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Validation of an Italian questionnaire to assess sleep disorders: The Sleep Disorders Score Questionnaire (SDS-Q)

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Abstract

Introduction: Many occupational factors disturb sleep. This can have significant consequences because sleep problems mediate the relationship between work stress and health disorders. The objective of this study is to validate the Sleep Disorders Score Questionnaire (SDS-Q), a questionnaire designed to measure sleep disorders and their consequences in workers.

Methods: A cross-sectional study was carried out. Validity was analysed by exploratory factor analyses, and reliability by Cronbach's alpha.

Results: The study was conducted with 240 male police officers. Principal component analysis confirmed the existence of 3 subscales, regarding Insomnia symptoms, Excessive daytime sleepiness (EDS) and Obstructive Sleep Apnoea (OSA). The Cronbach's alpha values of the subscales Insomnia symptoms (IS), Sleepiness symptoms (SS) and Apnoea symptoms (AS) were acceptable.

Discussion and Conclusions: The Insomnia, Sleepiness and Apnoea subscales of SDS-Q have demonstrated good psychometric properties in terms of reliability and validity. The SDS-Q is a valid and reliable tool for assessing workers' sleep problems and disorders.

KEY WORDS: Eexcessive Daytime Sleepiness; insomnia; principal component analysis; questionnaire; police officers; sleep apnoea.

Riassunto

Introduzione: Molti fattori occupazionali inducono disturbi del sonno. Ciò può avere conseguenze significative poichè i problemi del sonno mediano la relazione tra stress da lavoro e disturbi di salute. L'obiettivo di questo studio è convalidare il questionario-punteggio dei disturbi del sonno (SDS-Q), ideato per valutare la presenza dei disturbi del sonno e le loro conseguenze nei lavoratori.

Metodi: È stato effettuato uno studio trasversale per analizzare la validità del SDS-Q mediante analisi fattoriali esplorative e l'affidabilità tramite l'alfa di Cronbach.

Risultati: Lo studio è stato condotto su un campione di 240 operatori di Polizia di genere maschile. L'analisi delle componenti principali ha confermato l'esistenza di 3 sottoscale, riguardanti: sintomi di insonnia, eccessiva sonnolenza diurna (EDS) e apnea ostruttiva del sonno (OSA). I valori alfa di Cronbach delle sottoscale Insonnia (IS), Sonnolenza (SS) e Apnea (AS) sono risultati accettabili.

Conclusione: Le sottoscale Insonnia, Sonnolenza e Apnea di SDS-Q hanno dimostrato buone proprietà psicometriche in termini di affidabilità e validità. Quindi l'SDS-Q può essere considerato uno strumento valido e affidabile per la valutazione di problemi e disturbi del sonno nei lavoratori.

TAKE-HOME MESSAGE

This validation study showed that the Sleep Disorders Score Questionnaire (SDS-Q) is a valid and reliable tool for assessing workers' sleep problems and disorders.

INTRODUCTION

Police activities can be particularly stressful, especially in law enforcement operations. Occupational stress can have numerous effects on police officers, ranging from the onset of anxiety and depression [1] to hypertension, dyslipidemia, abdominal obesity and diabetes [2], all known cardiovascular risk factors; finally, work stress is correlated with absenteeism [3]. Recent studies have shown that all of these unfavourable events occur especially among those with sleep problems [4]. Sleep problems are relevant among police officers, who emerge as a population at augmented risk of sleep disorders [5]. A high prevalence of sleep disorders, excessive daytime sleepiness and sleep-related accidents has been observed in Italian police officers [6]. As observed in other categories of workers, police officer sleep and wellbeing could be affected by nightshift and long work schedules [5]. Rajaratnam showed that 40.4% of police officers reported symptoms consistent with at least one sleep disorder, where the most prevalent disorder was obstructive sleep apnea (OSA), followed by moderate-to-severe insomnia and shift work disorder. Sleep disorders were significantly associated with an increased risk of self-reported adverse health, performance and safety outcomes [7].

Work-related stress was a significant predictor of insomnia symptoms, short sleep duration, sleep dissatisfaction, and sleepiness [8]. Some aspects of work organization, such as lack of control over work times [9], insufficient rest between shifts [10], psychosocial burden and night work [11] or shift work [12] are predictors of sleep problems. Exposure to workplace violence is also associated with a significant increase risk of sleep problem and disorders [13]. Therefore, all these risk factors have to be considered for the occupational risk assessment process in police officers as well [14–18].

The Sleep Disorders Score Questionnaire (SDS-Q) is a questionnaire designed to measure sleep disorders and their consequences in workers that contains questions related to quality and quantity of sleep, obstructive sleep apnoea (OSA), other sleep disorders, excessive daytime sleepiness (EDS), accidents and injuries and near-miss accidents.

Consisting of 43 items, the SDSQ addresses the habits of sleep and wakefulness, any sleep disorder, excessive sleepiness and accidents / injuries also associated with shift work, in order to assess the impact of these factors on the well-being and health of workers. The questionnaire contains a section relating to personal data (age, qualification, length of service), objective findings (weight, height, neck circumference) and habits and lifestyles (smoking, alcohol). Most of the other questions contain information that can be used individually, such as the number of hours slept on average or the degree of satisfaction with the work shift. Thirteen questions refer to insomnia symptoms (IS), excessive sleepiness symptoms (SS), and obstructive sleep apnoea symptoms (OS), and are composed by a 4-point Likert-type scale that includes the following response options: "1=Never; 2=Rarely; 3=Sometimes; 4=Often". Since the answers are sorted in ascending order, adding the answers gives an IS or OS score ranging from 4 to 16, and an SS score ranging from 5 to 20.

The objective of this study was to assess the validity and reliability of these subscales and verify if they can be extracted from the questionnaire and used in isolation.

METHODS

Study sample and design

A cross-sectional study was carried out. The sample of this work consisted of a total of 240 male police officers (age 46.8 ± 7.4 years) who were employed at a police air unit in Genova, in the North Italy. The study was conducted on-site while the officers were on duty.

Study procedure and data analysis

The questionnaire was evaluated through the five steps listed below:
1. Face validation: In this step, we ensured that the respondents' understanding of the questions was aligned with our goals.

2. Predictive validation, with analysis of the grouping of responses.

3. Reliability: In this step, we investigated the relevance of the question items.

In the face validation step, the questionnaire was evaluated from the design point of view. Some experts were committed in evaluating whether the questions effectively capture the topic under investigation. Questionnaire construction was checked for common errors like double-barrelled, confusing, and leading questions. A pilot test was performed with a small sample (40 police officers). None of the respondents reported problems understanding the content of the questionnaire. The items were labelled from negative (never) to positive (often) responses. Labelling the items on a scale using minimal descriptive words helped to eliminate confusion about the value of the scale levels.

The 2nd step, Predictive Validation, was the identification of the underlying components using principal components analysis (PCA). Component or factor loadings were used for grouping, including in each component values that are ±0.60, or even less, depending on the rest of the loadings. Questions loading onto the same factors can be aggregated. We used Principal component analysis (PCA), with Varimax rotation and Kaiser normalization.

The 3rd step involved checking the reliability of the questionnaire. The internal consistency of the questionnaire was assessed by Cronbach's Alpha (CA).

Analyses were performed with IBM/SPSS version 26.0.

Ethical aspects

Before giving their consent to the survey, participants were briefed that all information would be gathered anonymously and handled confidentially. Participation was voluntary, and the questionnaire was collected only from subjects who had expressed consent for study participation. As individual participants cannot be identified based on the presented material, this study caused no plausible harm or stigma to individuals. As the study don't included clinical data about patients, nor con-figured itself as a clinical trial, a preliminary evaluation by an Ethical Committee was not required, according to the Italian law (Gazzetta Ufficiale no. 76, dated 31/3/2008). Our study was conducted in accordance with the ethical standards of the Declaration of Helsinki (2008). All data in the study were processed in accordance with Italian data protection legislation and received authorization by the Italian State Police authority.

RESULTS

Face validity of the questionnaire was established by a panel of experts, who adopted the questionnaire in a series of previous studies [6, 18–21]. The pilot test helped in removing some typos or inappropriate statements.

Confirmatory factor analysis was performed on three subscales, concerning IS, SS, and OS. Since both insomnia and OSA can be associated with excessive daytime sleepiness, we examined separately IS and SS and OS and SS (Table 2). Principal component analysis (PCA), with Varimax Rotation and Kaiser normalization confirmed the correct grouping of items in: Insomnia symptoms (items 1, 2, 3, 4); sleepiness symptoms (items 10, 11, 12, 13, 15); obstructive sleep apnoea symptoms (items 26, 27, 28, 29). The scores of these sub-scales, therefore, can be added together to form an indicator.

The Cronbach's Alpha for IS representing insomnia symptoms was 0.693; for SS regarding sleepiness 0.739; for OS concerning apnoea symptoms was 0.605. All subscales had acceptable internal consistency.

DISCUSSION AND CONCLUSION

We aimed to generate a validated questionnaire that provides the required information with the lowest number of questions. The use of parsimonious questionnaires is of particular interest in occupational medicine, because time and simplicity are important values from the point of view of productivity and efficiency [22].

Our investigation confirmed that the SDS questionnaire contains three sub-scales, relating respectively to insomnia, EDS and OSA

Table 1. Similarities between the Police Sleep Disorders Score Questionnaire (PSDS-Q) and other questionnaires.

PSDS-Q (item n.)	QUESTIONNAIRE (item n.)
Insomnia Symptoms (IS) subscale	*PITTSBURG SLEEP QUESTIONNAIRE INDEX*
SDS1: Are you having difficulty in falling asleep? SDS2: How long do you usually take to fall asleep?	PSQI 5a: During the past month, how often have you had trouble falling asleep within 30 minutes?
SDS3: Do you wake up during sleep?	PSQI 5b: During the past month, how often have you had sleeping problems because you wake up in the middle of the night?
SDS4: Do you wake up early in the morning?	PSQI 5c: During the past month, how often have you had sleeping problems because you wake up early in the morning?
SDS7: How many hours do you sleep on average at night? SDS8: How many hours do you sleep during the 24 hours (night and day)?	PSQI 4: During the past month, how many hours of actual sleep did you get at night?
SDS6: Are you generally satisfied with the quality and quantity of your sleep?	PSQI 9: During the past month, how would you rate your sleep quality overall?
Sleepiness symptoms (SS) subscale	*EPSWORTH SLEEPINESS SCALE*
You happen to have sleep attacks, against your will, …?	ESS How likely are you to doze off or fall asleep in the following situations?
SDS10: …during the day when are you inactive?	ESS 4 As a passenger in a car for an hour without a break ESS 7 Sitting quietly after a lunch without alcohol
SDS11: … when do you read or watch television?	ESS 1 Sitting and reading ESS 2 Watching TV
SDS12: …while you are carrying out activities that require your attention and interest?	ESS 3 Sitting inactive in a public place (e.g., a theatre, or a meeting) ESS 6 Sitting and talking to someone
SDS15: …when driving?	ESS 9 In a car, while stopped for a few minutes in traffic
SDS13: During the day, do you feel a more or less constant need to sleep, which you have difficult to resist?	ESS 5 Lying down to rest in the afternoon when circumstances permit
Apnoea symptoms (AS) subscale	*BERLIN QUESTIONNAIRE*
SDS26: Do you snore?	BQ1: Do you snore?
SDS27: Does your partner say you have breathing interruptions (apnoea) while you sleep? SDS29: Do you wake up with sensations of not being able to breathe with a choking sense?	BQ5. Has anyone noticed that you stop breathing during your sleep?

Table 2. Principal component analysis, with Varimax rotation and Kaiser normalization. Grouping in single factors of insomnia symptoms (IS), sleepiness symptoms (SS), and OSAS symptoms (OS).

ITEM	PCA-I		PCA-II	
	1st factor	2nd factor	1st factor	2nd factor
Insomnia Symptoms (IS) subscale				
SDS1: Are you having difficulty in falling asleep?		0.855		
SDS2: How long do you usually take to fall asleep?		0.495		
SDS3: Do you wake up during sleep?		0.598		
SDS4: Do you wake up early in the morning?		0.834		
Sleepiness symptoms (SS) subscale				
SDS10: Sleep attacks…during the day when are you inactive?	0.754		0.724	
SDS11: … when do you read or watch television?	0.732		0.646	
SDS12: …while you are carrying out activities that require your attention and interest?	0.660		0.711	
SDS15: …when driving?	0.490		0.601	
SDS13: During the day, do you feel a more or less constant need to sleep, which you have difficult to resist?	0.770		0.730	
Apnoea symptoms (AS) subscale				
SDS26: Do you snore?				0.818
SDS27: Does your partner say you have breathing interruptions (apnoea) while you sleep?				0.780

ITEM	PCA-I		PCA-II	
	1st factor	2nd factor	1st factor	2nd factor
SDS28: Do you get up in the morning with a dry mouth?				0.615
SDS29: Do you wake up with sensations of not being able to breathe with a choking sense?				0.449
Total variance explained	53.311		48.968	
Variance explained by each factor	28.266	25.046	26.946	22.022

PCA-I: analysis of IS and SS subscales
PCA-II: analysis of SS and OS subscales

symptoms. The three scales, which are composed respectively of 4, 5 and 4 items, have acceptable reliability and can be used in isolation in cases where it is not appropriate to administer the entire questionnaire.

The experts observed a similarity in the content of these subscales with those contained in other largely used questionnaires. The IS scale has many points in common with the Pittsburgh Sleep Quality Index (PSQI) [23]. The Pittsburgh Sleep Quality Index (PSQI) is the most commonly used sleep assessment instrument in both clinical and research settings [24]. However, it has been debated whether the unidimensional application of the instrument using the total PSQI score is useful to comprehensively evaluate the multifaceted nature of sleep. Previous studies concluded that the instrument is best viewed as a multidimensional tool [25, 26]. In particular, Insomnia symptoms of the SDS-Q were similar to PSQI items 5a ('During the past month, how often have you had trouble falling asleep within 30 minutes?'), 5b ('During the past month, how often have you had sleeping problems because you wake up in the middle of the night?'), 5c ('During the past month, how often have you had sleeping problems because you wake up early in the morning?'). Also the PSQI item 4 ('During the past month, how many hours of actual sleep did you get at night?'), and 9 ('During the past month, how would you rate your sleep quality overall?') had an equivalent in SDS. Compared to the 4 questions of the SDS-Q, the PSQI is certainly much more complete. However, this tool, which represents the gold standard for collecting sleep problems in work psychology, has a rather laborious correction technique.

To facilitate the researchers' task, computer programs and online calculators have been developed (e.g.: https://qxmd.com/calculate/calculator_603/pittsburgh-sleep-quality-index-psqi). The IS scale of the SDS-Q, on the other hand, can be calculated immediately at the time of the visit by the occupational doctor.

The expert also observed similarities between the sleepiness section of the SDS-Q and the Epworth Sleepiness Scale - ESS [27] that is validated in Italian [28]. ESS is a self-administered questionnaire with 8 questions that rated on a 4-point scale (0-3) the chances of dozing off or falling asleep while engaged in eight different activities. An EES score >10 indicates EDS [29]. The five questions of the SDS-Q that investigate EDS contain the same concepts that the ESS questionnaire investigates with 9 questions. The SDS-Q therefore appears more concise and parsimonious than the EDS questionnaire.

The sub-scale OS has an affinity with the Berlin Questionnaire which is a widely used tool for diagnosing suspected OSA [30]. The BQ is a 10-item questionnaire designed to assess three OSA risk categories: the presence and frequency of snoring behavior, wake time sleepiness or fatigue, a history of obesity (i.e., body mass index–BMI ≥ 30 kg/m²) and/or hypertension. It has been translated into Italian and validated. To express the BQ score, however, it is necessary to integrate the clinical data with the subjective ones; on the contrary, the OS scale of the SDS-Q can also be used in cases where it is not possible to collect objective clinical elements.

Overall, these measures show that the subscales Insomnia, EDS and OSA of the SDS-Q

can be used alone in studies relating to specific aspects of the relationship between sleep and work. In conclusion, the Insomnia, Sleepiness and Apnoea subscales of SDS-Q have demonstrated good psychometric properties in terms of reliability and validity. The SDS-Q is a valid and reliable tool for assessing workers' sleep problems and disorders.

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