Key points

- Continuous positive airway pressure (CPAP) adherence is low among individuals with obstructive sleep apnoea.
- Type D personality and high scores on the depression and hypochondriasis scales on the Minnesota Multiphasic Personality Inventory (MMPI) have been identified as factors contributing to non-compliance with CPAP.
- Further research into personality type may assist in understanding why some people adhere to CPAP, while others fail.
Obstructive sleep apnoea (OSA) is a condition characterised by repetitive, intermittent partial or complete collapse/obstruction of the upper airway during sleep. Continuous positive airway pressure (CPAP) is highly efficacious in treating OSA but its effectiveness is limited due to suboptimal acceptance and adherence rates, with as many as 50% of OSA patients discontinuing CPAP treatment within the first year. Until recently, research has focused on examining mechanistic and demographic factors that could explain nonadherence (e.g., age, sex, race and education level) with limited applicability in a prospective or clinical manner. More recent research has focused on personality factors or types of patients with OSA who comply and do not comply with CPAP adherence in an attempt to enhance the accuracy of predicting treatment compliance. Type D personality has been found to be prevalent in one third of patients with OSA. The presence of Type D personality increases noncompliance and poor treatment outcomes due to negative affectivity, social inhibition, unhealthy lifestyle, and a reluctance to consult and/or follow medical advice. Conversely, individuals who are more likely to adhere to CPAP treatment tend to have a high internal locus of control and high self-efficacy, self-refer for treatment, and have active coping skills. By assessing personality and coping skills, the clinician may gain insight into the likelihood of a patient’s adherence to treatment. If the patient displays potential risk factors for CPAP noncompliance, the clinician can offer the patient education, refer them to a support group, engage in behavioural/motivational therapy and undertake regular follow-up visits or phone calls incorporating troubleshooting to increase CPAP adherence, especially in individuals with Type D personality.

Does personality play a role in continuous positive airway pressure compliance?

Obstructive sleep apnoea (OSA) is a condition characterised by repetitive, intermittent partial or complete collapse/obstruction of the upper airway during sleep. During wakefulness, dilator muscles contract during inspiration to maintain airway patency. This prevents collapse as a consequence of suction during inspiration. However, during sleep, the tone of these muscles falls, causing narrowing or total obstruction of the airway. Continuous positive airway pressure (CPAP) is highly efficacious in treating OSA but its effectiveness is limited due to suboptimal acceptance and adherence rates; 5–89% of patients will reject CPAP as a treatment immediately, 25–50% of patients who
commence treatment will fail to continue [1–4], 50% will discontinue CPAP treatment within 1 year [5] and 25% terminate CPAP treatment within 3 years [1]. This large prevalence of nonadherence decreases its effectiveness, and is limited in improving daytime sleepiness, mental and physical health, and cognitive functioning [1, 6]. These nonadherence numbers are similar to other populations with health concerns, where roughly 20–40% of individuals with acute illness, 30–60% with chronic illness and 50–80% of those using preventative care are nonadherent to their prescribed medical treatment [5].

Research has focused on finding common qualities and/or circumstances that may lead to nonadherence, such as age, sex, race, apnoea hypopnea index (AHI), body mass index (BMI) and education levels, but these have been inconclusive, equivocal or confounded by other demographic variables [1, 4]. Therefore, more recent research has focused on the psychosocial and personality traits that may contribute to noncompliance, shifting the focus of patient treatment from socioeconomic, physical and environmental predictors to that of more stable personality factors [1, 2, 5].

Aikens et al. [7] evaluated patients with OSA using the Minnesota Multiphasic Personality Inventory (MMPI), and discovered that 58% of these patients demonstrated at least one MMPI elevation and 38% had two or more, with depression, hypochondriasis and hysteria being the highest. From this study, it was reported that those with core depressive symptoms on the MMPI had less severe OSA, and those with a diverse set of psychological symptoms stronger than depression had a greater AHI and lower oxygen saturation [7]. Depressive symptoms and anxiety are often seen in patients with OSA, which worsens fatigue, but CPAP decreases fatigue providing significant improvement in depression and anxiety [8]. OSA patient satisfaction with CPAP treatment positively correlates with adherence, with the greater the day to day improvement noticed the greater the likelihood of using CPAP [9].

Methods

Method

We conducted a review of published, peer-reviewed articles on personality factors that increase risk of nonadherence to CPAP therapy.

Search strategy

The databases used to search the literature for this review were MEDLINE (2000–present), EMBASE (2000–present), PsycINFO (2000–present), SCOPUS (2000–present) and PubMed (2000–present). These databases allowed for a wide range of clinical medical material to be covered over a broad base of global journals. Each database was searched between August and November 2016. Recommendations from the Cochrane Collaboration for a comprehensive, sensitive and wide-variety search were followed to ensure all the highest standards in evidence-based research were undertaken and all relevant articles for this review were identified for review [10]. No conflicts of interest were identified. The following search terms were used; (CPAP) OR [continuous positive airway pressure] AND ((OSA) OR (obstructive sleep apnoea or obstructive sleep apnea)) AND (personality]) AND [(non-compliance or compliance]. The additional limit was “to all adult (plus 18 years)” (table 1).

Study selection

All titles and abstracts were assessed and full texts of the relevant studies were obtained if they fulfilled the required inclusion criteria (see later). Selected publications were assessed by two reviewers (E.L. Maschauer and D. Fairley) separately to reduce selection bias. Once a list of articles was created that each reviewer felt met the inclusion criteria, they met to compare results and discuss which articles would be included in the final review.

Study type

The inclusion criteria were that the studies had to investigate personality types, factors or traits in individuals with OSA and compliant/noncompliant CPAP use. All studies that did not meet the criteria or were not peer-reviewed, published articles were not included in the review. Duplicate studies and those that were not in English were excluded.

Study group

The study group had to have consisted of adults over the age of 18 years with OSA on CPAP.

Date of Publication

Studies published between 2000 and 2016 were eligible.

This search identified a total of 13 studies to be included in the review (table 1). The measures used to assess personality factors in these articles consisted of the:

- MMPI, which scores indicators of personality characteristics [11, 12];
- behavioural inhibition system/behavioural activation system (BIS/BAS) questionnaires exploring appetitive and aversive motives [4];
- Type D scale (DS14 and DS16) to assess for Type D personality [3, 6, 9];
- Big Five, NEO Five Factor Inventory and Mini-International Personality Item Pool, which all measure the five main domains of personality (neuroticism, extraversion, openness, agreeableness and conscientiousness) [4, 9];
Does personality play a role in CPAP compliance?

Table 1  Summary of studies included in this review

| Study          | Participants                                                                 | Intervention                                                                 | Methods                                      | Outcomes                                                                                                                                 |
|----------------|------------------------------------------------------------------------------|------------------------------------------------------------------------------|----------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|
| Olsen et al. [1] | 1488 patients with OSA from various studies 1247 male 241 female Age: 46–60 years | An overview of psychologically informed interventions for CPAP adherence The HBM was used in prediction of both CPAP acceptance and adherence | Moderated regression techniques             | Applying theoretical models to OSA research has substantially improved the understanding of psychological constructs in CPAP adherence Using psychological and educational interventions for improving CPAP adherence is an understudied area of research; however, CBT-based interventions as well as motivational interventions addressing aspects of CPAP use are suggested as appropriate interventions for this population |
| Wild et al. [2] | 119 patients with OSAHS attending a sleep centre for overnight CPAP titration over an 8-month period 94 male 25 female Age: mean 51 years | Patients completed health value, health locus and self-efficacy prior to CPAP titration | Three psychological measures were used in accordance with Wallston’s learning theory | Objective adherence data measured using CPAP run-time clocks were collected At 3-month follow-up, the mean CPAP use was 3.6±2.7 h per night in this population with 21 (18%) participants receiving some technical intervention for CPAP-related side-effects |
| Broström et al. [3] | 247 patients recruited from a CPAP clinic with three 1-h visits over a period of 2 weeks 203 male 44 female Age: mean 60 years | SECI was posted to perceive the effects on CPAP adherence | ESS, OSAS severity variable and objective adherences to CPAP treatment were obtained from the medical records | Type D patients scored significantly higher (p<0.05–0.001) in 12 of the 15 side-effects compared with non-Type D patients A total of 74 (30%) of the patients with OSAS (28% of the men versus 39% of the women) had Type D personality |
| Bollic [5] | Review of multiple studies | Clinical status outcomes were collected both before and after 3 months of therapy with questionnaires | ESS, MSLT and FOSQ | Type D personality OSA patients reported a higher complaint of adverse effects from CPAP therapy and reported a higher rate of continued sleepiness than non-D personalities In a discussion, 50% of patients with Type D personality used their CPAP <4 h per night, compared to 16% of the non-Type D participants |
| Dieltjens et al. [6] | 82 patients out of 113 with a known baseline Type D scale started using MAD treatment between 2006/2009 58 male 24 female Age: mean 50±1 years | 82 patients from 113 patients using MAD completed the DS14 Type D scale at baseline then follow up at 2 years | SDB diagnosis started on a MAD device with demographic and clinical data including results from DS14, and a perceived side-effects and adherence postal questionnaire | Characteristics of the 82 patients: BMI 27.9±4.3 kg·m⁻²; AHI 17±13 events per h; ESS 10±5; VAS 6±2 Of the Type D patients, 45% discontinued MAD treatment with 15% of non-Type D reported treatment discontinuation |

Continued
**Table 1 Continued**

| Study          | Participants                                                                 | Intervention                                                                 | Methods                        | Outcomes                                                                                                                                 |
|----------------|-----------------------------------------------------------------------------|------------------------------------------------------------------------------|--------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|
| **Moran et al. [4]** | 63 participants diagnosed with OSAHS, with CPAP for 30 days, usage defined as >4 h per night on 70% of nights  
31 male  
32 female  
Age: mean 57.1 years | Predictors of adherence were identified including demographic variables and personality traits | Mini-IPIP, BIS/BAS and WAYS | On ratings from the BIS/BAS, a raised BIS was a strong predictor of nonadherence (r = −0.452, p < 0.01), followed by neuroticism. An elevated BIS score and neuroticism may indicate that personality factors are important in the determination of adherence to CPAP |
| **Ekici et al. [11]** | The MMPI was used for 94 treatment-naïve snorers and OSA people  
All patients with OSA and snorers were accepted with SDB (AHI >0 events per h)  
The threshold of 5 events per h sleep was chosen to define both OSA and snorers | Admitted for overnight PSG with questionnaires | PSG, MMPI, Fatigue scale, Adult ADHD scale, ESS, and SF-36 | OSA patients scored significantly higher on Hs scale (65.0±12.0 versus 58.4±7.9, p = 0.01)  
OSA patients compared to snorers have significantly higher rate of clinical elevation on both Pd (13.0 versus 0%, p = 0.03) and Hs (26.1 versus 3.3%, p = 0.01)  
The results of the study may indicate that patients with OSAS, compared to snorers, presented with more Hs and Pd personality characteristics |
| **Hayashida et al. [12]** | 230 patients referred with OSAS with AHI >5 events per h; given CPAP  
230 male  
Age: 20–73 years | ESS, MMPI, SDS, age, BMI, sleep duration during the preceding month and AHI | Single and multiple linear regression analyses were performed to estimate the association between the ESS and the other measures tested | Age had negative association with ESS score (r = −0.245, p < 0.001)  
BMI (r = 0.165, p = 0.012), AHI (r = 0.199, p = 0.002), SDS (r = 0.169, p = 0.010), Hs (r = 0.212, p = 0.001), Hy (r = 0.177, p = 0.007), Pd (r = 0.133, p = 0.044), Pt (r = 0.227, p = 0.001), Sc (r = 0.228, p < 0.001) and Ma (r = 0.163, p = 0.014) all had a positive association with ESS score  
There were several statistically clear and significant correlations (r ≥0.5) among many MMPI variables:  
Hs versus D  
Hy, Pd, Pt and Sc  
D versus Pt, Sc and Si  
Hy versus Pd and Pt  
Pd versus Pt and Sc  
Pt versus Sc |
Table 1 Continued

| Study               | Participants                                                                 | Intervention                                                                                     | Methods                                                                                                               | Outcomes                                                                                                                                                                                                 |
|---------------------|------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Mols and Denollet   | 2813 patients total from 12 studies                                          | 10-item standardised checklist for pre-defined criteria for systematic review on published papers | A cross-sectional design analysing Type D personality amongst non-cardiovascular patient population in a medical population | Patients with sleep apnoea on treatment reported more side-effects of treatment and were less likely to adhere to treatment than their non-type counterparts (*p*<0.05–0.001) Type D patients experienced their condition to be more disabling compared to non-Type D patients (40.5 versus 26.4; *p*=0.015), especially emotionally (*p*=0.007) and functionally (*p*=0.033) |
| Pierobon et al.     | 157 patients with OSAS from an obese population                             | CBA 2.0, neuropsychological assessment, WAIS-R, verbal span test and PSG                         | Cross-sectional study Patients were assessed using both psychological and neuropsychological variants                  | Patients reported with higher frequency, compared to the normal distribution, the presence of an extrovert personality trait and depressive behaviours: 15.9% of the patients minimised symptoms and denied distress, whereas 28.0% presented psychological disorders Compared to the normative group, patients’ results were characterised as impaired with a higher percentage in short-term verbal memory (30.6%) and in short-term visual spatial memory (20.5%) Moreover, 30.6% of patients were impaired in one cognitive function, 11.5% in two, 8.9% in three, and 8.2% in four or more cognitive functions No significant relationships between psychological–neuropsychological data and clinical variables emerged |
| So et al.           | 88 patients with UARS.                                                      | AIS, PSQI and ESS                                                                                 | Overnight PSG, AIS, PSQI, SCL-90-R and EPQ                                                                        | The UARS group scored significantly higher than the OSA group on the ESS, AIS and PSQI (*p*<0.001) Scores of all SCL-90-R subscales in the UARS group were significantly higher than those in the OSA group (all were *p*<0.001, except somatisation, which was *p*=0.016) Patients with UARS also scored lower on the EPQ-E (*p*=0.006) and EPQ-L (*p*:0.001), and showed higher scores on EPQ-P (*p*=0.002) and EPQ-N (neuroticism) (*p*<0.001) than those with OSA/OSAS The ESS scores for UARS and OSAS were 10.2 and 6.8 (*p*<0.001) Patients with UARS are more likely to have neurotic personalities and tend to be more anxious and sensitive than patients with OSAS (psychoticism 2.97±2.37 versus 2.14±1.76, neuroticism 16.57±4.46 versus 13.10±4.89) |
|                     | 45 male 43 female                                                           |                                                                                                 |                                                                                                                       |                                                                                                                                                                                                         |
|                     | Age: 36.84±13.85 years                                                      |                                                                                                 |                                                                                                                       |                                                                                                                                                                                                         |
|                     | 365 patients with OSAS                                                      |                                                                                                 |                                                                                                                       |                                                                                                                                                                                                         |
|                     | 299 male 66 female                                                         |                                                                                                 |                                                                                                                       |                                                                                                                                                                                                         |
|                     | Age: 49.52±11.79 years                                                     |                                                                                                 |                                                                                                                       |                                                                                                                                                                                                         |

Continued
Does personality play a role in CPAP compliance?

Several studies have used personality type indicator measures (e.g., MMPI and Big Five) to investigate individuals with varying degrees of OSA. Type D personality appears to be prevalent in 30% of the OSA population, in contrast to only 13–24% in the general population [3, 5, 6, 9] according to several studies conducted in the USA, Sweden, Belgium, Canada, Germany, and the Netherlands. Type D personality is characterized by two traits:

- negative affectivity, which is the tendency to experience negative emotions and social inhibition, the hindering of emotional and behavioural expression for fear of rejection or disapproval by others [4–6, 9].

Type D is a predictor of poor health status and increased risk of mortality in other medical conditions (e.g., chronic pain, mild traumatic brain injury, and asthma) [9]. Type D has been linked to negative physical, psychological and social factors were found to influence both CPAP use and non-use. The way patients feel about themselves influences the ways in which they manage their OSA with or without CPAP.

Table 1 Continued

| Study | Participants | Intervention | Methods | Outcomes |
|-------|--------------|--------------|---------|----------|
| Avow et al. [15] | 8 patients recruited from a multisite sleep clinic, 4 who used CPAP for >5 h for 7 nights and 4 <1 h for 7 nights | Demographic data, extent of OSA, CPAP use, use of prescribed adjunct sedatives/hypnotics, and selected comorbidities known to influence CPAP adherence | Semistructured interviews took place in a private office in the clinic and lasted approximately 15–60 min | Perceived physical, psychological and social factors were found to influence both CPAP use and non-use. The way patients feel about themselves influences the ways in which they manage their OSA with or without CPAP. |
| | 4 male | 4 female | Age: 20–73 years | |

HBM: Health Belief Model; CBT: cognitive behavioural therapy; OSHAS: obstructive sleep apnoea–hypopnoea syndrome; SECI: Side-Effects of CPAP Inventory; ESS: Epworth Sleepiness Scale; OSAS: obstructive sleep apnoea syndrome; MSLT: Multiple Sleep Latency Test; FOSQ: Functional Outcomes of Sleep Questionnaire; MAD: mandibular advancement device; SDB: sleep disordered breathing; VAS: visual analogue scale for snoring; IP: International Personality Item Pool; BIS/BAS: behavioural inhibition system/behavioural activation system; WAYS: Ways of Coping; PSG: polysomnography; ADHD: attention deficit/hyperactivity disorder; SF-36: 36-item Short Form Survey; HS: hypochondriasis; PD: psychopathic deviate; SDS: Self-Rating Depression Scale; Hy: hysteria; Pt: psychosis; Sc: schizophrenia; Ma: hypomania; D: depression; Sl: social introversion; CBA: Cognitive Behavioural Assessment; WAIS-R: Wechsler Adult Intelligence Scale Revised; UARS: upper airway resistance syndrome; AIS: Athens Insomnia Scale; PSQI: Pittsburgh Sleep Quality Index; SCL-90-R: Symptom Checklist-90 Revision; EPQ: Eysenck Personality Questionnaire; E: extroversion/introversion; L: lie; P: psychoticism; N: neuroticism.
## Table 2: Personality tests used in this review

| Test          | What it measures                                                                 | Test information                                                                 |
|---------------|----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|
| MMPI [11, 12] | Personality characteristics on 10 clinical scales:                               | 567 items                                                                        |
|               | Hypochondriasis                                                                  | True/false                                                                        |
|               | Depression                                                                       |                                                                                   |
|               | Hysteria                                                                         |                                                                                   |
|               | Psychopathic deviate                                                             |                                                                                   |
|               | Masculinity/femininity                                                           |                                                                                   |
|               | Paranoia                                                                         |                                                                                   |
|               | Psychasthenia                                                                    |                                                                                   |
|               | Schizophrenia                                                                    |                                                                                   |
|               | Hypomania                                                                        |                                                                                   |
|               | Social introversion                                                              |                                                                                   |
| BIS/BAS [7]   | Appetite and aversive motives                                                     | BAS regulates appetitive motives, moves toward something desired, sensitive to reward and escape from punishment, and associated with positive affect and optimism |
| DS14 and DS16 [4, 6, 13] | Type D personality                                                               | BIS regulates aversive motives, moves away from something aversive, sensitive to punishment and nonreward, and related to fear and anxiety |
| The Big Five [7] | Five main domains of personality (OCEAN)                                        | 50 questions to rate on how true they are about the person on a 5-point Likert-scale (1, disagree; 3, neutral; 5, agree) |
| NEO-FFI [13]  | Five main domains of personality (OCEAN)                                         | 60 questions assessing the essentials of personality                               |
| Mini-IPIP [7] | Five main domains of personality (OCEAN)                                         | 20 questions containing 4 items for each of the Big Five traits indicating the degree the statement applies to them on a 5-point scale |
| DOCCO [7]     | Stress, personality and lifestyle                                                 | 200 questions                                                                     |
| CBA [14]      | State and trait anxiety, personality characteristics, psychophysiological disorders, fears and phobias, and depressive behaviours | Includes an anamnestic schedule providing information on habits, personal history, sleep, eating behaviour, work, etc. |
| WAYS [7]      | Different domains or aspects of personality, including basic descriptive traits, motivation and coping skills | 66 items to measure thoughts and actions used in stressful situations               |
|               | Measures 8 coping factors:                                                        |                                                                                   |
|               | confrontive coping                                                               |                                                                                   |
|               | distancing                                                                       |                                                                                   |
|               | self-controlling                                                                  |                                                                                   |
|               | seeking social support                                                            |                                                                                   |
|               | accepting responsibility                                                           |                                                                                   |
|               | escape avoidance                                                                  |                                                                                   |
|               | planful problem solving                                                            |                                                                                   |
|               | positive reappraisal                                                              |                                                                                   |
Does personality play a role in CPAP compliance?

More frequently (e.g., dry throat and mask leaks) [1, 3, 9]. Type D decreased adherence to CPAP may also be caused by decreased perceived effects of the treatment and low self-efficacy [3].

When compared to those with snoring, OSA patients have significantly higher absolute scores on the hypochondriasis, psychopathic deviance, and depression scales of the MMPI [1, 11]. Scores high on the hypochondriasis scale also predict low CPAP adherence [16].

The hypochondriasis scale measures an over-concern with one’s state of health [4] and high scores indicate extreme attention to physical symptoms, chronic fatigue and weakness, and noticing vague symptoms, which lead to higher rates of noncompliance [11]. High scores on psychopathic deviance may show difficulty adhering to rules and following the advice of authority figures/medical staff and failing to learn from past mistakes, again increasing risk of continual nonadherence [11].

Prevalence rate of depression in OSA compared to people without OSA is roughly 33%, which may be a direct consequence of sleep deprivation or could be an indirect consequence of social effects caused by the disorder [13], as long-term sleep deprivation can adversely affect mood [3]. Individuals with OSA tend to have a higher BMI than the normative population [15] and obesity is associated with an increased risk of depression as well [13].

The personality patterns of OSA patients with low CPAP adherence have been found to be a somatic–neurotic type, consisting of physical symptoms that derive from the psyche more than from a physical illness [11]. This increased somatic development of symptoms creates a high level of psychological distress for the patient, as a consequence of OSA, not as a cause of it [11].

Another factor that could give insight into whether a patient will have low CPAP adherence is knowing who scheduled the patient for treatment. If the patient’s partner referred them, rather than the patient referring themselves, adherence to CPAP decreases [2]. This phenomenon may be due to Type D personalities having a high external locus of control (e.g., believing their health is determined by external forces, not the internal self) or minimizing the symptoms, or believing their health is determined by external forces, not the internal self.

Table 2 Continued

| Test | What it measures | Test information |
|------|-----------------|------------------|
| SCL-90-R [16] | Psychiatric symptoms | Multidimensional, self-report symptom inventory consisting of 90 items divided into 9 symptom dimensions: somatisation, obsessive-compulsive, interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation, and psychotism. |
| EPQ [16] | Personality traits measuring psychoticism, neuroticism, extraversion and lying | 4-item measures of psychoticism (social psychopath, solitary, troublesome, cruel and inhumane traits), neuroticism (anxious, worrying, moody and frequently depressed), extraversion (sociable, craves excitement, carefree and optimistic) and lying (social desirability). |

More frequently (e.g., dry throat and mask leaks) [1, 3, 9]. Type D decreased adherence to CPAP may also be caused by decreased perceived effects of the treatment and low self-efficacy [3]. Type D decreased adherence to CPAP may also be caused by decreased perceived effects of the treatment and low self-efficacy [3].
their symptoms, thereby not considering treatment to be necessary [1–3, 15].

**Personality traits of treatment compliance**

Patients who have a high internal locus of control (e.g., believing they have control over their health) are more likely to adhere to CPAP treatment [1–3, 15]. This is due to internalising and following advice received from sleep specialists, having the ability not to perseverate on treatment side-effects, and displaying high self-efficacy [2]. High self-efficacy empowers individuals to believe in their own ability to deal with obstacles and take control of their own health [5], thus increasing treatment compliance. This also explains why self-referring patients are more likely to adhere to treatment.

Individuals with a high level of conscientiousness and openness, active coping skills, and problem solving traits are also most likely to adhere to treatment [4]. Implementation of coping strategies/skills in demanding situations can lead to a higher overall level of CPAP use per night and continued use over time [2].

CPAP adherence is also increased if a patient is educated on the negative health outcomes that will develop as a result of not using the treatment, as well as believing they have a more severe form of the disorder [2]. Physiological measures of disease severity rarely accurately predict >10% of the variance in adherence [1] but the patient’s belief that his/her OSA is severe will lead to higher treatment compliance.

Those who comply more with CPAP tend to have a higher BMI, report less daytime sleepiness, report better nocturnal sleep quality, and score lower on the depression and hypochondriasis scales on the MMPI prior to treatment [16]. These five predictors identify ~80% of individuals who eventually fail to comply with CPAP treatment as well as 97% of those who comply long-term [16].

**Discussion**

Despite CPAP being an effective treatment for OSA, improving quality of sleep, excessive daytime sleepiness (EDS) and road accidents, patient adherence to this device is relatively low. By better understanding which factors play into the prediction of treatment noncompliance, health professionals can create preventative plans and support systems for patients to increase adherence. One way to increase CPAP adherence is for clinicians to use a short personality inventory (DS14 is recommended [9]) and a coping skills questionnaire to evaluate OSA patients. From this information, clinicians can determine if the patient has a Type D personality and assess active coping skills, whilst the patient awaits CPAP titration. Screening patients before treatment may allow clinicians the opportunity of prescribing a structured, well-designed intervention that is focused on improving the patient’s self-management, coping skills and self-efficacy, thus improving adherence and long-term continuation of CPAP [3, 6].

Assessing for anxiety and depression pre-treatment has been found to strongly predict CPAP adherence and may lead to better subsequent CPAP use by educating the patient on how CPAP decreases depression and anxiety [1, 4, 5]. The goal of the CPAP titration appointment should not simply be about treating OSA but should include education on OSA and CPAP, enhance patient acceptance of the treatment, and provide continual support and education, encouraging long-term adherence [1].

Intense educational programmes, mask fitting and a familiarisation session with CPAP prior to CPAP titration also increase adherence [2, 3, 5, 17, 18]. Training by a sleep specialist or nurse coupled with a video depicting information on OSA, symptoms, health consequences and

**Educational questions**

1. What are the characteristics of Type D personality?
   a) Relaxed, easy going and prone to few health concerns
   b) Usually stressed, negative emotions, social inhibition and fear of rejection/disapproval of others
   c) Highly strung, organised and unwilling to change or adapt to new situations
   d) A mix between Type A (organised) and Type B (relaxed)

2. What are the characteristics of those who are compliant with continuous positive airway pressure (CPAP)?
   a) Relaxed, easy going and prone to few health concerns
   b) Usually stressed, unable to cope with everyday problems and having an overly involved partner
   c) Negative emotions, social inhibition and introverted
   d) High internal locus of control, high self-efficacy and active coping skills

3. What can specialists/doctors do to increase CPAP adherence?
   a) Wait 4 weeks after giving CPAP and check with the patient
   b) Use a personality inventory, coping skills questionnaire, educational programmes/sessions and giving information booklets
   c) Stress the importance of CPAP but if a patient is not going to use the machine, there is little that can be done
   d) Introduce a CPAP compliance smartphone app into the patient’s care plan

4. How can partners affect CPAP adherence?
   a) Supporting/reinforcing the patient’s desire to use CPAP increases adherence
   b) Partners who complain about the noise the CPAP machine emits decrease CPAP adherence
   c) Partners who come to the doctor’s appointments with the patient increase CPAP adhesion
   d) Partners who make doctor’s appointments for the patient decrease CPAP adherence
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1. Olsen S, Smith S, Oei TP. Adherence to continuous positive airway pressure therapy in obstructive sleep apnoea sufferers: a theoretical approach to treatment adherence and intervention. Clin Psychol Rev 2008; 28: 1355–1371.
2. Wild MR, Engleman HM, Douglas NJ, et al. Can psychological factors help us to determine adherence to CPAP? A prospective study. Eur Respir J 2004; 24: 461–465.
3. Broström A, Strömberg A, Mårtensson J, et al. Association of Type D personality to perceived side effects and adherence in CPAP-treated patients with OSAS. J Sleep Res 2007; 16: 439–447.
4. Moran AM, Everhart DE, Davis CE, et al. Personality correlates of adherence with continuous positive airway pressure (CPAP). Sleep Breath 2011; 15: 687–694.

Conflict of interest
None declared.

References
Does personality play a role in CPAP compliance?

5. Bollig SM. Encouraging CPAP adherence: it is everyone’s job. *Respir Care* 2010; 55: 1230–1239.

6. Dieltjens M, Vanderveken OM, Van den Bosch D, et al. Impact of type D personality on adherence to oral appliance therapy for sleep-disordered breathing. *Sleep Breath* 2013; 17: 985–991.

7. Aikens JE, Caruana-Montaldo B, Vanable PA, et al. MMPI correlates of sleep and respiratory disturbance in obstructive sleep apnea. *Sleep* 1999; 22: 362–369.

8. Habukawa M, Uchimura N, Kakuma T, et al. Effect of CPAP treatment on residual depressive symptoms in patients with major depression and coexisting sleep apnea: contribution of daytime sleepiness to residual depressive symptoms. *Sleep Med* 2010; 11: 552–557.

9. Mols F, Denollet J. Type D personality among noncardiovascular patient populations: A systematic review. *Gen Hosp Psychiatry* 2010; 32: 66–72.

10. Lefebvre C, Manheimer E, Glenville J. Searching for studies. In: Higgins J, Green S, eds. *Cochrane Handbook for Systematic Reviews of Interventions*. Chichester, The Cochrane Collaboration, 2008.

11. Ekici A, Ekici M, Oğuztürk O, et al. Personality profiles in patients with obstructive sleep apnea. *Sleep Breath* 2013; 17: 305–310.

12. Hayashida K, Inoue Y, Chiba S, et al. Factors influencing subjective sleepiness in patients with obstructive sleep apnea syndrome. *Psychiatry Clin Neurosci* 2007; 61: 558–563.

13. Pierobon A, Giardini A, Fanfulla F, et al. A multidimensional assessment of obese patients with obstructive sleep apnoea syndrome (OSAS): a study of psychological, neuropsychological and clinical relationships in a disabling multifaceted disease. *Sleep Med* 2008; 9: 882–889.

14. So SJ, Lee HJ, Kang SG, et al. A comparison of personality characteristics and psychiatric symptomatology between upper airway resistance syndrome and obstructive sleep apnea syndrome. *Psychiatry Investig* 2015; 12: 183–189.

15. Ayow TM, Paguet F, Dallaire J, et al. Factors influencing the use and nonuse of continuous positive airway pressure therapy: A comparative case study. *Rehabil Nurs* 2009; 34: 230–236.

16. Edinger JD, Carwile S, Miller P, et al. Psychological status, syndromic measures, and compliance with nasal CPAP therapy for sleep apnea. *Percept Mot Skills* 1994; 78: 1116–1118.

17. Wozniak DR, Lasserson TJ, Smith I. Educational, supportive and behavioural interventions to improve usage of continuous positive airway pressure machines in adults with obstructive sleep apnoea. *Cochrane Database Syst Rev* 2014; 8: CD007736.

18. Hoy CJ, Vennelle M, Kingshott RN, et al. Can intensive support improve continuous positive airway pressure use in patients with the sleep apnea/hypopnea syndrome? *Am J Respir Crit Care Med* 1999; 159: 1096–1100.

19. Aloia MS, Arnedt JT, Strand M, et al. Motivational enhancement to improve adherence to positive airway pressure in patients with obstructive sleep apnea: a randomized controlled trial. *Sleep* 2013; 36: 1655–1662.

20. Olsen S, Smith SS, Oei TP, et al. Motivational interviewing (MINT) improves continuous positive airway pressure (CPAP) acceptance and adherence: a randomized controlled trial. *J Consult Clin Psychol* 2012; 80: 151–163.

21. Chervini RD, Threat S, Bassetti C, et al. Compliance with nasal CPAP can be improved by simple interventions. *Sleep* 1997; 20: 284–289.

22. Sparrow D, Aloia M, Demolles DA, et al. A telemedicine intervention to improve adherence to continuous positive airway pressure: a randomised controlled trial. *Thorax* 2010; 65: 1061–1066.

23. Dickerson SS, Kennedy MC. CPAP devices: encouraging patients with sleep apnea. *Rehabil Nurs* 2006; 31: 114–122.

24. Thomasouli MA, Brady EM, Davies MJ, et al. The impact of diet and lifestyle management strategies for obstructive sleep apnoea in adults: a systematic review and meta-analysis of randomised controlled trials. *Sleep Breath* 2013; 17: 925–935.