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ORIGINAL ARTICLE

Risk-seeking attitude in health and safety domain is associated with continuous positive airway pressure discontinuation in patients with obstructive sleep apnea—a multicenter prospective cohort study

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Abstract

Study Objectives: Many studies have already looked at factors that may influence adherence to continuous positive airway pressure (CPAP) (severity of obstructive sleep apnea (OSA), patients' age, technical aspects, socioeconomic factors, living conditions, psychological factors). Although it has been shown that individuals' preference for risky behaviors in daily life can influence the use of care or adherence to drug therapies in care settings, this has never been tested in OSA. This study aims to analyze the association between risk attitude in the health/safety domain and CPAP discontinuation in a cohort of OSA patients.

Methods: In a prospective multicenter cohort study nested within the IRSR sleep cohort, consecutive patients who were prescribed CPAP were monitored for at least 6 months. In addition to the data usually collected in the IRSR sleep cohort at baseline, patients also completed a risk-taking questionnaire using the Domain-Specific Risk-Taking (DOSPERT) scale. Cox's proportional hazards regression was used to model the risk of CPAP discontinuation as a function of a linear combination of variables hypothetically related to this risk including health risk attitude.

Results: Of the 489 patients under CPAP, 12.1% ($n = 59$) were risk-seeking, 87.9% ($n = 430$) were risk-neutral, and none were risk-averse. Cox's model indicated that a risk-seeking attitude ($p = 0.04$) and an AHI <30 ($p < 0.01$) were significantly associated with CPAP discontinuation.

Conclusions: Patients with risk-seeking behaviors in daily life have been shown to be more likely to discontinue CPAP. The DOSPERT scale can be a useful tool for screening this specific group of patients in clinical practice.

Statement of Significance

Social scientists have done a great deal of work on the issue of risk behaviors in many areas (social, financial, etc.) and their influence on individual decision-making. Very little work has examined the links between these risk behaviors and health decisions (use of preventive/curative care, adherence to medication). Based on this literature, it can be hypothesized that health/safety risk behaviors such as unprotected sun exposure, driving without a seat belt, etc. can be predictive of poor CPAP adherence. Using a psychometric scale, the Domain-Specific Risk-Taking (DOSPERT) scale, our study results confirm this assumption.

Key words: obstructive sleep apnea; continuous positive airway pressure; adherence; DOSPERT scale; Cox's proportional hazards model

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Introduction

Obstructive sleep apnea (OSA) is a common disorder with major neurocognitive and cardiovascular sequelae [1, 2]. The number of individuals aged 30–69 years worldwide, with moderate to severe OSA, based on an apnea-hypopnea index (AHI) of 15 or more events per hour, was estimated at 425 million [3]. This group could be considered the clinically important population for which treatment would be recommended. Continuous positive airway pressure (CPAP) is a highly effective therapy for OSA [4–6]. However, poor adherence can limit its effectiveness [7]. Efforts to improve adherence to CPAP therapy are a key component of OSA management. Numerous studies have already examined factors that may influence adherence to CPAP, including severity of the condition, patient age, technical aspects, socioeconomic factors, living conditions [8], and psychological factors [9]. None of these studies has ever taken into consideration the potential influence of patients' preference for risky behaviors. Yet, social science research has shown the influence of behavioral factors such as health risk attitude on preventive behaviors [9], the use of care [10], or adherence to drug therapies [11, 12]. Regarding adherence to drug therapies, Prosser *et al.* [11] for instance showed that a risk-seeking attitude was associated with lower than expected utilization of β-interferons in patients with multiple sclerosis. Significant associations were also found by Barfoed *et al.* [12] between health risk attitude and adherence to statin treatment, where risk-neutral and risk-seeking patients had poorer adherence than risk-averse patients. If, as these authors show, adherence to drug therapies is related to behavioral factors such as health risk attitude, then there is reason to believe that CPAP adherence is also related to such factors. This is the hypothesis we wish to test in this article. Highlighting this phenomenon could further have implications in terms of patient care by identifying patients at risk of nonadherence as soon as they start treatment.

Several risk attitude scales have been developed and validated, in particular the Domain-Specific Risk-Taking (DOSPERT) scale, which provides, according to Harrison *et al.* [13], an effective clinical tool for measuring health-related risk attitude in health care settings, captured by responses to items in the health/safety domain.

Using the DOSPERT scale and Cox's proportional hazards model, our study was conducted to analyze the association between risk attitude in the health/safety domain and CPAP discontinuation in a cohort of OSA patients.

Methods

This was a prospective multicenter cohort study conducted in France in three sleep centers in Angers, Le Mans, and Les Sables d'Olonne, which routinely treat patients with OSA.

Study design and population

IRSR sleep cohort.

Since May 2007, the Institute for Respiratory Health Research (Institut pour la Recherche en Santé Respiratoire des Pays de la Loire, IRSR) has been setting up a prospective data collection system that can be used for research purposes on patients with OSA: this is the IRSR sleep cohort. This involves collecting daily clinical, socio-professional, living conditions, and sleep recording data from all patients referred for suspicion of OSA who have signed consent forms to participate in the cohort at participating centers. After the therapeutic decision, patients treated with CPAP are monitored regularly after 1 month, 6 months, 1 year, and annually. On this occasion, technical data on equipment and mean daily rate of use are also recorded. The cohort operates in eight hospitals in the Pays de la Loire region. The collection of individual data in the IRSR sleep cohort is computerized and identical for all sleep centers. Authorization for the processing of personal data was obtained from the Advisory Committee on Research Information Processing in the field of health (CCTIRS) and the National Commission for Data Protection and Liberties (CNIL) (07.207 bis).

Study population

Between January 2016 and December 2018, consecutive patients aged 18 or older who were prescribed CPAP were recruited from three sleep centers participating in the cohort mentioned above. These patients (the last patients included in the cohort) were monitored for at least 6 months, as part of the usual follow-up of patients included in the IRSR sleep cohort (see below).

Patients with mental retardation unable to fill in the questionnaires, patients unable to give their informed consent, patients unable to read and/or speak French, and patients with neuromuscular diseases were excluded from this study.

Data collection

Data usually collected in the IRSR sleep cohort at baseline

PATIENT CHARACTERISTICS. Patients were characterized according to their age (<65 / ≥65 years), gender, body mass index (BMI) (<30 / ≥30 kg/m^2), smoking habits (currently smoking, Yes / No), alcohol-consuming habits (0 / ≥ 1 glass of beer, wine or spirits per day), cardiovascular morbidities including hypertension (Yes / No), diabetes (Yes / No), hyperlipidemia (Yes / No), and chronic obstructive pulmonary disease (Yes / No).

SOCIOECONOMIC FACTORS. Socioeconomic status was measured by the following variables: educational attainment as determined by the age at which the patient left full-time education (≤18 / >18years); employment status (employed full time or part time/retired/unemployed); and marital status (married or living as a couple/living alone [never married, divorced, separated, or widowed]).

DAYTIME SLEEPINESS. Daytime sleepiness was measured by the Epworth Sleepiness Scale (ESS). Excessive daytime sleepiness was defined by an ESS ≥ 11 [14].

DEPRESSIVE SYMPTOMS. Depressive symptoms were measured by the Pichot scale. This 13-item questionnaire was specifically designed for depression screening in community studies. Depression was diagnosed when at least seven items were positive [15].

OSA SEVERITY. OSA severity was assessed according to the AHI measured by overnight polysomnography (PSG) or

respiratory polygraphy (RP). According to French guidelines, patients with a high clinical probability of OSA are investigated by RP [16]. Patients with a low likelihood of OSA and/or coexisting sleep disorders received a PSG. Recorded data include nasal-oral airflow (thermistor and nasal pressure cannula), chest and abdominal wall motion (respiratory inductance plethysmograph belts), arterial oxygen saturation (pulse oximetry), body position and electrophysiological signals for sleep evaluation. Respiratory events are scored manually using the recommended criteria [17]. Apnea is defined as an at least 90% decrease in the oronasal thermal sensor signal and hypopnea is defined as an at least 30% decrease in the nasal pressure signal combined with either ≥3% arterial oxygen desaturation or arousal, both lasting at least 10 seconds. Severe OSA is defined as AHI ≥ 30 and moderate OSA as a 15 ≤ AHI < 30.

DOSPERT questionnaire (DOSPERT scale)

In addition to the data usually collected in the cohort at baseline, patients included in this study also completed a risk-taking questionnaire. To address the need for a measure of individual differences in risk-taking, Weber *et al.* [18] developed a psychometric scale (the DOSPERT scale), which captures individual behaviors across five risk domains: the health, financial, social, recreational, and ethical domains. Within the DOSPERT scale, risk-taking—the self-reported likelihood of engaging in a risky activity—is measured separately from two additional scales that measure perceived risks and expected benefits of engaging in risky activities in each domain. The DOSPERT scale is a generic psychometric scale whose properties are already validated in the general population. The original 40-item DOSPERT scale, measuring risk-taking, and perceived risks and benefits, has been demonstrated to have satisfactory internal consistency, reliability of its scale items, adequate test–retest reliability, and to capture the domain-specific nature of real-world risk-taking. In 2006, the authors provided a revised version of the DOSPERT scale that is 25% shorter while remaining stable in terms of its psychometric properties. In addition, it consists of items that are applicable to respondents from a broader range of ages, cultures, and educational level. That is the scale we used in this article. It has been validated in French [19]. Each domain can be studied separately. The DOSPERT scale can be used freely (Figure 1).

To determine the "health/safety" risk behaviors of interest here, patients were confronted with 6 risky situations and were asked to indicate the likelihood with which they might engage in these risky behaviors, choosing one of the options ranging from "Extremely unlikely" to "Extremely likely" on a Likert scale from 1 to 7. A score per patient was calculated by adding the scores to each item (see DOSPERT scale used in Figure 1).

To determine perceived risks, patients were confronted with the same 6 risky situations and were asked to indicate their perceived risk for each of these situations by choosing one of the options ranging from "Not at all risky" to "Extremely risky" on a Likert scale from 1 to 7. A score per patient was calculated by adding the scores to each item.

To determine risk attitude, which is our variable of interest in this study, Weber and colleagues [18, 19] have provided a risk-return framework, in which people's preference for risky options (risk attitude) is assumed to reflect a trade-off between an option's expected benefit and its perceived riskiness: risk attitude (X) = a (perceived risk (X)) + b (expected benefit (X)) + c.

The first step was therefore to determine the expected benefits of taking risks. To do so, patients were confronted with the same 6 risky situations and had to indicate the level of benefit they expected for each of them by choosing one of the options ranging from "No benefit at all" to "Lots of benefit" on a Likert scale from 1 to 7. Then we regressed perceived risks and expected benefits on risk-taking to calculate coefficients a and b; and, finally, we calculated risk attitude using the above formula. As recommended, patients were classified as "risk-seekers" if their score was higher than the mean by at least 1 *SD*; they were classified as "risk-averse" if their score was lower than the mean by at least 1 *SD*, and they were classified as "risk-neutral" if their score was between the two.

CPAP initiation and follow-up

According to the criteria defined by the French national health insurance, CPAP therapy was prescribed in patients with severe OSA and in those with moderate OSA and cardiovascular morbidities or severe daytime sleepiness. As previously described [8], a single home respiratory care company (Aliséo, Beaucouzé, France) was involved in this study for CPAP delivery and the follow-up support program. Following the diagnosis of OSA, a board-certified sleep specialist prescribed CPAP therapy using either a fixed-pressure device or a self-adjusting pressure device. Before CPAP titration, all patients received treatment education including explanation of the treatment by a specialized nurse, mask-fitting, and a CPAP acclimatization period during daytime. All patients received a phone call from the specialized nurse during the first week of treatment and follow-up visits were then held after 3 months, 6 months, and then every 6 months. A meter reading of CPAP was taken, and a mean value of daily CPAP use was computed at each follow-up visit. When patients abandoned their CPAP treatment between two follow-up visits, the date of treatment discontinuation was recorded.

Statistical analysis

The statistical analysis was performed using the SAS program (SAS Institute, Cary, NC).

Description of the population

Values are given as means (*SD*s) or proportions. We used the unpaired *t*-test to compare cross-classified continuous variables and the chi-square test to evaluate proportions when we compared patient groups defined according to their risk attitude.

Patients' adherence

Using the Kaplan-Meier cumulative incidence method, we estimated the proportion of patients still under CPAP over time, taking into account right-censored observations due to termination of the study [20].

We used the log-rank test to compare the proportion of patients still under CPAP over time in univariate analyses. For the

Health/Safety Risk-Taking (Adult) Scale –Risk Taking

For each of the following statements, please indicate the likelihoodthat you would engage in the described activity or behavior if you were to find yourself in that situation. Provide a rating from *Extremely Unlikely* to *Extremely Likely*, using the following scale:

1	2	3	4	5	6	7
Extremely unlikely	Moderately unlikely	Somewhat unlikely	Not sure	Somewhat likely	Moderately likely	Extremely likely

1. Drinking heavily at a social function.
2. Engaging in unprotected sex.
3. Driving a car without wearing a seat belt.
4. Riding a motorcycle without a helmet.
5. Sunbathing without sunscreen.
6. Walking home alone at night in an unsafe area of town.

Health/Safety Risk-Taking (Adult) Scale –Risk Perceptions

People often see some risk in situations that contain uncertainty about what the outcome or consequences will be and for which there is the possibility of negative consequences. However, riskiness is a very personal and intuitive notion, and we are interested in your gut level assessment of how risky each situation or behavior is.

For each of the following statements, please indicate how risky you perceive each situation. Provide a rating from *Not at all Risky* to *Extremely Risky*, using the following scale:

1	2	3	4	5	6	7
Not at all risky	Slightly risky	Somewhat risky	Moderately risky	Risky	Very risky	Extremely risky

Health/Safety Risk-Taking (Adult) Scale–Expected Benefits

For each of the following statements, please indicate the benefits you would obtain from each situation. Provide a rating from 1 to 7, using the following scale:

1	2	3	4	5	6	7
No benefits at all	-	-	Moderate benefits	-	-	Great benefits

Figure 1. DOSPERT scale.

variables that were not already divided into classes, such as the perceived risk attitude, gender, smoking and alcohol-consuming habits, cardiovascular morbidities, diabetes, hyperlipemia, chronic obstructive pulmonary disease, educational level, employment status, and marital status the relative importance of each of them on the proportion of patients still under CPAP over time was calculated according to the following strata for age (<65 vs. ≥65), BMI (<30 vs. ≥30), ESS (<11 vs. ≥11), Pichot score (<7 vs. ≥7), AHI (<30 vs. ≥30).

Cox's proportional hazards multiple regression analysis [21] was used to model the risk of treatment discontinuation as a function of a linear combination of the variables cited above hypothetically related to this risk (confounding factors) including health risk attitude (our variable of interest). We chose to leave all the confounding factors in the final model. A stratified analysis by age, gender, BMI, employment status, marital status, and AHI was also performed. The results are described as non-adjusted and adjusted hazard ratio (95% confidence intervals).

Results

Study population

A total of 622 patients were included in the present study. Among them, 498 were treated with CPAP, 128 were not (24 did not have any OSA, 32 refused CPAP, three were treated with a mandibular advancement device, and 65 had their CPAP delivered by another home respiratory care company

than Aliséo). Among the treated patients, nine patients were excluded: for 4 of them the starting date of treatment was missing, and five patients did not complete the DOSPERT scale. We followed up the 489 patients under CPAP for 624 (270) days. Among them, 24.5% (n = 120) stopped treatment before the end of the follow-up period. No patients died or were lost to follow-up. Patients' baseline characteristics are summarized in Table 1.

With regard to risk-taking, perceived risks and expected benefits of risk-taking in our study, there was consistency in the responses to the three sets of items. The Cronbach's α were 0.7, 0.90, and 0.80, respectively. Scores are summarized in Table 2. The risk attitude score (calculated after regression of perceived risks and expected benefits of risk-taking on risk-taking) was 11.6 (2.7). Note that the regression model gave significant coefficients with signs in the expected direction: risk-taking was negatively related to risk perception and positively related to the expected benefit of risk-taking with an estimate (standard error) of –0.13 (0.03) and 0.48 (0.05), respectively (Table 2). Of the 489 patients under CPAP, 12.1% (n = 59) were risk-seeking, 87.9% (n = 430) were risk-neutral, and none were risk-averse.

The proportion of patients still under CPAP was estimated to be 86% after 6 months, 76.3% after the first year, and 61 % after the second year and thereafter (Figure 2). The mean daily rate of use was 2.9 (2.4) hours for the patients who gave up treatment before the end of the study, and 6.1 (1.7) hours for the patients still under treatment.

Risk-seeking patients compared to risk-neutral patients

Table 1 shows the characteristics of the patients who were risk-seeking and those who were risk-neutral. In the risk-seeking group, patients were younger (p = 0.01), women were underrepresented (p = 0.02), and current smokers were overrepresented (p = 0.01). There was no difference in terms of OSA severity between groups. The proportion of patients who stopped CPAP therapy was significantly higher in the risk-seeking group (p = 0.02).

Comparison of the proportions of patients still under CPAP over time

In univariate analysis, the risk attitude at the beginning of CPAP therapy significantly influenced the proportion of OSA patients still under CPAP over time: after 3 months, this proportion was estimated to be 94.9% in the risk-seeking group vs. 96.3% in the risk-neutral group; after 6 months it was estimated to be 86.4% vs. 90.4%; after 1 year 76.3% vs. 85.3%; and after 2 years and over 61.1% vs. 75.9% (p = 0.02) (Figure 3). In addition to risk attitude, only an AHI < 30 (p < 0.01) was significantly associated with lower proportions of patients still under CPAP over time in univariate analysis (Table 3).

Multivariate analysis

Cox's multiple regression analysis indicated that a risk-seeking attitude and an AHI <30 were associated with CPAP discontinuation at a p-value level of 0.05 (Table 4). The stratified analysis showed that the predictive role of a risk-seeking attitude was even more important in men, younger (<65 years), not employed, non-obese, and less severe patients (Table 5).

Discussion

The objective of this study was to examine the association between risk attitude in the field of health and safety and CPAP

Table 1. Baseline characteristics of the 489 patients with OSAS under nCPAP included in the study[†]

	Risk-seeking group, n = 59	Risk-neutral group, n = 430	Total, n = 489
Age (years)	54.4 (17.7)	60.2 (12.3*)	59.5 (12.5)
Gender (% of females)	20.3	35.6*	33.7
Body mass index (kg/m^2)	32.6 (6.8)	31.5 (6.2)	31.6 (6.3)
Current smokers (%)	39.7	15.6*	18.5
Current alcohol consumers[‡] (%)	52.5	41.1	42.5
Having cardiovascular morbidities (%)	36.8	49.5	48.0
Having diabetes (%)	8.8	19.1	17.8
Having hyperlipemia (%)	21.4	22.1	22.0
Having chronic obstructive pulmonary disease (%)	7.3	10.9	10.5
Patients who left full-time education ≤18 years (%)	29.3	34.7	34.0
Employment status (%)			
Employed full time or part time	51.7	43.1	44.2
Retired	32.8	45.1	43.5
Unemployed	15.5	11.8	12.3
Marital status[§] (living alone) (%)	15.8	21.4	20.7
Epworth sleepiness scale score	9.4 (8.3)	10.3 (9.7)	10.1 (5.0)
Pichot scale score	3.6 (3.6)	3.2 (3.0)	3.2 (3.1)
Apnea hypopnea index (number per hour)	40.2 (19.0)	39.0 (18.6)	39.1 (18.7)
CPAP discontinuation (%)	36.7	22.8*	24.5
Length of follow-up (days)	590.9 (302.2)	629.2 (265.2)	624 (270)

nCPAP = nasal continuous positive airway pressure.
[†]Values are means (SD) unless stated otherwise.
[‡]≥1 glass of beer, wine or spirits per day.
[§]Living alone (never married, divorced, separated, widowed) vs. married or living as a couple.
*p < 0.01.

Table 2. Results of the DOSPERT questionnaire in the 489 patients with OSAS under nCPAP included into the study

	N = 489
Score (mean ± *SD*)	
- Risk-taking	11.6 ±5.6
- Perceived risks	35.0 ±5.4
- Expected benefits of risk-taking	9.6 ±4.8
Regression†	
- a (perceived risk score)	–0.13 (0.03)*
- b (expected benefits of risk-taking score)	0.48 (0.05)*
- c (intercept)	11.54 (1.26)*
Score (mean ± *SD*)	
Risk attitude	11.6 ±2.7
Risk attitude groups, number of patients (%)	
- Risk-seeking	59 (12.1)
- Risk-neutral	430 (87.9)
- Risk-adverse	-

nCPAP = non-continuous positive airway pressure.
†Risk attitude (X) = a (perceived risk (X) + b (expected benefit (X) + c.
*$p < 0.01$.

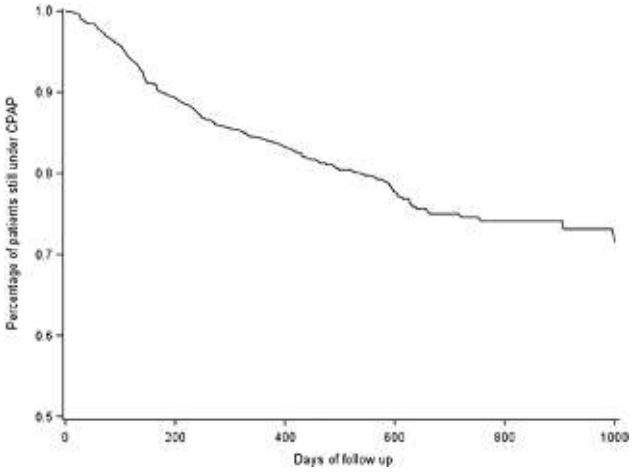

Figure 2. Proportion of the 489 patients with OSA still under CPAP over time (Kaplan Meier method).

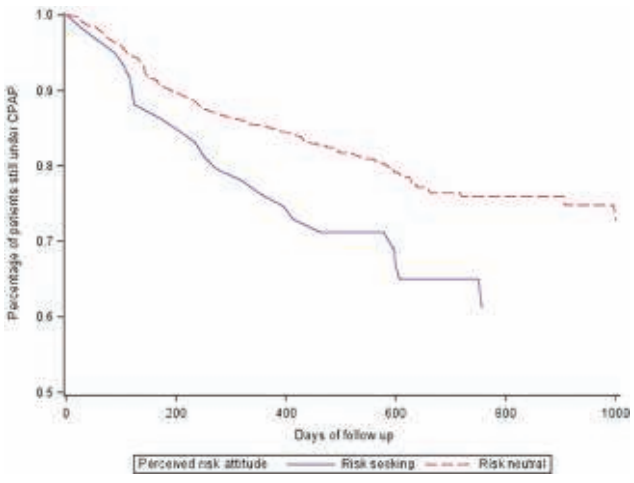

Figure 3. Proportion of the 489 patients with OSA still under CPAP over time according to their risk attitude group (Kaplan Meier method).

Table 3. Comparison of the proportions of patients with OSA still under CPAP over time in univariate analysis (log-rank test) (*n* = 489)

	p value
Risk-seeking attitude	0.04
Age (<65 vs. ≥65 years old)	0.36
Gender (being a man)	0.25
Body mass index (<30 vs. ≥30 kg/m^2)	0.17
Current smokers (Yes vs. No)	0.61
Current alcohol consumers† (Yes vs. No)	0.61
Having cardiovascular morbidities (Yes vs. No)	0.12
Having diabetes (Yes vs. No)	0.64
Having hyperlipemia (Yes vs. No)	0.60
Having chronic obstructive pulmonary disease (Yes vs. No)	0.14
Patients who left full-time education (≤18 vs. >18 years)	0.51
Employment status‡	0.35
Marital status§	0.08
Epworth sleepiness scale score (≥11 vs. <11)	0.85
Pichot scale score (≥7 vs. <7)	0.06
Apnea hypopnea index (<30 vs. ≥30)	0.01

†≥1 glass of beer, wine or spirits per day.
‡Employed full time or part time vs. retired or unemployed.
§Living alone (never married, divorced, separated, widowed) vs. married or living as a couple.

Table 4. Associated factors with CPAP discontinuation in 489 patients with OSAS by means of Cox's multiple regression analysis

	Adjusted hazard ratio (95% CI)	*p* value
Risk-seeking attitude	1.72 (1.04–2.86)	0.04
Age <65 years old	0.96 (0.55–1.66)	0.88
Being a man	1.53 (0.97–2.42)	0.07
Body mass index <30	1.00 (0.67–1.50)	0.99
Currently smoking	0.95 (0.57–1.58)	0.85
Currently consuming alcohol†	0.88 (0.58–1.33)	0.54
Having cardiovascular morbidities	0.79 (0.52–1.22)	0.29
Having diabetes	1.03 (0.57–1.86)	0.92
Having cholesterol	0.92 (0.55–1.55)	0.76
Having chronic obstructive pulmonary disease	1.72 (0.96–3.10)	0.07
Patients who left full-time education >18 years	1.16 (0.77–1.75)	0.47
Being employed full time or part time‡	1.04 (0.61–1.77)	0.88
Living alone§	1.57 (0.99–2.49)	0.06
Epworth sleepiness scale score ≥11	0.95 (0.65–1.41)	0.81
Pichot scale score ≥7	1.51 (0.90–2.54)	0.12
Apnea hypopnea index <30 per hour	2.37 (1.60–3.51)	0.01

†≥1 glass of beer, wine or spirits per day.
‡Employed full time or part time vs. retired or unemployed.
§Living alone (never married, divorced, separated, widowed) vs. married or living as a couple.

discontinuation. It showed, for the first time that, all other things being equal, the more risky patients were, the more likely they were to discontinue treatment, especially men, the youngest, not employed, non-obese, and less severe patients.

Table 5. Associated factors with CPAP discontinuation in 489 patients with OSAS by means of Cox's multiple regression analysis stratified by age, gender, body mass index, employment status, marital status, apnea hypopnea index

	Non-adjusted hazard ratio (95% CI)	*p* value	Adjusted hazard ratio (95% CI)	*p* value
Age (in years)				
<65	1.70 (0.96–3.04)	0.07	2.36 (1.16–4.78)	0.02
≥65	1.34 (0.57–3.13)	0.50	1.48 (0.59–3.76)	0.40
Gender				
Male	1.86 (1.11–3.10)	0.02	2.06 (1.13–3.77)	0.02
Female	0.72 (0.17–3.01)	0.66	0.45 (0.09–2.32)	0.34
Body mass index (in kg/m^2)				
<30	2.43 (1.29–4.59)	0.01	3.14 (1.39–7.07)	0.00
≥30	1.17 (0.58–2.37)	0.67	1.28 (0.59–2.77)	0.53
Employment status				
Employed full time or part time	1.37 (0.69–2.73)	0.37	1.33 (0.58–3.08)	0.50
Retired or unemployed	2.07 (1.07–3.99)	0.03	2.31 (1.14–4.68)	0.02
Marital status				
Living alone	2.20 (0.92–5.27)	0.09	1.38 (0.35–5.65)	0.65
Married or living as a couple	1.54 (0.88–2.69)	0.13	1.60 (0.88–2.91)	0.12
Apnea hypopnea index				
<30	2.14 (1.13–4.07)	0.02	2.66 (1.15–6.16)	0.02
>30	1.27 (0.63–2.57)	0.52	1.12 (0.50–2.51)	0.77

In the literature, many studies have already been published that analyze the influence of different parameters (anthropometric, socioeconomic, and living conditions of patients, and the severity of OSA and the technical characteristics of treatment) on daily CPAP use. Few studies have modeled the risk of CPAP discontinuation, using Cox's proportional hazard models [22–25]. We also found, as it is in all of these studies, that having a mild to moderate OSA was associated with higher risk of CPAP discontinuation, but like Kohler *et al.* [24] we did not find any significant association with daytime sleepiness. Age and gender did not influence CPAP discontinuation [22, 24, 25], nor the BMI [22, 24]; this is corroborated in our study. Marital status—in this case living alone—tend to be (p = 0.06) associated with higher risk of treatment discontinuation. This result is in line with literature when the variable of interest is daily CPAP use [8]. A recent comprehensive literature review examined the psychological factors and personality of OSA patients in relation to their treatment. It showed that patients have more inactivity, anergia, guilt, pessimism, low self-esteem, and persistence of type-D personality than individuals in the general population. It also concluded that these personality traits, which may be secondary to OSA, accompanied by prominent somatic concerns and significantly higher rates of clinically elevated hypochondriasis and psychopathic deviance, i.e. "difficulty adhering to rules, be reluctant to accept the advice of authority figures and fail to learn from previous mistakes," present challenges in the uptake and maintenance of the use of CPAP and weight loss [26].

To our knowledge, no study has ever focused on risk attitude in the health and safety domain as a behavioral factor that could influence CPAP adherence. Yet, health-related behaviors such as attitude towards prevention, consulting a doctor in case of symptoms, adherence to drug therapy, etc. may be affected by an individual's underlying propensity to take risks. Risk attitude, which is defined as a person's standing on the continuum from risk aversion to risk-seeking, has been shown to differ across different life decisions and contexts [27].

The DOSPERT scale is a validated instrument [18, 19] recommended for measuring risk propensity in healthcare decisions, including behaviors [13]. For example, it has been successfully used to classify risk attitudes to inform shared decision-making in patients with multiple sclerosis [28]. In a genomic risk information behavior change trial for melanoma prevention, Morton *et al.* [29] found that individuals classified as health risk-seekers had significantly higher mean UV sun exposure, higher intentional tanning behaviors, and lower mean sun protection habits, than those classified as health risk-averse, and that an individual's underlying risk attitude may modify the effect of the intervention. In an online sample of individuals meeting diagnostic criteria for social phobia, obsessive-compulsive disorder or generalized anxiety disorder, Lorian *et al.* [10] predicted that clinically anxious individuals would report lower risk-taking behavior and that this would be positively correlated with a willingness to seek treatment in individuals who had never before sought help.

However, to our knowledge, no study in the literature has ever analyzed the association between risk attitude and adherence to drug treatments using the DOSPERT scale. Using a standard gamble question on health outcomes, Prosser *et al.* [11] explored the role of risk attitudes in lower than expected utilization of β-interferons in patients with multiple sclerosis. They found that the more risk-seeking an individual is, the more likely he or she is to choose no treatment, but the study is limited by a small sample size and self-reported adherence. In a larger study, carried out on the basis of questionnaire data combined with register data from the Danish National Prescription Registry, Barfoed *et al.* [12] estimated associations between patients' adherence to statin treatment and health-related risk attitude, measured using three items that were developed specifically for this study. Significant associations were found between the risk attitude for the health dimension "Preference for healthcare-seeking when having symptoms" and adherence to statin treatment, where risk-neutral and risk-seeking patients had poorer adherence than risk-averse patients.

Although these two studies did not use the DOSPERT scale, it is nevertheless their findings that led us to hypothesize an association between health risk attitude and CPAP discontinuation. In the present study, using the DOSPERT scale, we demonstrated that risk-seeking attitude in health and safety

domain predicts CPAP discontinuation. Reading the article by Rolinson *et al*. [27] was a determining factor in our choice to use the DOSPERT scale which, according to him, in addressing the domain-specific nature of risk (in this case the Health/safety domain), avoids the pitfall of considering risk-taking as "a single personality trait or a small cluster of subtraits." Among the validated scales, the DOPSERT scale is considered to be one of the most relevant to a clinical environment as it directly measures risk propensity across a number of everyday situations, including the propensity to take health/safety-related risks. In addition, the DOSPERT scale allows for the measurement of multiple risk constructs and exhibits reliability across age groups [13]. Finally, it is validated in French, which is also why we chose it in this study [19].

Our results are pioneering in the field of CPAP adherence. This is a strength. However, it might be interesting to verify them in a larger sample of OSA patients and take advantage of this context to collect the estimated a and b regression coefficients (of perceived risks and expected benefits of risk-taking on risk-taking) and the thresholds of the risk groups in this population. These data could further be used in clinical practice to calculate the individual risk attitude score and assign the patient to a risk group. However, the feasibility of using the DOSPERT scale in routine practice in a doctor's office or hospital still needs to be discussed (patient's acceptance, questionnaire completion time, computerization of the algorithm for calculating the risk attitude score, etc.).

This study is not without potential limitations. First, there is no detailed information available (which can be taken into account in the model), relating to housing conditions, family background, and health literacy that could influence CPAP cessation. However, this limitation would be valid for all studies that looked at adherence to treatment. Furthermore, in this study, all patients included in the cohort were provided with comprehensive information on the disease and its management and were given appropriate follow-up by the same home care provider. Second, participants were categorized into risk attitude categories based on the mean (*SD*) of the cohort. There were no risk-averse patients in our study population. This could lead to the suspicion of selection bias that could prevent the extrapolation of the results to other clinical settings in France. But this is not the case, because if we compare the characteristics of the study population, in terms of age and gender, which are major variables related to health risk behaviors, to those of other populations with OSA in other clinical studies [30], the populations look similar. It could be justified to ask whether the same DOSPERT questionnaire asked to a population of OSA patients outside France would yield the same results in terms of classification in the different risk groups. The answer is perhaps yes or perhaps no. But whatever the answer, there is no reason to think that a different ranking would change the relationship between the risk variable and adherence to CPAP. Finally, the result obtained in our sample is perhaps not so surprising since this sample is made up of only 1/3 women, who, if we refer to the article by Rolison *et al*., [27] seem to have significantly lower risk-taking attitudes than men in the health domain.

To conclude, patients with risk-seeking behaviors in daily life have been shown to be more likely to discontinue CPAP. Although there are still steps that need to be completed before it can be used in routine practice, the DOSPERT scale can be a useful tool for screening this specific group of patients. Drawing clinicians' attention to these patients, so that they can receive additional support adapted to their profile, may improve CPAP adherence. CPAP is only beneficial if patients use it consistently and long-term.

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