health or care professional responsible for their care) that they are taking part in the study?

Yes No

If Yes, please enclose a copy of the information sheet/letter for the GP/health professional with a version number and date.

PUBLICATION AND DISSEMINATION

A50. Will the research be registered on a public database?

The UK Policy Framework for Health and Social Care Research sets out the principle of making information about research publicly available. Furthermore: Article 19 of the World Medical Association Declaration of Helsinki adopted in 2008 states that "every clinical trial must be registered on a publicly accessible database before recruitment of the first subject"; and the International Committee of Medical Journal Editors (ICMJE) will consider a clinical trial for publication only if it has been registered in an appropriate registry. Please see guidance for more information.

Yes No

Please give details, or justify if not registering the research.

The study is not a clinical trial and the resulting thesis write up will be publicly available online via Lancaster University.

Please ensure that you have entered registry reference number(s) in question A5-1.

A51. How do you intend to report and disseminate the results of the study? Tick as appropriate:

- Peer reviewed scientific journals
- Internal report
- Conference presentation
- Publication on website
- Other publication
- Submission to regulatory authorities
- Access to raw data and right to publish freely by all investigators in study or by Independent Steering Committee on behalf of all investigators
- No plans to report or disseminate the results
- Other (please specify)

A non-scientific report will be offered to all participants and anyone else who expresses an interest in receiving the study findings.

A52. If you will be using identifiable personal data, how will you ensure that anonymity will be maintained when publishing the results?

Published data will not be identifiable.

A53. Will you inform participants of the results?

Yes No

Please give details of how you will inform participants or justify if not doing so.

All participants will be asked if they wish to receive a non-scientific report of the study's findings and this will be sent once the study has been written up.

5. Scientific and Statistical Review

A54. How has the scientific quality of the research been assessed? Tick as appropriate:

- Independent external review
- Review within a company
- Review within a multi-centre research group

- Review within the Chief Investigator's institution or host organisation
- Review within the research team
- Review by educational supervisor
- Other

Justify and describe the review process and outcome. If the review has been undertaken but not seen by the researcher, give details of the body which has undertaken the review:

The design and methodology has been developed under supervision from two academic supervisors and has been reviewed and approved by members of the Doctorate in Clinical Psychology Programme team at Lancaster University.



For all studies except non-doctoral student research, please enclose a copy of any available scientific critique reports, together with any related correspondence.

For non-doctoral student research, please enclose a copy of the assessment from your educational supervisor/ institution.

A56. How have the statistical aspects of the research been reviewed? Tick as appropriate:

- Review by independent statistician commissioned by funder or sponsor
- Other review by independent statistician
- Review by company statistician
- Review by a statistician within the Chief Investigator's institution
- Review by a statistician within the research team or multi-centre group
- Review by educational supervisor
- Other review by individual with relevant statistical expertise
- No review necessary as only frequencies and associations will be assessed – details of statistical input not required

In all cases please give details below of the individual responsible for reviewing the statistical aspects. If advice has been provided in confidence, give details of the department and institution concerned.

	Title Forename/Initials Surname
	Dr Guillermo Perez Algorta
Department	Doctorate in Clinical Psychology
Institution	Lancaster University
Work Address	Department of Clinical Psychology Division of Health Research Lancaster University
Post Code	LA1 4YW
Telephone	
Fax	0
Mobile	0
E-mail	

Please enclose a copy of any available comments or reports from a statistician.

A57. What is the primary outcome measure for the study?

The primary outcome measures for this study are participants' scores across the twice-daily questionnaires and participants' sleep characteristics (rated quality of sleep, total sleep time and number of awakenings) across the two week measurement period.

A58. What are the secondary outcome measures?(if any)

Participants' scores on the Pittsburgh Sleep Quality Index and Epworth Sleepiness Scale.

A59. What is the sample size for the research? *How many participants/samples/data records do you plan to study in total? If there is more than one group, please give further details below.*

Total UK sample size: 40
Total international sample size (including UK): 40
Total in European Economic Area: 40

Further details:

It is intended that a total of 20 participants will be recruited to each group: suspected obstructive sleep apnoea and bipolar disorder diagnosis alone.

A60. How was the sample size decided upon? *If a formal sample size calculation was used, indicate how this was done, giving sufficient information to justify and reproduce the calculation.*

As data will be collected every day from all participants across two weeks, fewer participants are required to achieve statistical power than in cross-sectional design studies (Lu et al, 2013). However, there is no agreed method of calculating the number of participants required to achieve statistical power for this kind of study (Scherbaum & Ferreter, 2009). Therefore, the intended number of participants has been selected based on the sample sizes of previous studies and pragmatic considerations. It is the aim to recruit this many participants as it is similar to the number of participants in previous studies that have used a similar design to investigate the relationship between sleep and affect variability with people with a BD diagnosis (Gershon et al, 2012; Harvey, Schmidt, Scarnà, Semler & Goodwin, 2005; Leibenluft, Albert, Rosenthal & Wehr, 1996), and this number will provide enough power to extract a robust conclusion. Moreover, it is conceivably feasible to recruit this number of participants in the allotted time frame and with the available resources of the study.

A61. Will participants be allocated to groups at random?

Yes No

A62. Please describe the methods of analysis (statistical or other appropriate methods, e.g. for qualitative research) by which the data will be evaluated to meet the study objectives.

Preliminary analyses of between group comparisons based on demographic and clinical data (questionnaire responses) collected at baseline will be conducted using descriptive statistics and parametric tests (e.g. t-tests) or appropriate non-parametric tests if data is not normally distributed. This will be to determine if there are significant differences between the groups at baseline that may have impacted on sleep and affect variability.

Descriptive/exploratory analyses will also be conducted to evaluate average characteristics of the sleep (subjective and objective) and affect data collected for each group. Actigraph data will be analysed using GGIR package in R (van Hees et al., 2019).

Measures of instability in sleep and affect recordings will be calculated using the mean squared successive difference (MSSD; Jahng, Wood & Trull, 2008). MSSD differences between groups will be explored using generalised multilevel modelling (Jahng, Wood & Trull, 2008).

The probability of acute change (PAC; Jahng, Wood & Trull, 2008) index will be calculated and explored between groups using generalised multilevel modelling.

Patterns of missing data will be explored and decisions will be made accordingly (e.g. use of multiple imputation if missing data points are completely random).

Analysis will be conducted using R software (van Hees et al., 2019) and SPSS.

6. MANAGEMENT OF THE RESEARCH

A63. Other key investigators/collaborators. Please include all grant co-applicants, protocol co-authors and other key members of the Chief Investigator's team, including non-doctoral student researchers.

	Title	Forename/Initials	Surname
	Professor	Steven	Jones
Post	Professor of Clinical Psychology and Co-Director of the Spectrum Centre for Mental Health Research		
Qualifications	PhD.		
Employer	Lancaster University		
Work Address	Spectrum Centre Division of Health Research Lancaster University		
Post Code	LA1 4YW		
Telephone	[REDACTED]		
Fax	0		
Mobile	0		
Work Email	[REDACTED]		

A64. Details of research sponsor(s)

A64-1. Sponsor

Lead Sponsor

Status: NHS or HSC care organisation
 Academic
 Pharmaceutical industry
 Medical device industry
 Local Authority
 Other social care provider (including voluntary sector or private organisation)
 Other

Commercial status: Non-Commercial
 Commercial

If Other, please specify:

Contact person

Name of organisation Lancaster University
 Given name Becky
 Family name Gordon
 Address Head of Research Quality and Policy
 Town/city Lancaster University
 Post code LA1 4YT
 Country UNITED KINGDOM
 Telephone [REDACTED]
 Fax 0

E-mail [REDACTED]

A65. Has external funding for the research been secured?

Please tick at least one check box.

- Funding secured from one or more funders
- External funding application to one or more funders in progress
- No application for external funding will be made

What type of research project is this?

- Standalone project
- Project that is part of a programme grant
- Project that is part of a Centre grant
- Project that is part of a fellowship/ personal award/ research training award
- Other

Other – please state:

A66. Has responsibility for any specific research activities or procedures been delegated to a subcontractor (other than a co-sponsor listed in A64-1) ? Please give details of subcontractors if applicable.

- Yes
- No

A67. Has this or a similar application been previously rejected by a Research Ethics Committee in the UK or another country?

- Yes
- No

Please provide a copy of the unfavourable opinion letter(s). You should explain in your answer to question A6-2 how the reasons for the unfavourable opinion have been addressed in this application.

A68-1. Give details of the lead NHS R&D contact for this research:

	Title	Forename/Initials	Surname
	Ms	Beverley	Low
Organisation	Lancashire Care NHS Foundation Trust		
Address	The Lantern Centre		
	Vicarage Lane, Fulwood		
	Preston		
Post Code	PR2 8DW		
Work Email	[REDACTED]		
Telephone	[REDACTED]		
Fax	0		
Mobile	0		

Details can be obtained from the NHS R&D Forum website: <http://www.rdforum.nhs.uk>

A69-1. How long do you expect the study to last in the UK?

Planned start date: 01/08/2019

Planned end date: 08/05/2020

Total duration:

Years: 0 Months: 9 Days: 8

A71-1. Is this study?

Single centre

Multicentre

A71-2. Where will the research take place? (Tick as appropriate)

England

Scotland

Wales

Northern Ireland

Other countries in European Economic Area

Total UK sites in study

Does this trial involve countries outside the EU?

Yes

No

A72. Which organisations in the UK will host the research? Please indicate the type of organisation by ticking the box and give approximate numbers if known:

NHS organisations in England

NHS organisations in Wales

NHS organisations in Scotland

HSC organisations in Northern Ireland

GP practices in England

GP practices in Wales

GP practices in Scotland

GP practices in Northern Ireland

Joint health and social care agencies (eg community mental health teams)

Local authorities

Phase 1 trial units

Prison establishments

Probation areas

Independent (private or voluntary sector) organisations

Educational establishments

1

Independent research units

Other (give details)

Total UK sites in study: 1

A73-1. Will potential participants be identified through any organisations other than the research sites listed above?

Yes No

A76. Insurance/ indemnity to meet potential legal liabilities

Note: in this question to NHS indemnity schemes include equivalent schemes provided by Health and Social Care (HSC) in Northern Ireland

A76-1. What arrangements will be made for insurance and/or indemnity to meet the potential legal liability of the sponsor(s) for harm to participants arising from the management of the research? Please tick box(es) as applicable.

Note: Where a NHS organisation has agreed to act as sponsor or co-sponsor, indemnity is provided through NHS schemes. Indicate if this applies (there is no need to provide documentary evidence). For all other sponsors, please describe the arrangements and provide evidence.

- NHS indemnity scheme will apply (NHS sponsors only)
 Other insurance or indemnity arrangements will apply (give details below)

Lancaster University legal liability cover will apply.

Please enclose a copy of relevant documents.

A76-2. What arrangements will be made for insurance and/ or indemnity to meet the potential legal liability of the sponsor(s) or employer(s) for harm to participants arising from the design of the research? Please tick box(es) as applicable.

Note: Where researchers with substantive NHS employment contracts have designed the research, indemnity is provided through NHS schemes. Indicate if this applies (there is no need to provide documentary evidence). For other protocol authors (e.g. company employees, university members), please describe the arrangements and provide evidence.

- NHS indemnity scheme will apply (protocol authors with NHS contracts only)
 Other insurance or indemnity arrangements will apply (give details below)

Lancaster University legal liability cover will apply.

Please enclose a copy of relevant documents.

A76-3. What arrangements will be made for insurance and/ or indemnity to meet the potential legal liability of investigators/collaborators arising from harm to participants in the conduct of the research?

Note: Where the participants are NHS patients, indemnity is provided through the NHS schemes or through professional indemnity. Indicate if this applies to the whole study (there is no need to provide documentary evidence). Where non-NHS sites are to be included in the research, including private practices, please describe the arrangements which will be made at these sites and provide evidence.

- NHS indemnity scheme or professional indemnity will apply (participants recruited at NHS sites only)
 Research includes non-NHS sites (give details of insurance/ indemnity arrangements for these sites below)

Lancaster University legal liability cover will apply.

Please enclose a copy of relevant documents.

A78. Could the research lead to the development of a new product/process or the generation of intellectual property?

Yes No Not sure

PART C: Overview of research sites

Please enter details of the host organisations (Local Authority, NHS or other) in the UK that will be responsible for the research sites. *For further information please refer to guidance.*

Investigator identifier	Research site	Investigator Name
IN1	<input type="radio"/> NHS/HSC Site <input checked="" type="radio"/> Non-NHS/HSC Site	Forename Amy Middle name Victoria Family name Brown Email ████████████████████ Qualification MSci Psychology and Psychological (MD...) Practice Country UNITED KINGDOM
Institution name	Lancaster University	
Department name	Department of Clinical Psychology	
Street address	Division of Health Research	
Town/city	Lancaster University	
Post Code	LA1 4YW	
Country	UNITED KINGDOM	

PART D: Declarations

D1. Declaration by Chief Investigator

1. The information in this form is accurate to the best of my knowledge and belief and I take full responsibility for it.
2. I undertake to fulfil the responsibilities of the chief investigator for this study as set out in the UK Policy Framework for Health and Social Care Research.
3. I undertake to abide by the ethical principles underlying the Declaration of Helsinki and good practice guidelines on the proper conduct of research.
4. If the research is approved I undertake to adhere to the study protocol, the terms of the full application as approved and any conditions set out by review bodies in giving approval.
5. I undertake to notify review bodies of substantial amendments to the protocol or the terms of the approved application, and to seek a favourable opinion from the main REC before implementing the amendment.
6. I undertake to submit annual progress reports setting out the progress of the research, as required by review bodies.
7. I am aware of my responsibility to be up to date and comply with the requirements of the law and relevant guidelines relating to security and confidentiality of patient or other personal data, including the need to register when necessary with the appropriate Data Protection Officer. I understand that I am not permitted to disclose identifiable data to third parties unless the disclosure has the consent of the data subject or, in the case of patient data in England and Wales, the disclosure is covered by the terms of an approval under Section 251 of the NHS Act 2006.
8. I understand that research records/data may be subject to inspection by review bodies for audit purposes if required.
9. I understand that any personal data in this application will be held by review bodies and their operational managers and that this will be managed according to the principles established in the Data Protection Act 2018.
10. I understand that the information contained in this application, any supporting documentation and all correspondence with review bodies or their operational managers relating to the application:
 - ◊ Will be held by the REC (where applicable) until at least 3 years after the end of the study; and by NHS R&D offices (where the research requires NHS management permission) in accordance with the NHS Code of Practice on Records Management.
 - ◊ May be disclosed to the operational managers of review bodies, or the appointing authority for the REC (where applicable), in order to check that the application has been processed correctly or to investigate any complaint.
 - ◊ May be seen by auditors appointed to undertake accreditation of RECs (where applicable).
 - ◊ Will be subject to the provisions of the Freedom of Information Acts and may be disclosed in response to requests made under the Acts except where statutory exemptions apply.
 - ◊ May be sent by email to REC members.
11. I understand that information relating to this research, including the contact details on this application, may be held on national research information systems, and that this will be managed according to the principles established in the Data Protection Act 2018.
12. Where the research is reviewed by a REC within the UK Health Departments Research Ethics Service, I understand that the summary of this study will be published on the website of the Health Research Authority (HRA) together with the contact point for enquiries named below. Publication will take place no earlier than 3 months after the issue of the ethics committee's final opinion or the withdrawal of the application.

Contact point for publication *(Not applicable for R&D Forms)*

HRA would like to include a contact point with the published summary of the study for those wishing to seek further

information. We would be grateful if you would indicate one of the contact points below.

- Chief Investigator
- Sponsor
- Study co-ordinator
- Student
- Other – please give details
- None

Access to application for training purposes (Not applicable for R&D Forms)

Optional – please tick as appropriate:

I would be content for members of other RECs to have access to the information in the application in confidence for training purposes. All personal identifiers and references to sponsors, funders and research units would be removed.

This section was signed electronically by Miss Amy Brown on 27/08/2019 10:11.

Job Title/Post: Trainee Clinical Psychologist

Organisation: [REDACTED]

Email: [REDACTED]

D2. Declaration by the sponsor's representative

If there is more than one sponsor, this declaration should be signed on behalf of the co-sponsors by a representative of the lead sponsor named at A64-1.

I confirm that:

1. This research proposal has been discussed with the Chief Investigator and agreement in principle to sponsor the research is in place.
2. An appropriate process of scientific critique has demonstrated that this research proposal is worthwhile and of high scientific quality.
3. Any necessary indemnity or insurance arrangements, as described in question A76, will be in place before this research starts. Insurance or indemnity policies will be renewed for the duration of the study where necessary.
4. Arrangements will be in place before the study starts for the research team to access resources and support to deliver the research as proposed.
5. Arrangements to allocate responsibilities for the management, monitoring and reporting of the research will be in place before the research starts.
6. The responsibilities of sponsors set out in the UK Policy Framework for Health and Social Care Research will be fulfilled in relation to this research.

Please note: The declarations below do not form part of the application for approval above. They will not be considered by the Research Ethics Committee.

7. Where the research is reviewed by a REC within the UK Health Departments Research Ethics Service, I understand that the summary of this study will be published on the website of the National Research Ethics Service (NRES), together with the contact point for enquiries named in this application. Publication will take place no earlier than 3 months after issue of the ethics committee's final opinion or the withdrawal of the application.
8. Specifically, for submissions to the Research Ethics Committees (RECs) I declare that any and all clinical trials approved by the HRA since 30th September 2013 (as defined on IRAS categories as clinical trials of medicines, devices, combination of medicines and devices or other clinical trials) have been registered on a publically accessible register in compliance with the HRA registration requirements for the UK, or that any deferral granted by the HRA still applies.

This section was signed electronically by An authorised approver at sponsorship@lancaster.ac.uk on 27/08/2019 12:29.

Job Title/Post: Head of Research Quality and Policy

Organisation: Lancaster University

Email: 

D3. Declaration for student projects by academic supervisor(s)

1. I have read and approved both the research proposal and this application. I am satisfied that the scientific content of the research is satisfactory for an educational qualification at this level.
2. I undertake to fulfil the responsibilities of the supervisor for this study as set out in the UK Policy Framework for Health and Social Care Research.
3. I take responsibility for ensuring that this study is conducted in accordance with the ethical principles underlying the Declaration of Helsinki and good practice guidelines on the proper conduct of research, in conjunction with clinical supervisors as appropriate.
4. I take responsibility for ensuring that the applicant is up to date and complies with the requirements of the law and relevant guidelines relating to security and confidentiality of patient and other personal data, in conjunction with clinical supervisors as appropriate.

Academic supervisor 1

This section was signed electronically by Professor Steven Jones on 27/08/2019 10:29.

Job Title/Post:

Organisation:

Email:

Academic supervisor 2

This section was signed electronically by Dr. Guillermo Perez Algorta on 27/08/2019 21:14.

Job Title/Post: Lecturer

Organisation: Lancaster University

Email: 

Impact of obstructive sleep apnoea for people with a bipolar disorder diagnosis

Applicants**Chief Investigator**

Amy Brown, Trainee Clinical Psychologist, Division of Health Research, Lancaster University, Lancaster, LA1 4YT, UK

Supervisors

Dr Guillermo Perez Algorta, Lecturer in Health Research, Division of Health Research, Lancaster University, Lancaster, LA1 4YT, UK

Professor Steven Jones, Professor in Health Research and Director of the Spectrum Centre, Division of Health Research, Lancaster University, Lancaster, LA1 4YT, UK

Introduction

Obstructive Sleep Apnoea (OSA) describes repetitive pharyngeal obstruction during sleep, which reduces airflow, consequently disrupting sleep and leading to fatigue, daytime sleepiness and low mood (Akashiba, 2002; Chervin, 2000; Jordan, McSharry & Malhorta, 2014). OSA is believed to be six to twelve times more prevalent in people with a bipolar disorder (BD) diagnosis, suggesting that approximately a quarter of people with a BD diagnosis have OSA (Kelly, Douglas, Denmark, Brasuell & Lieberman, 2013; Steier et al, 2014; Stubbs et al., 2016; Young et al., 1993). Similarly, around 20% of people with a diagnosis of OSA have been found to meet diagnostic criteria for BD or other mood difficulties (Schröder & O'Hara, 2005). People with OSA or a BD diagnosis often share difficulties of reduced quality of life, difficulties socialising, fatigue and reduced cognitive abilities and it has been suggested that symptoms of OSA may either add to or be misattributed to difficulties diagnosed as BD (Kelly, Douglas, Denmark, Brasuell & Lieberman, 2013). Whilst the high co-morbidity between OSA and mood difficulties have informed routine

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considerations of mood within assessment and treatment for OSA (National Institute for Health and Care Excellence (NICE), 2015), OSA is not routinely considered when assessing and supporting people with a BD diagnosis (NICE, 2014; Schröder & O'Hara, 2005). Little is known on the relationship between OSA and mood for people with a BD diagnosis, impeding clinical recognition and management. Therefore, research into the relationship between OSA and experiences diagnosed as BD is important to inform clinical guidelines and practice.

Whilst sleep disturbance is considered characteristic of periods of acutely elevated and low mood experienced by people with a BD diagnosis (Belmaker, 2004), research has found increased variations in sleep and affect, and more extreme experiences of negative affect, for people with a BD diagnosis compared to the general population, even when people are “inter-episode” (not currently experiencing a phase of acutely high or low mood; Harvey, Schmidt, Scarnà, Semler & Goodwin, 2005; Lovejoy & Steuerwald, 1995). Gershon and colleagues (2012) argue the importance of investigating difficulties for people with a BD diagnosis when they are “inter-episode” to learn of factors that maintain and trigger further difficulties. They measured daily affect and sleep and recorded more variability in sleep for people with a BD diagnosis compared to controls, in addition to more variability and extremes in negative affect, recommending further research into the reasons for increased affect variability in “inter-episode” periods to inform targets for intervention. It is theorised that sleep, and consequently circadian rhythms, for people with a BD diagnosis are disrupted and variable, even when “inter-episode” (Grandin, Alloy & Abramson, 2006), leading to further acute mood difficulties due the apparent bi-directional relationship between sleep and mood (Geddes & Miklowitz, 2013). Interpersonal and social rhythms therapy (IPSRT; Frank, 2007) uses a biopsychosocial approach to support people with a BD diagnosis to regulate their sleep-wake cycle and mood stability to increase functioning (Frank, Swartz & Kupfer, 2000). Despite evidence for the effectiveness of IPSRT (Geddes & Miklowitz, 2013), it does not account for the potential impact of OSA affecting a quarter of people with a BD diagnosis, indicating a need for research to ascertain the relationship between OSA and difficulties diagnosed as BD.

OSA conceivably deregulates circadian rhythms through disrupting the sleep cycle (Noda, Yasuma, Okada & Yokota, 1998), potentially having a more disruptive effect on people with a BD diagnosis who are believed to be more vulnerable to circadian rhythm disruption (Frank, Swartz & Kupfer, 2000). However, the little literature surrounding OSA and a BD diagnosis comprises of case reports that do not present a consistent picture of the potential impact of OSA on people who have a BD diagnosis (Blazer, 1981; Fleming, Fleetham, Taylor & Remick, 1985; Strakowski et al., 1991; Szaulińska et al., 2017). The proposed study aims to investigate sleep and affect variability of people with a BD diagnosis and suspected OSA, compared to people with a diagnosis of BD alone. Specifically, the study will intend to answer whether sleep characteristics and affect vary more for people with suspected OSA and a BD diagnosis compared to those with a diagnosis of BD alone, in addition to whether people with suspected OSA and a BD diagnosis experience greater acute affect changes compared to those with a diagnosis of BD alone. It is predicted that people with suspected OSA and a BD diagnosis will experience more sleep and affect variability and greater extremes of affect change.

Method

Design

The study will be a longitudinal comparison of the variability and relationship between quantitative sleep and affect measures, collected over two weeks (15 nights), between a group of participants with a BD diagnosis and suspected OSA and a group of participants with a diagnosis of BD alone (control group). Sleep data will be captured using objective (actigraphy) and self-report measures of sleep. Affect will be captured using a twice-daily self-report measure. This design will allow for comparison of the variability of sleep and affect data, and the extent of affect changes, between the control and suspected OSA group.

Night to night variability in sleep parameters is high, even in the general population (Wohlgemuth, Edinger, Fins & Sullivan, 1999) and there is a body of literature around the length of measurement necessary to accurately capture sleep variables (e.g. Edinger, Marsh, McCall, Erwin & Lininger, 1991; Knutson, Rathouz, Yan, Liu & Lauderdale, 2007; Wohlgemuth et al., 1999). However, there is no agreed length of necessary measurement to accurately measure sleep parameters of people with OSA. Therefore,

measurement across two weeks (15 nights) is considered appropriate as it strikes a balance between the length of time suggested necessary for accurate measurement, based on the age of the participants, and considerations of the time commitment for participants.

Participants

It is intended that 20 people with a BD diagnosis and suspected OSA (OSA group) and 20 people with a diagnosis of BD alone (control group) will be recruited. As data will be collected every day from all participants across two weeks, fewer participants are required to achieve statistical power than in cross-sectional design studies (Lu et al, 2013). However, there is no agreed method of calculating the number of participants required to achieve statistical power for this kind of study (Scherbaum & Ferreter, 2009). Therefore, the intended number of participants has been selected based on the sample sizes of previous studies and pragmatic considerations. It is the aim to recruit this many participants as it is similar to the number of participants in previous studies that have used a similar design to investigate the relationship between sleep and affect variability with people with a BD diagnosis (Gershon et al, 2012; Harvey, Schmidt, Scarnà, Semler & Goodwin, 2005; Leibenluft, Albert, Rosenthal & Wehr, 1996), and this number will provide enough power to extract a robust conclusion. Moreover, it is conceivably feasible to recruit this number of participants in the allotted time frame and with the available resources of the study.

Although the ideal protocol would be to match participants by age and biological sex, this is likely to be too challenging alongside time and geographical constraints. As age, biological sex and sex steroids are known to influence sleep variables (Mong & Cusmano, 2016; Reyner & Horne, 1995), particularly OSA (Jordan, McSharry & Malhorta, 2014), participants will be asked to disclose their biological sex and if they are currently taking any hormonal drugs so that comparisons can be made between groups. Moreover, all participants will be aged between thirty and sixty years old. This chosen age range is intended to capture the demographic identified as most at risk of OSA (NHS, 2016; Stubbs et al., 2016; Young et al., 1993) to maximise recruitment, whilst minimising the presence of other extraneous sleep variables, such as sleep fragmentation, of which the prevalence is known to increase with age (Crowley, 2011).

Participants will be recruited from the North West due to the locality of the chief investigator and the research protocol involving the need to visit a subset of participants at home. Furthermore, restricting the geographical area of recruitment may minimise costs of posting sleep measurement equipment, as it may be possible to deliver some devices personally. Therefore, inclusion criteria for all participants will be as follows:

Inclusion criteria for all participants:

- Aged between thirty and sixty years old.
- Live in North West England.
- Report a diagnosis of BD (or manic depression), the difficulties associated with which will be verified as being consistent with the current diagnostic criteria for BD through screening using the Mini International Psychiatric Interview, (MINI; Sheehan, 2016), sections A and C, which are the sections of this brief screening structured interview that are consistent with the DSM-V (American Psychological Association, 2013) criteria for BD. It is understood that a diagnosis of BD is commonly accompanied with further psychiatric diagnoses (Krishnan, 2005) and so excluding participants with any further diagnoses would not likely achieve a representative sample (Harvey, Schmidt, Scarnà, Semler & Goodwin, 2005). However, it will be confirmed that BD is participants' primary diagnosis, defined as the diagnosis given to the experiences that are most prominent, distressing and/or disabling, to reduce the effects of confounding difficulties on results as much as feasibly possible.
- Report to being between periods of extreme mood. This will be confirmed through participants not affirming current difficulties (in the past two weeks) that meet criteria for a "major depressive" or "hypomanic/manic" episode during screening using the MINI (Sheehan, 2016).

Exclusion criteria for all participants:

Report of the following:

- Currently living in an environment that is likely to disrupt sleep, e.g. having no sheltered accommodation.

- A medical condition that may affect sleep such as a previous traumatic brain injury, current neurodegenerative condition or substance addiction (Hasler, Smith, Cousins & Bootzin, 2012; Lee & Thomas, 2011; Ouellet, Beaulieu-Bonneau, & Morin, 2015).

The above exclusion criteria will initially be screened for using initial screening questions that participants will answer via an online or paper questionnaire following consenting to participate in the study. These questions are based on the demographic information section of the Duke Structured Interview Schedule (DSI; Edinger et al., 2009). Whilst this tool has not been validated for the screening of sleep disorders according to DSM-V criteria (Taylor et al., 2018), due to its design as a screening tool for sleep disorders, it contains demographic questions designed to collect information on wider factors that could impact on sleep. Participants' answers to these initial screening questions will inform questions asked during a later telephone-screening interview. Sections I and J of the MINI (Sheehan, 2016) will be administered during the telephone-screening interview to assess for "alcohol use disorder" and "substance use disorder (non alcohol)" respectively if participants have confirmed that they drink alcohol or/and use non-prescribed drugs. If participants report that they are frequently woken in the night on the initial screening questionnaire, this can be discussed further with the participant during the telephone-screening interview. Supervision will be used to discuss the eligibility of participants based on the information they provide.

Inclusion criteria for the OSA group will be as follows:

- Screens positively for suspected OSA. A positive screen will involve a score equal to or above 2 when interviewed using the Structured Clinical Interview for DSM-5 Sleep Disorders (SCISD; Taylor et al., 2018) and a score equal to or above 3 on the STOP-Bang Questionnaire (Chung et al., 2008), which has a high sensitivity of 93% (moderate OSA) and 100% (severe OSA) despite low specificity (43% and 37% respectively). This screen will also be administered with any potential participants with a reported existing diagnosis of sleep apnoea to determine if any treatment or lifestyle changes have reduced symptoms below inclusion criteria for this study.

Whilst information on participant medication will be collected through questions based on the demographic questions of the DSI (Edinger et al., 2009) it is anticipated that there will be no significant

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difference between medication taken by the control and suspected OSA groups as medication is the first line treatment for difficulties diagnosed as BD (NICE, 2014). Therefore, attempting to recruit participants with a diagnosis of BD not taking medication, or attempting to control for medication, is likely to be unfeasible and unrepresentative (Harvey, Schmidt, Scarnà, Semler & Goodwin, 2005; Harvey, Talbot & Gershon, 2009).

Materials

REDCap (Research Electronic Data Capture). REDCap (Harris et al., 2019; Harris et al., 2009) is a secure, online software platform for collecting research data. REDCap is licenced by Lancaster University and will be used to host the online aspects of the study.

Duke Structured Interview Schedule (DSI). The demographic information section of the DSI (Edinger et al., 2009) has been adapted to develop initial screening questions that participants will complete either online (through REDCap) or on paper following consenting to participate in the study. These questions will be used to collect demographic information and further information on factors that could impact sleep, informing the questions asked during the later telephone-screening interview. The following information will be collected using questions adapted from the DSI: name, date of birth, biological sex, information around current employment, travel and living arrangements, use of prescribed and non-prescribed medications/substances and information around parasomnias. Where information will not be used to screen participants for eligibility, it will be used to characterise the participant groups and inform of potential confounding variables and limitations following data collection. For instance, if a significant difference in prescribed medication use is found between the OSA and control group, this will need to be recognised as a confounding variable as medication can affect sleep (Eidelman, Talbot, Gruber, Hairston & Harvey, 2010).

Alongside questions adapted from the DSI (Edinger et al., 2009), participants will be asked questions around their BD diagnosis to further characterise the participant groups, and questions around their most recent experience of an extreme of mood to inform questions during the telephone-screening interview. Participants will also be asked to provide their preferred contact details and their address for postage/delivery of the actigraph equipment.

STOP-Bang Questionnaire. Participants will be asked to complete the STOP-Bang Questionnaire (Chung et al., 2008) as part of screening for eligibility for either the OSA or control group as it is cited as one of the best screening tools for OSA (Amra et al., 2018; Vana, Silva & Goldberg, 2013).

Pittsburgh Sleep Quality Index (PSQI) and Epworth Sleepiness Scale (ESS). Participants will also be asked to complete the PSQI (Buysse, Reynolds, Monk, Berman & Kupfer, 1989) and ESS (Johns, 1991) to further characterise the groups. These scales are two of the most frequently used subjective measures of sleep quality (Buysse et al., 2008) and each have been used to characterise groups with confirmed OSA (Epstein et al., 2009; Tufik, Santos-Silva, Taddei & Bittencourt, 2010; Vana, Silva & Goldberg, 2013), but not for people with a BD diagnosis (Soreca, Battenfield, Hall & 2015). Therefore, characterisation of the groups in the current study using these measures will newly contribute to the literature around OSA in people with a BD diagnosis.

7 Up 7 Down Inventory. Participants will also be asked to complete the 7 Up 7 Down Inventory (Youngstrom, Murray, Johnson & Findling, 2013) as it is a brief measure of the severity of experiences relating to a diagnosis of BD which will therefore provide a baseline characterisation of this for each group.

Mini International Psychiatric Interview (MINI). The MINI (Sheehan, 2016) sections A and C will be used as part of the telephone-screening interview for all participants to confirm that their past difficulties are consistent with the DSM-V (American Psychological Association, 2013) criteria for BD, but also that participants are currently “inter-episode” in terms of their difficulties and not currently experiencing pervasive extremes in mood. Moreover, Sections I and J of the MINI will be used to assess for “alcohol use disorder” and “substance use disorder (non alcohol)” respectively if participants have previously confirmed that they drink alcohol or/and use non-prescribed drugs through the initial screening questions.

Structured Clinical Interview for DSM-5 Sleep Disorders (SCISD). The Obstructive Sleep Apnoea section of the SCISD (Taylor et al., 2018) will also be administered during the telephone-screening interview as part of screening for eligibility for either the OSA or control group as is it consistent with the current DSM-V (American Psychological Association, 2013) criteria for OSA.

WatchPAT™ Oximeter. Whilst the gold standard assessment for OSA is polysomnography (Jordan, McSharry & Malhorta, 2014), evidence supports the use of an oximeter in detecting OSA when polysomnography is not possible (Mulgrew, Fox, Ayas & Ryan, 2007; Vázquez et al, 2000). An oximeter is a device that can be operated at home rather than in a laboratory. The WatchPAT™ 200U device (Itamar Medical, 2015) measures Peripheral Arterial Tone (PAT), oxygen saturation of the blood and movement through a probe worn on the finger connected to a device worn on the wrist while sleeping. Through recording these variables, the device calculates a Respiratory Disturbance Index (RDI) according to the number of times the variables indicate that the sleeper stopped breathing, had suppressed breathing, or experienced a respiratory effort related arousal from sleep, per hour of sleep. The device also estimates the person's Apnoea-Hypopnoea Index (AHI) score, which is a measure of OSA severity comparable with polysomnography results. Diagnosis of OSA using WatchPAT™ has been found to have good sensitivity and specificity for detecting OSA that was then confirmed with polysomnography (Ayas, Pittman, MacDonald & White, 2003; Kenny, Christine & David, 2007; Yuceege, Firat, Demir & Ardic, 2013).

It is possible to assess a subset of nine participants (maximum number possible utilising available resources) in the OSA group with the WatchPAT™ 200U over night. This will be done to gain a RDI measurement for nine participants to further characterise the OSA group. Participants asked will be those geographically closest to Lancaster University to reduce necessary time and cost of delivery and collection as the chief investigator will deliver the oximeter in order to demonstrate how to fit and use the device and answer any questions. The device also comes with clear demonstration card and there is also step by step tutorials of how to fit the device online: <https://www.youtube.com/watch?v=rckaIg8PHJA>.

GENEActiv™ actigraph. Sleep variability will be objectively measured through actigraphy. An actigraph is a light, waterproof, watch-like device worn on the non-dominant wrist that monitors movement through an acceleration sensor. Research has shown that actigraphy is able to estimate the following sleep variables with reasonable accuracy compared to polysomnography (Martin & Hakim, 2011): total sleep time (TST), sleep efficiency (SE, percentage of time in bed actually spend asleep) and wake after sleep onset (WASO, time spent awake during the night between initially falling asleep and finally waking up), which are

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relevant variables to OSA monitoring. Participants will be posted (or delivered, depending on geographical location) an actigraph device (GENEActiv™ Original model (Activinsights, 2017)) and asked to wear it continually for a period of two weeks (15 nights) before returning the device. The data collected through the actigraphs will provide estimates of variability in TST, SE and WASO for each participant across the two weeks of data collection.

Positive and Negative Affect Scale (PANAS). Participants will be asked to record affect twice on a daily basis using the PANAS (Watson, Clark & Tellegen, 1988). The PANAS asks participants to rate how much they identify with 10 positive affect adjectives and 10 negative affect adjectives on a scale of 1-5 (1 being “very slightly/not at all” and 5 being “extremely”). The PANAS has been shown to have good psychometric properties and has been used in previous research measuring sleep and affect variability in participants with a diagnosis of BD (Gershon et al, 2012).

Participants will be asked to answer the PANAS based on how they feel currently, once in the morning (before 13:00) and once in the afternoon/evening (between 13:00 and 24:00). They will be able to complete the PANAS online using a computer, laptop, tablet or mobile phone, and will receive an email containing the link to each questionnaire. Alternatively, participants can complete the PANAS using a paper booklet that they will receive with their actigraph.

Alongside the PANAS completed in the morning, participants will also be asked to answer three questions about their sleep the night before: the time they estimate falling asleep, the time they estimate waking up, and to rate the quality of their sleep. Research suggests that the combination of an objective measure through actigraphy, corroborated with a subjective, self-report measure, is the most reliable way to measure sleep (Kushida et al., 2001). Moreover, estimated sleep and wake times are the two variables required by the data analysis software to corroborate the actigraph data and increase the validity of interpretations. The three sleep questions will be presented to participants before the morning PANAS questions in the paper questionnaire booklet and online. It is expected that each PANAS questionnaire, including answering the questions on sleep will take two minutes to complete.

Procedure

Recruitment. Participants will be recruited through advertisement of the study through social media (using a dedicated Twitter account @AmyBrow68300074), through emails sent to the Spectrum Connect database held by the Spectrum Centre at Lancaster University, and through a poster advertisement placed in the premises of the [REDACTED] Community Mental Health Team (CMHT). Clinicians within [REDACTED] CMHT will be contacted by the chief investigator and provided information on the study to share, as is felt appropriate, with people eligible for the study that they are currently working with.

All methods of advertising the study will provide participants with an email address for the chief investigator and a QR code and link to the online participant information sheet (www.tinyurl.com/OSA-BDresearch). It will be advertised that participants can email the chief investigator to request a paper copy of the participant information sheet to be sent to them in the post if they prefer. Clinicians with [REDACTED] CMHT will be provided with paper participant information sheets to provide to participants if they are interested. Both online and paper information sheets inform potential participants of a video version of the information sheet that they can watch instead of reading the participant information sheet: <https://youtu.be/yFb1jPqsvso>. Participants are encouraged throughout the information given through the participant information sheet and video to email the chief investigator if they have any questions regarding the study.

Consent. Participants can consent to participate in the study online through clicking through from the participant information sheet and completing an online consent form (using a desktop or laptop computer only) or through completing a paper consent form and returning to the chief investigator using a pre-stamped envelope, depending on their preference. Once participants have consented to take part, they will be invited to take part in Step 1 of the study.

Step 1. Step 1 of the study begins once participants have consented to take part in the study and comprises of answering demographic and initial screening questions, the STOP-Bang questionnaire, PSQI, ESS and 7 Up 7 Down Inventory. It is anticipated that answering all questions will take participants twenty minutes in total.

Participants who consent to take part in the study online will be immediately navigated to the first page of online questions. Participants can save their progress and return to the online questions later at a time that is convenient for them.

Participants who would prefer a paper copy of the initial questionnaires will be posted these with a pre-stamped envelope to return.

Step 2. Following receiving their responses to the questions asked in Step 1, participants will be contacted by the chief investigator (using their preferred method of contact they provide in Step 1) to arrange a telephone-screening interview at a time that is convenient for them. Wherever possible, telephone interviews will be conducted over Zoom (<https://www.zoom.us/>) or Skype to minimise telephone costs. Zoom is a video conferencing software like Skype that will allow face to face contact with participants, if they consent to use the video function, which will enable the chief investigator (who will be conducting the telephone interviews) to be more aware of any signs of distress from the participant during the interview and able to adapt the process accordingly. If participants opt out of the video function on Zoom, the software acts like a telephone call. Zoom requires participants to have access to a smart phone, tablet, computer or laptop with at least a microphone if not also a camera. Participants will receive a link via email and will not require login credentials to use the software. However, Skype calls can be conducted if participants would prefer. If participants would prefer to be contacted telephone, the interview will be conducted using a landline telephone in a private room at Lancaster University. These interviews will be offered during the day or early evening to fit around participants' commitments.

During the telephone-screening interview, participants may be asked to clarify answers that they provided to questions during Stage 1 if their answers suggest they may not be eligible for the study. All participants will be interviewed using Section A and C of the MINI and the Obstructive Sleep Apnoea Syndrome section of the SCISD. If a participant's responses during Step 1 indicate that they drink alcohol and/or take non-prescribed substances, sections I and/or J of the MINI will also be administered accordingly. Participants will also be invited to ask any questions about the study that they may have. Telephone-screening interviews should take no longer than 45 minutes.

Following the telephone-screening interview, the chief investigator will seek supervision around any potential participants for whom it is unclear if they are eligible to participate based on the information they have provided. The chief investigator will then contact participants using their preferred method of contact, either to make arrangements for Step 3 of the study or to explain that the responses they have given suggest that they are not eligible to continue participating in the study. Everyone who is not able to continue participating in the study will be invited to leave an email or postal address to be sent a non-scientific report of the study once the study is completed and will be given the option to withdraw their data. People continuing to participate will be told which group they have been assigned to based on their responses.

Step 3. Nine participants in the OSA group who are geographically closest to Lancaster University will be invited to undergo the overnight oximeter test. If the participants who are geographically closest decline, then the next closest participants will be invited to undergo the test if it is still feasible for the chief investigator to deliver and collect the oximeter to the participants' homes. For participants who undergo the overnight test, the chief investigator will deliver the oximeter to the participant's home, at a time suitable for them, and provide instructions on how to operate it. The chief investigator will then leave the oximeter with the participant and return the next day to collect it at a convenient time for the participant. Participants will then be given their actigraph by the chief investigator to begin wearing for two weeks (15 nights), along with the paper questionnaire booklet if they wish to use this to complete the twice-daily questionnaires.

Participants not completing the overnight test will either be posted their actigraph to a convenient location for them or delivered it by the chief investigator (depending on geographical location). Participants will be asked to begin wearing their actigraph once they receive it and to begin completing the twice-daily questionnaires the next morning. The actigraphs will be programmed to be already measuring movement when participants receive them so that participants do not need to do anything more than put them on. Data collection will begin from the night preceding the first morning questionnaire that participants' complete and end after 15 nights in total, all other data will be deleted.

Once participants have worn their actigraphs for two weeks (15 nights), the chief investigator will contact them using the preferred method of contact to arrange either collection or free postage of the

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actigraph from where they collected it (depending on how they received the actigraph). At the end of the final afternoon questionnaire, participants are invited to leave any comments or feedback on the study. All participants will be invited to leave an email or postal address to receive a non-scientific report of the study findings.

Prize draw. The prize draw for a £50 Amazon voucher will be conducted once all participants have completed the study. All participants who wear the actigraph for two weeks (15 nights) and complete at least the first morning questionnaire will be entered. A name will be drawn at random by the chief investigator and that person will be contacted to arrange receipt of their prize. Should the winner not be contactable within a reasonable amount of time, names will continue to be drawn until the prize is accepted.

Analysis. Preliminary analyses of between group comparisons based on demographic and clinical data collected at baseline will be conducted using descriptive statistics and parametric tests (e.g. t-tests) or appropriate non-parametric tests if data is not normally distributed. This will be to determine if there are significant differences between the groups at baseline that may have impacted on sleep and affect variability.

Descriptive/exploratory analyses will also be conducted to evaluate average characteristics of the sleep (subjective and objective) and affect data collected for each group. Actigraph data will be analysed using GGIR package in R (van Hees et al., 2019).

Measures of instability in sleep and affect recordings will be calculated using the mean squared successive difference (MSSD; Jahng, Wood & Trull, 2008) index as done by Gershon and colleagues (2012), based on recommendations for use of this index in prospective measurement of affect for people with a diagnosis of a mood cycling condition such as BD (Ebner-Priemer, Eid, Kleindienst, Stabenow & Trull, 2009). MSSD differences between groups will be explored using generalised multilevel modelling (Jahng, Wood & Trull, 2008).

The probability of acute change (PAC; Jahng, Wood & Trull, 2008) index, which is similarly recommended for use in capturing affect instability for people with a diagnosis of a mood cycling condition, will be calculated and explored between groups using generalised multilevel modelling.

MSSD and PAC indices are recommended as measures of affect instability as they account for both variability and temporal dependency in a time series and have been found to capture affective instability better than other indices (Jahng, Wood & Trull, 2008).

Analysis will be conducted using R software (van Hees et al., 2019) and SPSS.

Dissemination. It is intended that the findings will be submitted for publication in an academic journal (e.g. *Bipolar Disorders* or *Journal of Affective Disorders*) and that findings may potentially be presented at a peer review conference. The chief investigator will produce a free, non-scientific report of the findings that will be available for anyone who is interested and those participants who have said they would like to receive one. The study findings will also be disseminated during the thesis presentation day organised by the Lancaster Doctorate in Clinical Psychology course.

Consultation with Experts by Experience

A panel of three experts by experience (people with a bipolar disorder or manic depression diagnosis), organised through the Spectrum Centre at Lancaster University, were consulted on the advertisement materials, participant information sheet and methodology of the study. The advertisement materials and participant information sheet have been adapted according to feedback. This involved specifying more clearly the expected time commitment of participants in each step and highlighting the benefits that participating in research can have. All three experts by experience felt that the design of the methodology of the study was acceptable and that they would participate in the study if they met the requirements.

Practical Issues

The Lancaster University Doctorate in Clinical Psychology department has accepted application for the funds necessary to complete the study. Permission for use of copyrighted measures has been sought where necessary. The licences for all the necessary statistical analyses and for the online platform to deliver questionnaires electronically (REDCap) are already available through Lancaster University.

Ethical Considerations

Risk to participants

It is hoped that the study may support people of moderate to high risk of OSA to recognise this and to seek advice from their GP. When participants are identified as having suspected OSA, they will be made aware of this and encouraged to see their GP. They will be provided with a letter to show to their GP that explains a little about the study and why the person is suspected to have OSA. Whilst it is considered that the study should pose little to no risk to participants, contact numbers and websites are provided to participants in case of distress. It is recognised that the study requires a twice-daily commitment from participants for two weeks in addition to the screening measures. Completion of all twice-daily measures during the two weeks is not mandatory and all participants who wear the actigraph for two weeks (15 nights) and complete at least the first morning questionnaire will be entered into the prize draw.

Risk to researcher

The chief investigator will need to visit participants at home to deliver and explain how to use the oximeter and deliver actigraphs. The [REDACTED] Done worker policy will be followed in order to ensure the safety of the chief investigator. This will involve the details of the visit (e.g., participant, date, time, location) being shared with one of the two supervisors within the research team. They will telephone or text the supervisor of the team when the visit is concluded. If this telephone call/text does not take place, attempts will be made to contact the chief investigator. If contact cannot be made, the appropriate authorities will be informed.

Risk to equipment

The equipment being provided to participants is expensive. Where actigraphs are posted this will be done using signed for delivery using a private courier. Participants will be asked to confirm that they are prepared to take care of the equipment and return it at the end of the data collection period. However, it is a recognised risk that equipment may be damaged or lost. In the event that equipment is damaged or lost, participants will be assured that this is a recognised risk and their participation will not necessarily be affected. The study has access to 40 actigraphs in total but it is the intention that not all actigraphs will be used at once to ensure that there are replacements available to participants in the event of the equipment not working or accidental loss or damage. Participants will not be held liable for any unintended loss or damage of the equipment.

Confidentiality and Anonymity

The personal information that participants provide will be kept confidential. The data collected for this study will be stored securely and only the researchers conducting this study will have access to the raw data.

- Personal data will be kept separately from all other data. REDCap marks personal data to ensure that is not transferred when data is exported from REDCap to data analysis software (e.g. SPSS), replacing it instead with a participant ID assigned in REDCap.
- Paper copies of questionnaires will be kept in a locked cabinet at Lancaster University for 10 years or 10 years from publication, whichever is the longer, and then destroyed.
- Consent forms and anonymised data will be kept for 10 years after the study has finished and will then be deleted or destroyed.
- Online consent forms and questionnaires will collect and initially store data through the secure data collection platform, REDCap, which only the researchers conducting the study have access to.
- Electronic personal data will be later be kept securely on the university secure network.
- Personal contact details will be kept for 6 months following the study finishing and they will then be deleted or destroyed. Files held on the computer will be encrypted (meaning no one other than the researchers can access them) and the computer itself will be password protected.

Approximate Timescale

July 2019: Submit ethical application and HRA application

September 2019 – February 2020: Recruitment and data collection

March 2020 – May 2020: Data analysis and write up

May 2020: Submit project as part of DCLinPsy thesis (it is intended that the project will be ready for submission in May 2020, however if there are unforeseeable delays in the project it is possible that the submission deadline can be extended until August 2020).

May 2020 – August 2020: Dissemination of findings

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Twitter adverts content Version 0.1 28/06/19 IRAS PROJECT ID: 240867

Text: It is thought that 1/4 of people with a bipolar disorder diagnosis have obstructive sleep apnoea (OSA). Participants in NW England (UK) needed for research investigating how to recognise OSA for people with a bipolar disorder diagnosis. #bipolar disorder #obstructivesleepapnoea

Included as image alongside text in Tweet:



PARTICIPANTS NEEDED FOR A STUDY OF OBSTRUCTIVE SLEEP APNOEA AND MOOD FOR PEOPLE WITH A BIPOLAR DISORDER DIAGNOSIS

- **A quarter (1/4) of people with a bipolar disorder diagnosis may have obstructive sleep apnoea**, a condition where breathing stops during the night, interrupting sleep.
- Obstructive sleep apnoea might increase mood changes for people with a bipolar disorder diagnosis. If we find this, this could lead to better diagnosis and treatment of obstructive sleep apnoea for people with a bipolar disorder diagnosis, improving people's lives.
- Some signs of obstructive sleep apnoea are **loud snoring, night time snorting/gasping and feeling very tired in the day**. However, some people do not know they have sleep apnoea.
- **Risks of obstructive sleep apnoea include being: male, over 40 and overweight.**

You are invited to participate if you:

- Have a diagnosis of bipolar disorder or manic depression
- Are between 30 and 60 years old
- Live in North West England

You DO NOT need to have sleep apnoea. Participants will be asked questions through questionnaires and a brief phone conversation to see if they might have obstructive sleep apnoea. We are hoping to recruit 20 people who might have obstructive sleep apnoea, or already know they have, and 20 people who are not likely to have obstructive sleep apnoea.

Nine people will be invited to take part in an overnight test to look for signs of sleep apnoea.

You will be asked to wear a watch-like device to monitor movement and sleep for two weeks. You will also be asked to answer a short questionnaire twice a day for two weeks using your phone/tablet/computer or a paper diary. The questionnaire asks how you feel and about your sleep the night before (morning only) and should take you around **2 minutes** to complete.

Prize draw to win a £50 Amazon voucher for participants completing the study.

For more information, or to take part, go to: www.tinyurl.com/OSA-BDresearch

Or, please contact Amy Brown, Chief Investigator on a [REDACTED]

This study has been sponsored by the Lancaster University Faculty of Health and Medicine Research Ethics Committee and has been reviewed and approved by the NHS Research Ethics Service, part of the Health Research Authority. IRAS project ID: 240867. If you wish to make a complaint or raise any concerns about this research and do not want to speak to the Chief Investigator, please contact Dr Ian Smith, Research Director, Doctorate in Clinical Psychology, on [REDACTED] or via email: [REDACTED]

Text: Do you have a bipolar disorder diagnosis? Between 30 and 60 years old and live in the North West of England (UK)? Participants needed for research on recognising obstructive sleep apnoea for people with a bipolar disorder diagnosis. #bipolardisorder #obstructivesleepapnoea

Included as image alongside text in Tweet:



PARTICIPANTS NEEDED FOR A STUDY OF OBSTRUCTIVE SLEEP APNOEA AND MOOD FOR PEOPLE WITH A BIPOLAR DISORDER DIAGNOSIS

- **A quarter (1/4) of people with a bipolar disorder diagnosis may have obstructive sleep apnoea**, a condition where breathing stops during the night, interrupting sleep.
- Obstructive sleep apnoea might increase mood changes for people with a bipolar disorder diagnosis. If we find this, this could lead to better diagnosis and treatment of obstructive sleep apnoea for people with a bipolar disorder diagnosis, improving people's lives.
- Some signs of obstructive sleep apnoea are **loud snoring, night time snorting/gasping and feeling very tired in the day**. However, some people do not know they have sleep apnoea.
- **Risks of obstructive sleep apnoea include being: male, over 40 and overweight.**

You are invited to participate if you:

- Have a diagnosis of bipolar disorder or manic depression
- Are between 30 and 60 years old
- Live in North West England

You DO NOT need to have sleep apnoea. Participants will be asked questions through questionnaires and a brief phone conversation to see if they might have obstructive sleep apnoea. We are hoping to recruit 20 people who might have obstructive sleep apnoea, or already know they have, and 20 people who are not likely to have obstructive sleep apnoea.

Nine people will be invited to take part in an overnight test to look for signs of sleep apnoea.

You will be asked to wear a watch-like device to monitor movement and sleep for two weeks. You will also be asked to answer a short questionnaire twice a day for two weeks using your phone/tablet/computer or a paper diary. The questionnaire asks how you feel and about your sleep the night before (morning only) and should take you around **2 minutes** to complete.

Prize draw to win a £50 Amazon voucher for participants completing the study.

For more information, or to take part, go to: www.tinyurl.com/OSA-BDresearch

Or, please contact Amy Brown, Chief Investigator on a [REDACTED]

This study has been sponsored by the Lancaster University Faculty of Health and Medicine Research Ethics Committee and has been reviewed and approved by the NHS Research Ethics Service, part of the Health Research Authority. IRAS project ID: 240867. If you wish to make a complaint or raise any concerns about this research and do not want to speak to the Chief Investigator, please contact Dr Ian Smith, Research Director, Doctorate in Clinical Psychology, on [REDACTED] or via email: [REDACTED]



Participant Information Sheet

Title of research:

Impact of obstructive sleep apnoea for people with a bipolar disorder diagnosis

My name is Amy Brown and I am conducting this research at Lancaster University, Lancaster, UK, as part of training to become a clinical psychologist.

This page aims to give you the main information about the study. Please take your time to read and understand the information, and discuss it with others if you wish.

You can watch an online video of me explaining the information on this page using the following link: <https://youtu.be/yFb1jPqsvso>

It is important that you understand why the research is being done and what it would involve from you before deciding whether you would like to take part in the study.

If you have any questions, please email me on [REDACTED]

What is the study about?

This study hopes to find out if obstructive sleep apnoea might be increasing changes in mood for people with a bipolar disorder diagnosis.

A quarter (1/4) of people with a bipolar disorder diagnosis may have obstructive sleep apnoea, a condition where breathing stops during the night, interrupting sleep.

If we find that obstructive sleep apnoea is linked to increased mood changes for people with a bipolar disorder diagnosis, this could lead to better diagnosis and treatment of obstructive sleep apnoea for people with a bipolar disorder diagnosis, **improving people's lives**.

This research is being conducted with help from services within [REDACTED] who work with people with a bipolar disorder diagnosis in the hopes that the findings will help inform the support that people are given.

What is obstructive sleep apnoea?

Obstructive sleep apnoea is a condition where the throat muscles relax during sleep, narrowing the air way and stopping breathing for 10 seconds or more.

The sleeper wakes up a bit to start breathing again. However, the sleeper usually does not wake up enough to remember this.

Some people do not know they have obstructive sleep apnoea but might be told that they snore loudly, gasp or snort in their sleep.

People with obstructive sleep apnoea are likely to feel very tired during the day and some might sweat a lot at night and/or wake up a lot to go to the toilet.

Some things that put people at risk of obstructive sleep apnoea are if they:

- are overweight
- are male
- are over 40 years old
- have a neck 43cm/17 inches or larger (41 cm/16 inches for women)
- take medications that make them sleepy
- smoke
- drink alcohol (especially at night)

For more information on obstructive sleep apnoea, including risk factors and treatment information please visit the NHS information webpage:
www.nhs.uk/conditions/obstructive-sleep-apnoea/

Why research obstructive sleep apnoea and people with a bipolar disorder diagnosis?

How well we sleep impacts on our mood. People with obstructive sleep apnoea are often very tired during the day and can feel low in mood.

People with a bipolar disorder diagnosis are believed to experience more changes in how well they sleep as well as more changes in their mood compared to people without a bipolar disorder diagnosis.

It is likely that people with a bipolar disorder diagnosis and obstructive sleep apnoea will experience even more changes in their mood, but no research has looked at this so far.

Learning more about how obstructive sleep apnoea might impact changes in mood for people with a bipolar disorder diagnosis will hopefully be helpful to them and the people who support them.

Research findings may lead to more people with a bipolar disorder diagnosis being found to have obstructive sleep apnoea. This could mean they can be supported to sleep better to decrease changes in their mood.

The study is not looking at solutions to snoring problems.

Who can take part in the study?

We are looking for volunteers who have a bipolar disorder diagnosis (or a manic depression diagnosis), who are between 30 and 60 years old and who live in North West England.

You **do not need to have obstructive sleep apnoea** to take part.

We are hoping to recruit 20 people who may have, or know they have, obstructive sleep apnoea, and 20 people who do not.

People taking part need to start when they are not currently feeling really high or low in mood.

People who have more than one mental health/psychiatric diagnosis can take part if they feel that bipolar disorder is their primary diagnosis (this means that it is the diagnosis given to the experiences that you find to be most noticeable, distressing or disabling).

Does anything mean I cannot take part?

You cannot take part if you:

- work night shifts
- regularly travel overseas
- are currently jet-lagged
- are likely to be disturbed at night (e.g. live with a child under 1 year old)
- have had a brain injury
- have a neurodegenerative condition (e.g. dementia or Parkinson's)
- have received treatment for obstructive sleep apnoea and no longer have symptoms (e.g. you no longer gasp at night and/or don't usually feel tired during the day)
- drink alcohol or caffeine or take drugs in a way that may impact on your sleep - you will be asked to give information on your alcohol/caffeine/drug intake

- are taking part in a drug trial
- are unable to move most of your body

If you have any questions about whether you can take part, please don't hesitate to ask me on **a.brown21@lancaster.ac.uk**

Do I have to take part?

No. It's completely up to you to decide whether or not you take part. Your decision will have no negative effect on any care that you are receiving now or may receive in the future.

If you decide to take part in the study, you may stop taking part in the study at any point, but this **DOES NOT** mean your data will be withdrawn.

If you would **also** like to withdraw your data from the study, please email me on **a.brown21@lancaster.ac.uk** to request that your data is withdrawn. It will be possible to withdraw your data **for at least 10 days** following the end of your participation in the study.

If you become unwell during the study and you are considered to lose capacity to consent to continue to take part, you will be withdrawn from the study but your data collected up until that point will be kept.

What will I be asked to do if I take part?

Step 1

If you consent to take part, you will be asked to provide some information about yourself and complete 4 questionnaires. **You will only have to answer these questions once.**

You can complete these questionnaires online **using a desktop computer or laptop**. Unfortunately **you cannot complete these questionnaires using a tablet or mobile phone**.

Paper copies can be posted to you with a stamped envelope to return them if you prefer.

Answering all the questions **should take up to 20 minutes** and can be done from home at a time that is suitable for you. You do not have to answer all the questions at once, you can save your answers and come back another time.

The questions will ask you about your sleep, your mood, and your risk of obstructive sleep apnoea. In order to work out your risk of obstructive sleep apnoea, you will be asked to give your height (in feet and inches), weight (stone and pounds) and neck measurement (cm or inches).

Step 2

I will contact you (using your preferred method of contact) to arrange a call over the phone, Skype or Zoom.

Skype and Zoom are online ways of making calls for free. Zoom is like Skype but easier as you do not need a login, username, or need to download any software. To use Zoom, you can just click on a link that is emailed to you to start the conversation, which is then like a telephone/Skype call.

If you prefer, I can call you using Skype or on the phone using your landline/mobile number.

During the call I will ask you about your mood and experiences relating to your bipolar disorder diagnosis (or manic depression diagnosis), and also about any symptoms of obstructive sleep apnoea that you might have.

This call should last no more than 45 minutes, and can be held at time that is most convenient for you.

Shortly after this call, I will contact you to confirm if it is possible for you to continue with the study. If it is not, this will be because information you have provided matches one or more of the reasons why people cannot take part. You will be invited to leave your contact details to be emailed a non-scientific report of the study findings. You will also be asked if you are happy for us to keep the information that you have provided so far, which will be anonymised and therefore not be identifiable to you.

Step 3

If it is possible for you to continue take part, you will be asked to wear a watch-like device called an actigraph for 2 weeks (15 nights). The actigraph measures movement to decide if you are asleep or awake.

An actigraph has no screen and you will not need to charge it or learn how to use it. Depending on where you live, I will either deliver an actigraph to you or post it to a local collection point where it is convenient for you to collect.

Once you have received the actigraph, all you will need to do is wear it on your non-dominant wrist (the wrist of the hand you do not write with). Actigraphs are completely waterproof so do not need to be taken off to play sport, shower, bath or go swimming. We ask that you do not remove the actigraph for two weeks, including to go to sleep.

Whilst you are wearing the actigraph, you will be asked to complete **one short questionnaire, two times a day**. The questionnaire will ask you how you feel and

(morning questionnaire only) what time you think you fell asleep the night before and what time you think you woke up that morning.

The questionnaire should take you 2 minutes to complete. These questionnaires can be completed on your computer, mobile phone or tablet, or using a paper questionnaire booklet.

You will be emailed a link to complete the questionnaires online, and a paper diary will be delivered along with your actigraph so you can choose how to complete the questionnaires. Please complete the questionnaires in the same way throughout the two weeks.

You do not have to complete all the questionnaires. If you miss a questionnaire, this does not matter, and you will be asked not to fill out missed questionnaires at a later point. If you complete the questionnaires online, the links will expire after a certain number of hours.

What happens after two weeks?

After two weeks (15 nights), you will either be asked to return your actigraph (and your paper questionnaire booklet if you completed it) to the collection point to post it back for free, or I will collect it from you.

Then you will have completed the study!

What if the information I provide suggests I might have obstructive sleep apnoea?

I will let you know if you may have obstructive sleep apnoea. This will be based on the information you will have provided in steps 1 and 2.

One of the online questionnaires will automatically tell you whether you are at low, moderate or high risk of obstructive sleep apnoea based on the answers you provide.

If it looks like you may have obstructive sleep apnoea, you will be given a letter explaining this to show to your GP.

The researchers of this study are not qualified to diagnose obstructive sleep apnoea.

If it is considered in this study that you may/may not have obstructive sleep apnoea (based on the information that you provide), there is no guarantee that you do/do not have obstructive sleep apnoea, or that this might not change in the future.

The overnight test

9 people who may have obstructive sleep apnoea will be invited to do an over night test using a device called an oximeter.

This means wearing a plastic tube on the end of one of your fingers, and a small, flat, microphone on your chest, over night. The finger tube and chest microphone are attached by thin wires to the oximeter device which you wear like a watch.

The oximeter device monitors the oxygen levels in your blood over night using infrared light. The microphone detects snoring and/or gasping.

If your blood oxygen levels regularly dip during the night and you snore and/or gasp loudly, this suggests you might have obstructive sleep apnoea.

The test does **not** involve needles. The equipment is comfortable to wear and the oximeter does not make any noise.

You do not have to have an overnight test with the oximeter. Not everyone will be invited to do the overnight test due to there being limited equipment.

If you are invited to do the overnight test and are happy to do so, I will deliver and collect the oximeter to and from your home at times convenient for you.

I will show you how to use it and also give you written instructions. There are also videos online to help you. Please use this link to see a video about using an oximeter: www.youtube.com/watch?v=NG0bhGBVWYA.

If you do the overnight test, I will share the results with you and let you know if they suggest you might have obstructive sleep apnoea or not. Again, **you will not receive a diagnosis of obstructive sleep apnoea from the researchers of this study** but may be advised to see your GP if you haven't already.

You will be invited to do the overnight test between step 2 and step 3 of the study. Whatever the results of the overnight test, you will be invited to continue to step 3 of the study.

What if the information I provide suggests I don't have obstructive sleep apnoea? Or what if I do not do the over night test?

If the information you have provided does not suggest that you have obstructive sleep apnoea, you will not be invited to do the overnight test. Due to limited equipment, not everyone who may have obstructive sleep apnoea (based on their information) will be invited to do the over night test.

If you do not do the overnight test for whatever reason, you will be invited to continue to step 3 of the study.

Are there any benefits to taking part?

Taking part in the study will mean contributing to potentially improving understanding and support of difficulties experienced by people with a bipolar disorder diagnosis.

It is hoped that the findings may lead to increased diagnosis and treatment of obstructive sleep apnoea for people with a diagnosis of bipolar disorder, **improving people's lives**.

Participants who complete the full study will also be entered into a prize draw for a **£50 Amazon voucher**. The draw will happen when all participants have finished taking part in the study and the winner will be contacted using their preferred contact information that they provided for the study.

All participants, including people who consent to participate but are told that they cannot continue participating, can be sent a non-scientific report of the study's findings.

Are there any risks?

There are no expected risks with participating in this study. However, if you experience any distress, you are encouraged to inform me (Amy) or someone on the research team, and contact the resources provided at the end of this information sheet.

What will happen to the results?

The results will be analysed and be written into a scientific report for my thesis, which will be submitted for examination as part of my final doctorate evaluation. This may also be submitted for publication in an academic or professional journal.

I will also write a non-scientific report and can send this to all participants who are interested.

Will my data be identifiable?

No. The information you provide is anonymous. No identifiable information (e.g. any names, date of birth and other information that might identify you) will be reported in the final report.

How will my data be kept?

The data collected for this study will be stored securely and only the researchers conducting this study will have access. This means me (Amy) and my supervisors.

All your personal data (name, date of birth and address) will be confidential and will be kept separately from your questionnaire responses, actigraph data (and oximeter data if relevant), making this other information anonymous.

Any personal data on paper will be kept in a secure locked location on the university premises. Electronic personal data will be kept securely on the university secure network.

Your personal contact details will be kept for 6 months following the study finishing and they will then be deleted or destroyed. Consent forms and anonymised data will be kept for 10 years after the study has finished and will then be deleted or destroyed.

Lancaster University will be the data controller for any personal information collected as part of this study.

Under the GDPR (General Data Protection Regulation) you have certain rights when personal data is collected about you.

You have the right to access any personal data held about you, to object to the processing of your personal information, to correct personal data if it is inaccurate, the right to have data about you erased and, depending on the circumstances, the right to data portability (to move your data from one data controller to another).

Please be aware that many of these rights are not absolute and only apply in certain circumstances. **If you would like to know more about your rights in relation to your personal data, please speak to me ([REDACTED]).**

For further information about how Lancaster University processes personal data for research purposes and your data rights, please use this URL:
www.lancaster.ac.uk/research/participate-in-research/data-protection-for-research-participants/

Who has reviewed this project?

This study has been sponsored by Lancaster University and has been reviewed and approved by the NHS Research Ethics Service, part of the Health Research Authority.

How do I consent to take part?

If you decide to take part, you can follow the link at the bottom of this page to an online consent form. If you would prefer a paper consent form to be posted to you (with a stamped envelope to return) please email [REDACTED] to request this.

If you consent to take part, you will also be asked to provide your preferred contact details so that I can contact you for Step 2 of the study.

Where can I get further information about the study?

If you have any questions about the study, please contact me:

Amy Brown

[REDACTED]
Department of Clinical Psychology
Furness Building
Lancaster University
Lancaster
LA1 4YG

Complaints

If you wish to make a complaint or raise concerns about any aspect of this study and do not want to speak to me, you can contact:

Dr Ian Smith

[REDACTED]
Research Director
Email: i.smith@lancaster.ac.uk
Division of Health Research
Faculty of Health and Medicine
Lancaster University
Lancaster
LA1 4YG

If you wish to speak to someone outside of project team, you may also contact:

Professor Roger Pickup

[REDACTED]
Associate Dean for Research
Email: r.pickup@lancaster.ac.uk
Division of Biomedical and Life Sciences
Faculty of Health and Medicine
Lancaster University
Lancaster
LA1 4YG

Resources in the event of distress

We are not expecting this study to cause you any distress.

However, if you do experience distress following your participation in the study, we advise you to contact your GP and/or your mental healthcare provider, who can offer guidance and advice to best manage this.

Here is a useful resource you can access if you feel distressed:

Mind UK

You can contact Mind UK via email, phone, text, post or by visiting your local branch.

Email: info@mind.org.uk

Telephone: 0300 123 3393

Text: 86463

Address: Mind Infoline, Unit 9, Cefn Coed Parc, Nantgarw, Cardiff, CF15 7QQ

Find your local branch by using this URL: www.mind.org.uk/information-support/local-minds/

In case you want more information on obstructive sleep apnoea, the NHS website has some helpful information:

Use this URL to access the NHS webpage on obstructive sleep apnoea:

www.nhs.uk/conditions/obstructive-sleep-apnoea/

Thank you for reading this information sheet. Please use this URL if you are interested in participating and are happy to proceed online:

<https://tinyurl.com/OSA-BDresearch>

or contact brown24@nhs.uk to request a paper consent form if you do not have one already.

If you do proceed online please only do so using a desktop or laptop computer, not a mobile phone or tablet.

Participant consent form

By signing below, I, (*your full name*) _____, confirm that:

Please write your initials in each box to confirm you understand and agree

1) I have read the information sheet and fully understand what is expected of me within this study;	
2) I understand that my participation is voluntary and that there are no guaranteed rewards for taking part in the study;	
3) I confirm that I understand that any information I give will remain anonymous;	
4) I consent to Lancaster University to keep my anonymised data for a period of 10 years after the study has finished;	
5) I consent to my data being used for these research purposes unless I take the necessary steps to withdraw my data from the study;	
6) I understand that I may stop the study at any point, but this does not mean that my data will be withdrawn. If I would also like to withdraw my data from the study, I will email the main researcher, Amy Brown, at a.brown21@lancaster.ac.uk and request to remove my data;	
7) I understand that I must take reasonable care of the study equipment and return it at the appropriate time;	
8) I consent to taking part in the study.	

Signed: _____

Date: _____

Please use the addressed and stamped envelope that was enclosed with this form to return your completed consent form.

Cover letter for paper questionnaires Version 0.1 28/06/19 IRAS PROJECT ID: 240867



Amy Brown
Department of Clinical Psychology
Furness Building
Lancaster University
Lancaster
LA1 4YG

[Date]

Dear [name of participant],

Thank you for participating in our study.

For Step 1 the study, **please answer the questions on the following pages.**

The **first 4 pages ask for some information about you** and then there are **4 questionnaires.**

There is also a page explaining how to work out your Body Mass Index as one of the questionnaires asks about this. If you have any problems with working out your Body Mass Index, please don't hesitate to email me on [REDACTED]

You do not have to answer all the questions at once. You can answer the questions when it is most convenient for you.

Once you have finished answering the questions, please use the enclosed addressed and stamped envelope to return your questionnaires and I can then contact you using your preferred method of contact once I have received them.

If you have any questions, please feel free to email me on [REDACTED]

Thank you once again for participating; your time is really appreciated.

Kind regards,

A handwritten signature in black ink that reads 'Amy Brown'. The signature is written in a cursive style with a large, sweeping initial 'A'.

Amy Brown
Trainee Clinical Psychologist

GP Letter

Version 0.1

26/09/19

IRAS PROJECT ID: 240867



Amy Brown
Trainee Clinical Psychologist
Department of Clinical Psychology
Division of Health Research
Lancaster University
LA1 4YW

Date:

Dear GP

RE: Name of person, address

The above named person has consented to participate in a research study that is investigating the impact of obstructive sleep apnoea for people with a bipolar disorder diagnosis. Their responses to the STOP-Bang questionnaire and Structured Clinical Interview for DSM-5 Sleep Disorders suggest that they may have obstructive sleep apnoea. Their scores were X and X respectively.

[They also underwent an overnight test using an oximeter. The outcome of this test also suggests this person may have obstructive sleep apnoea. The test outcomes were an Apnoea-Hypopnoea Index (AHI) of X and a Respiratory Disturbance Index (RDI) score of X. The AHI indicates the number of apnoeas or hypopnoeas detected per hour and the RDI indicates the number of apnoeas, hypopnoeas and any other respiratory disturbance of sleep per hour.] (This paragraph will not be applicable for all participants).

More details of the study are available via the online information sheet:

<http://www.tinyurl.com/OSA-BDresearch/>.

If you have any queries about the study please do not hesitate to contact me. Alternatively you may also contact my supervisor (contact details below).

Yours sincerely,

A handwritten signature in black ink that appears to read 'Amy Brown'.

Amy Brown
Trainee Clinical Psychologist

Supervised by Dr Guillermo Perez-Algorta
The Spectrum Centre and Department in Clinical Psychology
Division of Health Research
Lancaster University
LA1 4YW