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Psychological distress in patients with obstructive sleep apnoea: The role of hostility and coping self-efficacy

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Abstract

We aimed to assess whether hostility and coping self-efficacy are associated with psychological distress in obstructive sleep apnoea patients. Furthermore, we examined whether coping self-efficacy mediates the association between hostility and psychological distress. We included 150 obstructive sleep apnoea patients (Apnoea-Hypopnoea Index ≥ 5 ; 68% male; mean age: 48.9 ± 9.5 years). Regression models showed that hostility and poor coping self-efficacy were strongly associated with psychological distress in obstructive sleep apnoea patients. All assessed coping self-efficacy dimensions mediated the association between hostility and psychological distress. Coping self-efficacy for stopping unpleasant emotions and thoughts showed the strongest association with a lower level of psychological distress.

Keywords

chronic disease management, coping self-efficacy, hostility, obstructive sleep apnoea, psychological distress

Introduction

Obstructive sleep apnoea (OSA) is considered one of the most prevalent sleep disorders (Manarino et al., 2012), affecting 2–10 per cent of the adult population (Leger et al., 2012). OSA leaves patients exhausted due to sleep disruption (Manarino et al., 2012; Rezaeitalab et al., 2014; Tkacova and Dorkova, 2010). Besides physical symptoms, OSA patients may experience psychological distress (Kang et al., 2012; Rezaeitalab et al., 2014; Su et al., 2015), irritability and hostility (Booth et al., 2006; Lau et al., 2014; Unal et al., 2017; Yue et al., 2003). Sleep-related OSA symptoms, such as poor night-time sleep quality and daytime sleepiness, have been

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shown to have a negative impact on patients' psychological well-being and overall quality of life (Antic et al., 2011; Tsara et al., 2009).

Hostility has previously been found to be associated with the presence of OSA, the degree of daytime sleepiness (Yue et al., 2003) and poor night-time sleep quality (Freitag et al., 2017; Xiao et al., 2016) but not with severity of the Apnoea-Hypopnoea Index (AHI) or oxygen desaturation (Yue et al., 2003). Hostility is conceptualized as a negative cynical attitude towards others, with a propensity for anger, aggression (Cook and Medley, 1954; Ireland and Culpin, 2006), distrust or cynicism (Barefoot et al., 1989). Hostility may represent a risk factor for all-cause mortality (Nabi et al., 2008) and impaired mental health outcomes, with evidence being especially strong in patients with cardiovascular diseases (Silarova et al., 2016). Furthermore, hostility may be linked to increased negative emotionality (Brissette and Cohen, 2002), depression (Heponiemi et al., 2006), suicidal ideation and attempts (Brezo et al., 2006; Lemogne et al., 2011), sleep disruption (Brissette and Cohen, 2002) and poor sleep quality (Freitag et al., 2017). This symptomatic sleep disruption often causes serious decreases in blood oxygen levels, with potential life-threatening cardiovascular consequences (Bardwell et al., 2001; Leger et al., 2012), while these mechanisms may be even more strongly aggravated by hostility (Hall et al., 2004; Mezick et al., 2010). Several mechanisms explaining the link between hostility and health consequences have been proposed. For instance, hostile persons exhibit increased sympathetic reactivity in some situations, experience more interpersonal conflict and may display more unhealthy behaviours (Smith, 1992; Vandervoort, 2006).

Effective coping strategies may be beneficial in handling chronic diseases, including OSA (Bardwell et al., 2001; Gassara et al., 2017). Coping can be defined as an effort to manage a situation and involves various cognitive and behavioural strategies to overcome external or internal demands, which are appraised as either taxing or exceeding the person's resources

(Folkman et al., 1986). The terms coping and coping self-efficacy (CSE) are closely linked (Bandura, 1999; Chesney et al., 2006; Park and Folkman, 1997). The concept of CSE is based on the integration of two well-established theories within health research: the self-efficacy theory of Bandura (1999) and the coping theory of Lazarus and Folkman (1984). In the framework of these theories, CSE addresses which coping strategy a person will apply based on the perceived self-efficacy, and thus, it represents an important prerequisite to coping behaviour (Park and Folkman, 1997). The choice and level of CSE in a particular circumstance reflects prior relevant experiences (Bandura et al., 1977). As such, greater levels of CSE were found to be associated with more effective regulation of emotional distress (Luberto et al., 2014). The ability to regulate emotions is crucial in diminishing psychological distress; however, healthy emotion-regulation may not merely be about using the 'right' strategies (Haines et al., 2016). According to the strategy-situation-fit hypothesis, emotion-regulation strategies are able to diminish psychological distress only when used in appropriate contexts (Bonanno and Burton, 2013; Haines et al., 2016).

Previous research has focussed on the effect of CSE and coping behaviour on patients' self-reported health outcomes in various diseases, such as heart failure (Graven and Grant, 2013), multiple sclerosis (Mikula et al., 2019) or chronic obstructive pulmonary disease (Tiemensma et al., 2016; Vaske et al., 2017). Previous studies have shown that a higher level of CSE was associated with a better adjustment to various chronic diseases (Benka et al., 2014; Chesney et al., 2006; Mikula et al., 2019). Only a few studies have thus far addressed this concept, but these have shown an association between CSE and psychological distress (Benka et al., 2014; Chesney et al., 2006) and better quality of life (Mikula et al., 2019) in the context of various chronic diseases. Overall, these results suggest that CSE has direct effects on distress/well-being outcomes, beyond the impact of clinical and personality variables.

Some studies indicate that problem-focussed coping was the most beneficial in handling disease (Graven and Grant, 2013; Tiemensma et al., 2016), especially in the mental health domain (Scharloo et al., 2000). Nevertheless, in some studies, avoidance-oriented coping, such as CSE for the ability to stop unpleasant emotions and thoughts, was defined as most effective in dealing with the disease (Harmell et al., 2011; Mackay et al., 2012). Recent studies have concluded that the more active and the less passive the coping strategies reported by OSA patients, the lower the level of depressive symptoms experienced by patients (Bardwell et al., 2001; Gassara et al., 2017). Moreover, a mediating role of CSE in the association between personality traits and psychological health was identified in patients with multiple sclerosis (Mikula et al., 2019). Coping strategies were found to play a mediating role in the relationship between hostility and self-rated health outcomes in a sample of healthy individuals (Vandervoort, 2006). Unfortunately, the nature of coping styles utilized by hostility-prone individuals has received scant empirical attention.

So far, very little is known about the association between hostility, CSE and psychological distress in OSA patients. To our knowledge, only two studies have directly focussed on the association between coping and self-rated health outcomes (i.e. depression) in OSA patients (Bardwell et al., 2001; Gassara et al., 2017). Due to a lack of general consensus regarding the continuous positive airway pressure treatment effect on self-reported (Tippin et al., 2016; Weaver, 2013) and objective (Dimsdale et al., 2000) health outcomes, the present research and clinical practice should also focus on the identification of adequate internal resources which may diminish psychological distress in OSA patients. Thus, the aims of this study were (1) to assess whether hostility and CSE are associated with psychological distress in OSA patients when controlled for sociodemographic, clinical and sleep-related variables and (2) to examine whether CSE mediates the association between hostility and psychological distress.

Methods

Sample and procedure

This cross-sectional study was conducted at the Department of Pneumology and Phtiseology, L. Pasteur University Hospital and the Medical Faculty of PJ Safarik University in Košice, Slovak Republic. All patients who visited the department for one-night polysomnography (PSG) from July 2013 to June 2016 were eligible for the study. The indication for PSG was based on a general practitioner referral form. OSA was diagnosed based on an overnight sleep examination.

Only OSA patients between 18 and 65 years of age were included due to possible increased vulnerability, functional changes and a decline in abilities and/or performance related to age. The study sample consisted of patients with an AHI (number of apnoeas + hypopnoeas per hour of sleep) score of 5 or more (American Academy of Sleep Medicine, 2005), who had not undergone any previous continuous positive airway pressure (CPAP) treatment or other OSA treatment, had no regular shift work in the past 6 months, were Slovak-speaking and had no major comorbidities.

Out of $N=263$ patients, $N=41$ refused to participate in the study (response rate: 84.0%). Another $N=72$ patients were excluded because of major comorbidities. The reasons for exclusion were major comorbidities related to sleep (a coexisting sleep disorder such as insomnia, narcolepsy or circadian rhythm sleep disorder), major cardiovascular diseases (e.g. angina pectoris, myocardial infarction and primary pulmonary hypertension), pulmonary conditions (e.g. Pickwick syndrome and chronic obstructive pulmonary disease) and a history of cancer in the past 12 months. Neurological and psychological comorbidities included a neurological condition (e.g. epilepsy and stroke), a major psychiatric diagnosis (e.g. major depression and psychotic disorders) in the medical record and/or current usage of psychiatric medications which may affect cognitive functions (e.g. benzodiazepines, antidepressants or antipsychotics), drug abuse in the past 6 months and regular shift work in the

past 6 months. The clinical diagnoses of the comorbid diseases were established according to the standard International Classification of Diseases 10 revision Codes. Screening for comorbidities was based on medical data and an initial clinical interview prior to data collection. Medical examinations of patients were conducted by a pulmonologist specialized in sleep-disordered breathing. Patients with non-respiratory sleep-related complaints (e.g. narcolepsy and insomnia) were routinely referred to another group of clinical specialists.

The invitation letter, informed consent and questionnaires were sent to participants by postal mail 3 weeks before the medical examination. A week before the medical examination, patients were reminded about the questionnaires by telephone. Patients filled in self-report questionnaires at home. All patients' signed the informed consent form prior to study participation. Participation in the study was fully voluntary, with no incentives offered to participate in the research. The study was approved by the Ethics Committee of PJ Safarik University in Košice (approval no. 115/2011).

Measures

Psychological distress. Psychological distress was assessed using the General Health Questionnaire (GHQ-28) (Goldberg and Hillier, 1979). The GHQ-28 is a 28-item measure of psychological distress in the general population and within-community or non-psychiatric clinical settings, such as among primary care or general medical out-patients. The GHQ-28 was developed as a screening tool to detect those likely to be at risk of developing psychiatric disorders. The questionnaire is divided into four subscales: somatic symptoms (items 1–7); anxiety/insomnia (items 8–14); social dysfunction (items 15–21) and severe depression (items 22–28) (Goldberg and Hillier, 1979). Psychological distress was defined as a continuous variable (0–3), ranging from 0 to 84. A total score of 23/24 represents the threshold for the presence of psychological distress (Goldberg and Hillier, 1979). Psychological distress is

understood as the opposite continuum to psychological well-being (Goldberg and Hillier, 1979; Spiteri et al., 2013). Higher scores indicated a higher level of psychological distress. In our sample, the Cronbach's alpha for the total GHQ-28 scale was 0.83.

Hostility. Hostility was measured by the abbreviated 27-item version of the Cook–Medley Hostility Scale (CMHo) (Cook and Medley, 1954). The CMHo scale is a widely used self-report measure of trait hostility. The scale primarily assesses the cognitive aspects of hostility, cynicism and distrust. Cynicism items are defined as statements of belief; aggressive response items reflect behaviour, and hostile affect items reflect emotional experiences. Each item is rated on a dichotomized scale (1=true and 0=false). The score ranges from 0 to 27, with a higher score indicating more hostility (Cook and Medley, 1954). Cronbach's alpha for the total scale in our sample was 0.85.

CSE. CSE was measured using the 26-item CSE Scale developed specifically for people suffering from chronic disease (Chesney et al., 2006). The CSE scale represents a measure of an individual's confidence in performing coping behaviours when faced with life challenges. The term CSE relates to the tendency to make certain attributions about control not in one context but in many (Lazarus and Folkman, 1984). The CSE scale advances our ability to explore the theoretical links between the secondary appraisal of stress, which asks 'what can I do?', and the major coping functions postulated by stress and coping theory – the regulation of distress and the management of underlying problems (Chesney et al., 2006). The term CSE is understood as a prerequisite for using actual coping strategies, as people need to be sure that they can perform coping actions before they act upon them (Chesney et al., 2006). Patients were asked to respond to the following question: 'When things are not going well for you, or when you are having problems, how confident or certain are you that

you can do the following': 'sort out what can be changed, and what cannot be changed', 'break an upsetting problem down into smaller parts', 'look for something good in a negative situation' and 'get emotional support from friends and family' or 'take your mind off unpleasant thoughts'. The CSE consists of three subscales representing self-efficacy for the use of 'problem-focussed coping' strategies (ranging from 0 to 120), 'ability to get support from friends and family' (ranging from 0 to 50) and the 'ability to stop unpleasant emotions and thoughts' (ranging from 0 to 90). CSE for the use of 'problem-focussed coping' consists of items that measure an individual's self-efficacy with respect to overcoming problems by analysing the nature of the problem and employing cognitive strategies to make the respondent's perception of the problem less severe (e.g. 'break an upsetting problem down into smaller parts'). CSE for the 'ability to stop unpleasant emotions and thoughts' measures a respondent's self-efficacy with respect to trying not to dwell on negative feelings and altering the emotional response to an unsettling event or problem rather than addressing the characteristics of the problem itself (e.g. 'take your mind off negative thoughts'). The 'ability to get support from friends and family' represents a set of items that captures the social dimension by tapping the respondent's perception of their ability to seek help from friends and family to cope with problems (e.g. 'get emotional support from friends and family') (Chesney et al., 2006). The three factors in the CSE scale are consistent with the three major aspects of coping – problem-focussed coping, emotion-focussed coping and social support. Although the scales are moderately correlated, the results of the concurrent validity analyses indicate that the scales assess self-efficacy with respect to different types of coping and lend support to using the factors separately (Chesney et al., 2006). Respondents answered on an 11-point scale. A higher score indicates a higher ability to cope with a particular situation (Chesney et al., 2006). In our sample, the Cronbach's alphas were 0.94 for self-efficacy for the use

of problem-focussed coping, 0.86 for CSE for the ability to get support and 0.93 for the ability to stop unpleasant emotions and thoughts, respectively.

Sleep-related problems. Sleep-related problems concerned night-time sleep quality and daytime sleepiness. Night-time sleep quality was measured using the Pittsburgh Sleep Quality Index (PSQI) (Buysse et al., 1989). The PSQI is a self-rated questionnaire to assess sleep disturbances and sleep quality over a 1-month time interval. The PSQI consists of 19 self-report questions which cover seven domains: sleep duration, subjective sleep quality, sleep latency, habitual sleep efficiency, sleep disturbances, use of sleep medication and daytime dysfunction. The score ranges from 0 to 21, with higher scores reflecting poor night-time sleep quality. A cut-off score of 5 separates good from poor sleepers (Buysse et al., 1989). Cronbach's alpha in our sample was 0.85.

Daytime sleepiness was measured using the self-report Epworth Sleepiness Scale (ESS), an 8-item questionnaire describing the tendency to fall asleep in various daytime scenarios (Miletin and Hanly, 2003). The score ranges from 0 to 24, with higher scores indicating higher daytime sleepiness. An ESS total score greater than 10 indicates excessive daytime sleepiness (Miletin and Hanly, 2003). Cronbach's alpha in our sample was 0.86.

Sociodemographic and clinical data. Information on age, gender and marital status was obtained from patient records. Body mass index (BMI; height and weight) was assessed by a physician. BMI was categorized as: underweight (<18.5), normal (18.5–24.99), overweight (25.0–29.99) and obese (30+). PSG was used to determine whether the diagnosis of OSA was present and to identify the severity of the disorder. PSG consists of a simultaneous recording of multiple physiological parameters related to sleep and wakefulness which directly monitor and quantify the number of respiratory events, related hypoxaemia and arousals. PSG included standard central and occipital electroencephalogram, bilateral electro-oculogram,

submental electromyogram (EMG), oral and nasal airflow using a thermistor, thoracic and abdominal excursions using respiratory inductive plethysmography and bilateral tibialis EMG. OSA severity was determined based on an AHI score (American Academy of Sleep Medicine, 2005), with three categories: mild OSA (AHI ≥ 5 and ≤ 15), moderate OSA (AHI > 15 and ≤ 30) and severe OSA (AHI > 30).

Statistical analyses

First, we described the background characteristics of the sample and calculated means and standard deviations for hostility (CMHo), CSE and psychological distress (GHQ-28) and sleep-related problems. We calculated frequencies and percentage for sociodemographic and clinical variables. Second, we assessed the correlations between the variables under study. Third, using regression analyses, we assessed the crude associations of hostility and CSE with psychological distress. Multicollinearity was assessed using the variance inflation factor (VIF < 2.0). We applied the enter selection in multiple linear regression models to determine the factors associated with psychological distress. For each factor, beta coefficients represent the mean variation of the psychological distress score. As the choice of coping strategies may be influenced by clinical and sleep-related variables, the associations between hostility, CSE and psychological distress were adjusted for OSA severity, night-time sleep quality and daytime sleepiness. The first model of the variables included sociodemographic data (age and gender). A second model included a clinical variable (OSA severity – measured by AHI), and a third model included night-time sleep quality and daytime sleepiness. In the fourth and fifth model, hostility and all dimensions of CSE were included separately (following Bardwell et al., 2001; Gassara et al., 2017; Mikula et al., 2019) to assess the explained amount of the total variance of psychological distress.

Finally, we performed mediation analyses to investigate whether the associations between hostility and psychological distress were mediated by the CSE. According to Baron and Kenny

(1986), the following conditions must be met to establish mediation: the independent variable (hostility) must affect the dependent variable (psychological distress); second, the independent variable (hostility) must affect the mediator (separate CSE dimensions) and finally, the mediator (separate CSE dimensions) must affect the dependent variable (psychological distress). The proportion of the effect which is mediated was calculated as the indirect effect divided by the total effect and multiplied by 100, while the as-advised standardized total effect was at least ± 0.2 (Kenny, 2016). Sobel *z*-tests were used to examine the mediating effects of the CSE on the associations between hostility and psychological distress. Power analysis revealed that the statistical power for multivariate analysis exceed 95% at $\alpha = 0.05$. The statistical power for univariate analysis was 0.99 at $\alpha = 0.05$ (Faul et al., 2009). A *p*-value of < 0.05 was considered to be statistically significant. All analyses were performed using the Statistical Package for the Social Sciences (IBM SPSS 22) and MedGraph.

Results

Sample characteristics

A total of $N = 150$ OSA patients (68% male; mean age 48.9 ± 9.5 years) were included in the study (Table 1). The majority of patients had secondary education (57.3%). A total of 44.7% were obese and 49.3% had severe OSA.

Correlations between hostility, CSE and psychological distress

Table 2 shows the correlations between between hostility, CSE and psychological distress. Small but significant correlations were found between hostility, self-efficacy for the use of problem-focussed coping and CSE for getting support from family and friends. A moderate correlation was found between hostility and ability to stop unpleasant emotions and thoughts. The correlations between hostility, all dimensions of CSE and psychological distress were high.

Table 1. Baseline characteristics of the OSA patients AHI ≥ 5 (N = 150).

Characteristics	
Age in years; mean, SD	48.9 \pm 9.5
Gender; male, N (%)	102 (68.0)
Marital status; single, N (%)	36 (24.0)
Education; N (%)	
Elementary	8 (5.3)
Secondary	86 (57.3)
University	56 (37.3)
Body mass index; mean, SD	30.2 \pm 7.7
Body mass index; N (%)	
Underweight (<18.50)	9 (6.0)
Normal (18.50–24.99)	42 (28.0)
Overweight (25.00–29.99)	32 (21.3)
Obese (≥ 30.00)	67 (44.7)
Apnoea-Hypopnoea Index (AHI) in events/h; mean, SD	36.1 \pm 22.3
OSA severity; N (%)	
Mild (AHI $\geq 5 \leq 15$)	23 (15.3)
Moderate (AHI > 15 \leq 30)	52 (34.7)
Severe (AHI > 30)	74 (49.3)
Night-time sleep quality; mean, SD (PSQI; 0–21)	9.7 \pm 4.1
Excessive daytime sleepiness; mean, SD (ESS; 0–24)	11.0 \pm 5.3
Hostility (CMHo; 0–27)	15.1 \pm 5.6
Problem-focussed coping self-efficacy (CSE; 0–120)	79.5 \pm 24.1
Get support from friends and family (CSE; 0–50)	32.9 \pm 10.0
Stopping unpleasant emotions and thoughts (CSE; 0–90)	56.1 \pm 19.63
Psychological distress (GHQ-28; 0–84)	32.6 \pm 18.4
Psychological distress (GHQ-28 ≥ 24)	79 (56.0)

AHI: Apnoea-Hypopnoea Index; OSA: obstructive sleep apnoea; PSQI: Pittsburgh Sleep Quality Index; ESS: Epworth Sleepiness Scale; CMHo: Cook-Medley Hostility Scale; CSE: Coping Self-Efficacy Scale; GHQ-28: General Health Questionnaire.

Missing values: OSA severity (0.7%), age (1.0%), ESS (1.0%), PSQI (1.0%), CMHo (1.0%), GHQ-28 (6.0%), problem-focussed coping self-efficacy (6.0%), get support from friends and family (2.0%), and stopping unpleasant emotions and thoughts (3.0%).

Table 2. Correlation coefficients between hostility, coping self-efficacy and psychological distress.

	Hostility	Problem-focussed coping self-efficacy	Get support from friends and family	Stopping unpleasant emotions and thoughts
Problem-focussed coping self-efficacy	-0.24*	–	–	–
Get support from friends and family	-0.23*	0.89***	–	–
Stopping unpleasant emotions and thoughts	-0.26**	0.90***	0.82***	–
Psychological distress	0.58***	-0.50***	-0.35***	-0.53***

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$. Higher score indicates higher psychological distress.

Table 3. Hostility and coping self-efficacy on psychological distress (N = 150).

Psychological distress (GHQ-28)	Crude	Model 1	Model 2	Model 3	Model 4	Model 5 A	Model 5 B	Model 5 C
	B (95% CI)	B (95% CI)	B (95% CI)	B (95% CI)	B (95% CI)	B (95% CI)	B (95% CI)	B (95% CI)
Age	-0.22 (-0.54; 0.12)	-0.26 (-0.59; 0.06)	-0.33 (-0.65; -0.02)*	-0.33 (-0.56; -0.11)**	-0.22 (-0.44; -0.03)	-0.19 (-0.39; 0.00)	-0.21 (-0.42; 0.00)	-0.18 (-0.37; 0.00)
Gender	6.06 (0.43; 12.55)	6.63 (0.09; 13.17)	5.40 (-0.91; 11.70)	1.85 (-2.92; 6.61)	0.97 (-3.61; 5.55)	0.18 (-3.91; 4.26)	0.63 (-3.63; 4.88)	0.46 (-3.46; 4.39)
Body mass index	0.62 (0.23; 1.02)**	-	0.91 (-0.30; 0.69)	0.13 (-0.22; 0.49)	0.06 (-0.29; 0.40)	-0.06 (-0.36; 0.25)	-0.01 (-0.36; 0.31)	0.01 (-0.28; 0.30)
OSA severity	0.24 (0.11; 0.37)**	-	0.20 (0.03; 0.37)*	0.06 (-0.07; 0.81)	0.08 (-0.04; 0.20)	0.12 (0.01; 0.23)	0.13 (0.01; 0.24)	0.13 (0.03; 0.23)
Night-time sleep quality	2.89 (2.32; 3.45)**	-	-	2.60 (2.08; 3.13)**	2.15 (1.59; 2.71)**	1.85 (1.34; 2.36)**	2.00 (1.48; 2.53)**	1.79 (1.29; 2.27)**
Daytime sleepiness	1.44 (0.91; 1.97)**	-	-	0.89 (0.46; 1.32)**	0.71 (0.29; 1.13)**	0.68 (0.31; 1.06)**	0.69 (0.30; 1.08)**	0.68 (0.33; 1.04)**
Hostility	1.91 (1.47; 2.36)**	-	-	-	0.79 (0.36; 1.23)**	0.72 (0.33; 1.12)**	0.72 (0.31; 1.12)**	0.67 (0.30; 1.04)**
Problem focussed	-0.37 (-0.48; -0.26)**	-	-	-	-	-0.23 (-0.31; -1.15)**	-	-
Get support	-0.62 (-0.91; -0.35)**	-	-	-	-	-	-0.39 (-0.59; -0.20)**	-
Stopping emotions/ thoughts	-0.49 (-0.62; -0.35)**	-	-	-	-	-	-	-0.32 (-0.41; -0.22)**
F change	-	2.99	6.35**	59.88***	12.78***	32.83***	16.62***	44.59***
Adjusted R ²	-	0.03	0.12	0.54	0.59	0.67	0.63	0.70

Crude: effect of each variable separately on functional status; Model 1: effect of age and gender on GHQ-28 score; Model 2: effect of age, gender, BMI and OSA severity on GHQ-28 score; Model 3: effect of age, gender, BMI, OSA severity and sleep-related problems on GHQ-28 score; Model 4: effect of age, gender, BMI, OSA severity, sleep-related problems and hostility on GHQ-28 score; Model 5 A: effect of age, gender, BMI, OSA severity, sleep-related problems, hostility and problem-focussed coping self-efficacy on GHQ-28 score; Model 5 B: effect of age, gender, BMI, OSA severity, sleep-related problems, hostility and coping self-efficacy for the ability to get support from friends and family on GHQ-28 score; Model 5 C: effect of age, gender, BMI, OSA severity, sleep-related problems, hostility and coping self-efficacy for stopping unpleasant emotions and thoughts on GHQ-28 score. Gender – male gender was set as the reference

B: unstandardized regression coefficient; BMI: body mass index; CI: confidence interval; OSA: obstructive sleep apnoea; GHQ-28 – General Health Questionnaire; F change: significance of prediction improvement in model fit; adjusted R²: explained variance adjusted for the number of predictors in the particular model; GHQ-28: higher score indicates higher psychological distress.

*p < 0.05; **p < 0.01; ***p < 0.001.

Bold values' significance is related to F change.

Table 4. Mediating effect of coping self-efficacy on the association between hostility and psychological distress.

Coping self-efficacy	Psychological distress		
	Sobel z-value	Direct effect	Indirect effect
Problem-focussed coping self-efficacy	2.60***	0.49***	15.0%
Get support	2.16*	0.53***	10.0%
Stopping emotions and thoughts	2.85***	0.48***	17.0%

* $p < 0.05$; *** $p < 0.001$.

Associations between hostility, CSE and psychological distress

A crude effect on psychological distress was found for OSA severity, sleep-related problems, hostility and CSE (Table 3). The associations between hostility, CSE and psychological distress were adjusted for sociodemographic variables (age and gender), the clinical variables (OSA severity and BMI) and sleep-related variables (night-time sleep quality and daytime sleepiness). Model 4, with hostility added, explained 59% of the total variance of psychological distress. All CSE dimensions were strongly associated with a lower level of psychological distress. The regression models for CSE for the ability to get support from family and friends, self-efficacy for the use of problem-focussed coping and CSE for the ability to stop unpleasant emotions and thoughts explained 63, 67 and 70 per cent of the total variance of psychological distress (Model 5 A, B, C), respectively.

CSE as a mediator between hostility and psychological distress

The mediation analyses showed that all three CSE dimensions partially mediated the associations between hostility and psychological distress in OSA patients. The indirect effects of all three CSE dimensions were significant. They accounted for 10.0% of CSE for getting support from family and friends, 15.0% of self-efficacy for the use of problem-focussed

coping and 17.0% of CSE for the ability to stop unpleasant emotions and thoughts (Table 4). Figure 1 shows the mediating effects of separate CSE dimensions on the association between hostility and psychological distress.

Discussion

The aims of this study were (1) to assess whether hostility and CSE are associated with psychological distress in OSA patients, when controlled for sociodemographic, clinical and sleep-related variables and (2) to examine whether CSE mediates the association between hostility and psychological distress. We found that high levels of hostility and poor CSE were strongly associated with psychological distress in OSA patients. Compared with self-efficacy for the use of problem-focussed coping and CSE for the ability to get support from friends and family, poor CSE for stopping unpleasant emotions and thoughts was more strongly associated with psychological distress. All CSE dimensions mediated the association between hostility and psychological distress. CSE for stopping unpleasant emotions and thoughts was identified as the strongest mediator in the association between hostility and psychological distress.

We found a strong association between high levels of hostility and psychological distress in OSA patients, even after controlling for sociodemographic variables, disease severity, BMI and sleep-related problems. Earlier, it was shown that individuals with OSA demonstrated

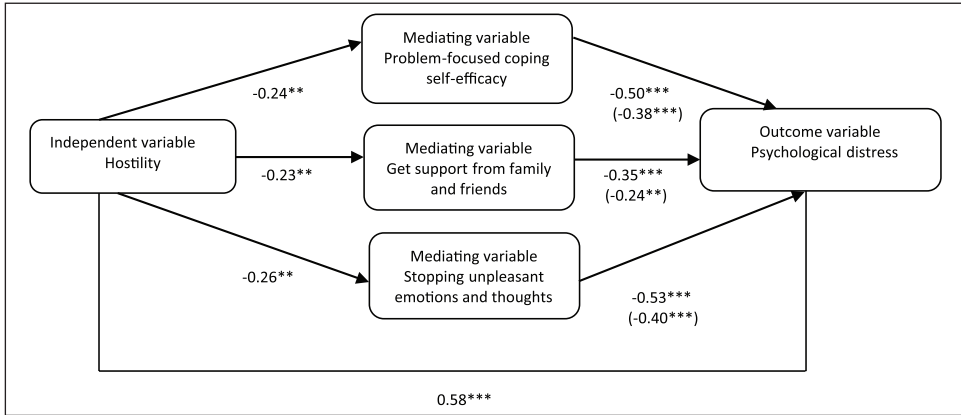


Figure 1. Mediating role of coping self-efficacy on the association between hostility and psychological distress.

Mediations were conducted separately for each particular coping strategy. ** $p < 0.01$; *** $p < 0.001$.

along with the presence of irritability, also frustration and increased engagement in conflict (Bardwell et al., 1999; Unal et al., 2017; Yue et al., 2003). Hostility and anger were also found to be higher in OSA patients when compared to healthy controls in a Korean population (Lau et al., 2014). Vandervoort (2006) showed that individuals with a high level of hostility reported poorer mental health and used avoidant coping strategies more often than individuals with a low level of hostility (Vandervoort, 2006).

As sleep-related symptoms in OSA may increase hostility, which may consequently potentiate the negative health consequences of the disease, CSE may represent one of the key determinants in adaptation to sleep disorders. Our analyses showed that poor CSE was strongly associated with psychological distress in OSA patients. These results confirm previous findings on the association between CSE and a lower level of psychological distress (Benka et al., 2014; Chesney et al., 2006) and a better quality of life (Mikula et al., 2019) in the context of chronic diseases. Self-efficacy for the ability to stop unpleasant emotions and thoughts in our sample explained the most variance of all the CSE dimensions in the psychological distress. One possible explanation why stopping unpleasant emotions and thoughts might be the most

adaptive CSE dimension in OSA is that the patients have very little control (e.g. Cheng, 2001) over the symptoms of their disease. When patients do not have the ability to control the disease and have to learn how to live with it, this kind of CSE can help them to reduce the stress that breathing and sleep-related symptoms bring and thus may diminish their psychological distress. In line with the strategy-situation-fit hypothesis, well-being may thus represent a function of the ‘goodness of fit’ between emotion-regulation efforts and the contextual characteristics (Conway and Terry, 1992) of OSA. This interpretation is consistent with previous research on chronic conditions, which suggests that CSE for stopping unpleasant emotions and thoughts is more adaptive when little control over disease is possible (De Ridder and Schreurs, 2001; Mikula et al., 2014). In line with our findings, previous research also showed that individuals scoring higher on hostility were also more likely to employ escape-avoidance coping styles while handling psychological distress (Vandervoort, 2006) and were less likely to use problem-focussed coping (Sasaki and Yamasaki, 2002).

Next, we found the ability to get support from friends and family to be the least adaptive CSE domain in the association with psychological distress, including diminishing the negative

effect of hostility on psychological well-being. This finding may be explained by the results of previous research, in which sleep-related problems represented an important predictor of daytime functioning, including engagement in social activities (Dew et al., 1994). Therefore, due to sleep-related OSA symptoms, such as daytime sleepiness, the sources of social support may be less utilized and thus may be of less importance. As hostility was found to be associated with poor levels of social support (Smith, 1992) and social dysfunction (Sasaki and Yamasaki, 2002) and involves an oppositional orientation towards others and negative beliefs and feelings towards others (Houston and Vavak, 1991), it may be assumed that patients with OSA may be even less motivated to participate in social activities, when potentiated by the presence of hostility. Furthermore, hostility was found to lead to difficulty in extracting the needed social support (Vandervoort, 1999).

In contrast, Bardwell et al. (2001) concluded that the more active and less passive the coping strategies reported by OSA patients are, the lower the level of depressive symptoms they experienced. Depressive symptoms were associated with more emotional coping and with less problem-focussed coping in the study by Gassara et al. (2017). Although our results differ from those of previous studies (Bardwell et al., 2001; Gassara et al., 2017), these discrepancies may be associated with the difference in OSA diagnosis criteria; for example, patients in the study by Bardwell et al. (2001) were diagnosed using a Respiratory Disturbance Index of ≥ 15 , while in our study, OSA diagnosis was stated based on an AHI of ≥ 5 . Another possible explanation for the inconsistency in the above studies could be caused by the use of univariate statistical procedures in the study by Gassara et al. (2017). Moreover, the discrepancies in the role of passive coping strategies could be influenced by the different assessment of psychological distress, with a focus on depression. These discrepancies may also concern the difference in theoretical perspective of the tools used to measure coping (e.g. Vaske et al., 2017).

We also found that all CSE dimensions mediated the association between hostility and psychological distress. Thus, active as well as passive coping may be adaptive when dealing with OSA. Moreover, CSE may serve as a trigger or perpetuator for psychological distress in OSA patients. In line with our findings, efficient coping strategies were associated with low levels of hostility in previous research (Comijs et al., 1999). One of the first investigations on coping and hostility in people with a chronic condition found that efficient coping was associated with reacting to stress with a minimum of hostility either expressed or suppressed (Schill et al., 1985). The transactional model of the relationship between hostility and disease suggests that personality, cognitive and behavioural factors operate in reciprocal interaction with the environment and lead to a variety of frequent physiological reactions and related pathophysiological consequences (Williams and Williams, 2001).

Mediation analyses in our study revealed that CSE for stopping unpleasant emotions and thoughts was the most effective in diminishing the strength of the association between hostility and psychological distress in OSA patients. In line with these findings, previous research also showed that escape-avoidance-oriented coping strategies had a significant mediating role in the relationship between hostility and self-rated health outcomes in a sample of healthy individuals (Vandervoort, 2006). This finding is not surprising, as the affective component of hostility consists of the tendency to experience several negative emotions (Barefoot et al., 1989).

Finally, we wanted to ensure that the choice of CSE and its association with psychological distress was not simply a result of sociodemographic or clinical variables. Therefore, gender and age were employed as controlled variables, along with BMI, AHI and sleep-related problems. We found no significant association between sociodemographic variables and psychological distress. Similarly, the association between clinical variables, measured as OSA severity and BMI, was no longer significant in complex models. Previous studies have shown

that age (Ryff and Singer, 2013), overweight and obesity were found to be associated with poor levels of subjective health status, particularly in terms of physical well-being (Doll et al., 2000). Other studies, have not found any association between BMI and psychological disturbances or psychosocial functioning (Klesges et al., 1992). The missing associations between age, obesity and psychological distress may be a result of confounding by the presence of accompanying chronic illness (Doll et al., 2000).

Strengths and limitations

Patients in our sample were diagnosed by PSG, which is an asset of the study. Moreover, this is the first study which examines the mechanism between hostility, CSE and psychological distress using comprehensive measurements in a rarely studied population of OSA patients. It is plausible that a number of limitations could have influenced our findings. First, we used cross-sectional data; thus, we cannot make any causal inferences. Second, self-report hostility may be prone to providing socially acceptable answers (Davidson and Hall, 1997); thus, replication with more objective measures would provide an important comparison. Finally, although emotional suppression may reduce the outward expression of emotion and possibly the subjective experience of emotion in the short term, it was found to be less effective in reducing emotion and physiological arousal over a long-term period (Gross and Thompson, 2007). Previous studies have also suggested that long-term suppression of negative thoughts may prevent habituation to emotional stimuli and as such may result in hypersensitivity to psychological distress and symptoms (Wenzlaff and Wegner, 2000). Thus, longitudinal studies are needed to assess the influence of CSE for the ability to stop unpleasant emotions and thoughts on psychological distress.

Implications for future research and practice

Psychological distress in OSA patients is clearly associated with hostility and poor CSE and

requires attention in both clinical care and research. We recommend that our study should be replicated with a larger sample and a longitudinal design. Furthermore, future research is needed to understand the causal mechanisms between hostility, CSE and psychological distress in OSA patients. It would also be interesting to examine the actual sleep disturbances among patients scoring high and low on the Cook–Medley hostility scale in the laboratory. Hostility levels are well known to fluctuate considerably over time, and thus, a longitudinal study including repeated measures is needed. Poor CSE may represent a background factor partially underlying the adverse effect of hostility on psychological well-being.

Psychological distress was found to have the capacity for interventions (Farrand et al., 2016) and various protective efforts, including self-efficacy and effective coping strategies (Hopman et al., 2009; Mikula et al., 2019; Trojan et al., 2012). From a clinical perspective, knowing which coping strategies a patient uses and how much hostility they experience and express may be useful in OSA management. Therefore, the assessment of hostility and particular CSE dimension may help to identify those patients who might benefit most from the direct treatment of psychological symptoms, in addition to treatment of sleep-disordered breathing itself. Our findings suggest that it is necessary to monitor hostility in OSA patients during clinical care. Understanding these associations may be beneficial for therapy, as well. A person who believes in his or her ability to produce a desired effect can conduct a more active and self-determined health-behaviour (Schwarzer and Renner, 2000). Therefore, education about the role of CSE can be included in shorter pragmatic programmes (Goudsmit et al., 2009; Wersebe et al., 2018). As disease occurs in people having premorbidly varying CSE in general and illness-related stress in particular, personality and behavioural patterns may play a key role in determining which OSA patients will experience higher levels of psychological distress. Thus, rather than solely focusing on patients' medical parameters and

standard OSA treatment, patients should be encouraged to use adaptive coping strategies. When our findings are confirmed in longitudinal studies, screening for hostility and treatment focussed on decreasing high levels of hostility, in addition to standard therapy of the disordered breathing, might help to handle psychological distress experienced by OSA patients. Feelings of hostility may be decreased by cognitive behavioural therapy (Seligman et al., 2005), controlled interventions and behavioural modifications (Barefoot et al., 1989).

Conclusion

This study has led us to conclude that the presence of psychological distress in OSA patients may not be solely due to the effect of OSA itself. Rather, hostility and the choice of coping strategies may play a key role in examining which OSA patients will experience higher level of psychological distress. Thus, interventions focussed on reducing hostility, and enhancement of adaptive coping may help to optimize standard treatment in OSA patients and be paramount in diminishing psychological distress in OSA patients. Further longitudinal research is necessary to confirm the causality, however.

Author's Note

Any underlying research materials related to this paper can be accessed on demand.

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