PSYCHOMETRIC PROPERTIES OF THE FRENCH VERSIONS OF THE PERCEIVED STRESS SCALE

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Abstract
Objectives: This study was conducted to examine the psychometric properties of the French versions of the Perceived Stress Scale (PSS) and to compare the appropriateness of the three versions of this scale (14 items, 10 items, or 4 items) in a sample of workers. **Materials and Methods:** Five hundred and one workers were randomly selected in several occupational health care centers of the North of France during 2010. Participants completed a questionnaire including demographic variables and the PSS. The psychometric properties of this scale were analyzed: internal consistency, factorial structure, and discriminative sensibility. **Results:** For the PSS-14 and PSS-10, the Exploratory Factor Analysis (EFA) provided a two-factor structure, corresponding to the positively and negatively worded items. Those two factors were significantly correlated (r = 0.43 and 0.50, respectively). For the PSS-4, the EFA yielded a one-factor structure. The reliability was high for all three versions of the PSS (Cronbach's α values ranged from 0.73 to 0.84). The results concerning the effects of age, gender, marital, parental and occupational statuses showed that the 10-item version had the best discriminative sensibility. **Conclusions:** The findings confirmed satisfactory psychometric properties of all the three French versions of the PSS. We recommend the use of the PSS-10 in research settings because of its good psychometric properties.

Key words:
Stress, Scale, Validation

INTRODUCTION

The Perceived Stress Scale (PSS) was developed by Cohen, Kamarck and Mermelstein [1] to assess "the degree situations in one's life appraised as stressful". In accordance with the transactional model of stress and coping with it [2], this questionnaire was designed to tap into "the degree to which respondents found their life unpredictable, uncontrollable, and overloading" and it also included a number of direct items inquiring into the current levels of experienced stress.

Given its qualities (i.e. this scale can be administered in a few minutes, it is easily understood, easily scored, and

relatively general), this questionnaire is used worldwide, in a variety of samples such as workers or students and in a great variety of contexts (workplace, as well as in scientific and clinical studies). The PSS is a brief self-report scale of 14 items. People are asked to rate on a 5-point scale the extent to which they experienced each of the listed feelings and thoughts, in the past month (from 0 – never to 4 – very often). We should note that two shorter versions consisting of 10 items and 4 items (for telephone interviews) are also available [3].

The PSS, originally created in Anglo-Saxon language, was translated from English into European Spanish [4],

Mexican Spanish [5], Japanese [6], Chinese [7], Thai [8], Turkish [9], Arabic [10], Urdu (Pakistan language) [11], Lithuanian [12], Danish, Brazilian, Korean, Russian, Polish, Bulgarian, Hungarian, Italian, Hebrew [13].

Those international studies suggest that the psychometric properties of the scale are satisfactory. However, but for one study that has been published for the sake of the validation of the French 10-item version [14], no study has been published that would present the psychometric properties of the 14-item version of the scale in French. Moreover, no study that has been published explored a large range of professions.

Therefore, the aim of this study is to provide data on the psychometric properties of the PSS-14 in a sample of workers and to explore its scores for different professions (reliability, factorial structure and sensitivity). We will also present the psychometric properties of a 10-, and a 4-item versions of the scale.

MATERIALS AND METHODS

Five hundred and one workers were randomly selected in several occupational health care centers of the North of France (Champagne-Ardenne, Haute-Normandie, Ile-de-France), throughout 2010. In the French occupational health organizations, every worker is subjected to a systematic medical examination – annually or biennially. At their arrival at the center, the authors, having informed the participants about the aim of the study, asked for their voluntary and anonymous participation, emphasizing that they could withdraw their consent at any time. Both oral and written instructions were given to ensure that the items were understood, and participants were reassured about the confidentiality of their responses.

The French version of the PSS-14 was used [15]. As for its original English version, one must first of all reverse the scores of the seven negative items (items 4, 5, 6, 7, 9, 10,

and 13). A total score of the PSS can be obtained by summing the 14 items' scores (if a one-dimensional structure is considered). Thus, the total score ranges from 0 to a maximum of 56, a higher score indicating a higher level of perceived stress.

A shorter 10-item version (range: 0–40) can be extracted from the PSS pool of items (items 1, 2, 3, 6, 7, 8, 9, 10, 11, and 14) [3] as well as an even shorter one, a 4-item version (with items 2, 6, 7 and 14) [1].

Descriptive statistics (demographics, means, and standard deviations) were calculated with all the variables. Moreover, we performed an exploratory factor analysis (EFA) to explore the structure of the instrument, with Oblimin rotation. Eigenvalues above 1 were retained. The cutoff of factor loadings adopted was > 0.5 [16].

The reliability of the measure was examined in relation to the instrument's internal consistency by calculating the Cronbach's α coefficient and the homogeneity of the scale (mean inter-item correlations). A Cronbach's α coefficient of 0.70 or greater and mean inter-item correlations situated within a 0.20 to 0.40 range were considered satisfactory [17]. The means and the variances of all items were computed with 95% confidence limits. Sensitivity of the scale was assessed by means of group comparisons (based on age, gender, profession).

RESULTS

The mean age of the 501 participants was 40.4 years (95% confidence interval: 39.4–41.4) (Table 1). Men and women were evenly represented (249/252). As a large range of professions is represented in this sample, they have been regrouped into four occupational statuses, according to the French occupational status index.

An exploratory principal components analysis with an Oblimin rotation was conducted on the 14 items of the PSS that yielded to two distinct factors for the PSS-14 and PSS-10

Table 1. Means of the total scores on the Perceived Stress Scale – PSS-14, PSS-10 and PSS-4 by age, sex, marital status, parental status, occupational status

Categories	Sample (n = 501)	PSS-14 (range: 0–56)		PSS-10 (range: 0–40)		PSS-4 (range: 0–16)	
		overall score SD	p-value*	overall score SD	p-value*	overall score SD	p-value*
Age (years)							
overall mean (95% CI)	40.4 (39.4; 41.4)	21.2–7.6		15.3–6.2		5.4–2.9	
≤ 30	n = 125	19.6–7.7	0.02	13.7–6.4	0.003	4.7–2.0	0.007
31–40	n = 133	20.9–7.3		15.1–5.9		5.3–2.6	
41–50	n = 129	22.3–8.5		16.1–6.9		5.9–3.2	
≥ 51	n = 114	22.1–6.5		16.3–5.1		5.6–2.4	
Gender							
women	n = 252	21.7–8.4	0.10	15.9–6.7	0.04	5.6–3.2	0.20
men	n = 249	20.7–6.7		14.7–5.6		5.2–2.5	
Marital status							
couple	n = 337	21.1–7.4	0.76	15.3–6.0	0.99	5.3–2.7	0.57
single	n = 162	21.3–8.0		15.3–6.5		5.5–3.2	
Parental status							
with children	n = 335	21.8–7.7	0.009	15.9–6.1	0.002	5.6–2.8	0.008
without children	n = 166	19.9–7.4		14.1–6.2		4.9–3.0	
Occupational status							
managers/engineers	n = 123	20.9–6.7	0.29	15.2–5.5	0.63	5.1–2.6	0.12
technical workers	n = 53	21.1–6.2		15.3–5.1		5.5–2.3	
administrative workers, secretaries	n = 149	20.5–8.3		14.9–6.7		5.1–3.1	
blue collars	n = 176	22.1–8.0		15.7–6.5		5.8–2.9	

95% CI – 95% confidence interval. SD – standard deviation.
* ANOVA used for comparing means among the groups (age, sex, marital status, parental status, occupational status).

and to only one factor for the PSS-4, explaining respectively 49, 55 and 55% of the total variance (see Table 2). For the three scales, all factor loadings were higher than 0.60, except for items 12 (0.42) and 13 (0.59) of the PSS-14. Those two items are not included in the two other versions of the scale. As for the PSS-14 and the PSS-10, the two factors represent for the first one items that are formulated positively and for the second one items that are formulated negatively. It should be noted that those two factors are

highly and positively correlated (respectively for the PSS-14 and 10, r = 0.43, and 0.50).

The Cronbach's coefficient alpha values for the scores of factors 1 and 2 were respectively 0.81 and 0.79 for the PSS-14, 0.81 and 0.73 for the PSS-10 (Table 2). The alpha values ranged from 0.73 for the PSS-4 to 0.84 for the PSS-14. The one-way ANOVA showed an effect of age on the three scales, perceived stress being stronger as the participants get older (Table 1), except for the oldest group

Table 2. Standardized factor loadings of the Perceived Stress Scale – PSS-14, PSS-10, and PSS-4

Items	PSS-14		PSS-10		PSS-4
	factor 1	factor 2	factor 1	factor 2	factor 1
Negative items					
1 upset because of something that happened unexpectedly	0.64		0.66		–
2 unable to control the important things in your life	0.78		0.81		0.74
3 nervous and "stressed"	0.77		0.80		–
8 could not cope with all the things that you had to do	0.61		0.62		–
11 angered because of things that happened that were beyond your control	0.66		0.68		–
12 thinking about things that you have to accomplish	0.42		–		–
14 difficulties were piling up so high that you could not overcome them	0.65		0.69		0.78
Positive items					
4 dealt successfully with irritating life hassles		0.69		–	–
5 felt that you were effectively coping with important changes that were occurring in your life		0.75		–	–
6 felt confident about your ability to handle your personal problems		0.76		0.77	0.69
7 felt that things were going your way		0.60		0.63	0.76
9 were able to control irritation in your life		0.61		0.70	–
10 felt that you were on top of things		0.72		0.78	–
13 were able to control the way you spend your time?		0.59		–	–
Factor correlation	0.43		0.50		–
% explained variance	49		55		55
Cronbach's α	0.79	0.81	0.81	0.73	0.–	–
	0.84		0.83		0.73

Extraction method: principal component analysis. Rotation method: oblimin with Kaiser normalization.

(p = 0.02, 0.003 and 0.007 for the PSS-14, PSS-10 and PSS-4, respectively)

The total scores of the 3 versions are higher for workers having children (p-values < 0.01 for the three versions), and an effect of gender was found only for the PSS-10 (p < 0.05). No other effects (resulting from the marital status, gender, or professional status) were found, but for the effect of gender on the PSS-10 showing that women experience more perceived stress than men.

DISCUSSION

The aim of this paper was to provide some data on the psychometric properties of the PSS-14, and explore its structure, as well that on the two shorter versions, namely the PSS-10 and the PSS-4 (extracted from the longer one). The results showed that the properties of the French version are quite satisfactory. However, before going further into the discussion, we want to highlight two points that need to be reminded. First of all, it is important to note

that perceived stress, as defined and measured by Cohen and colleagues, is based on a robust theoretical concept, namely on Lazarus and Folkman's transactional model of stress [2]. At least the European "Framework agreement on work-related stress" is based on this model.

Next, following this model, the items of this scale explore neither non-specific stress-related symptoms (i.e. digestive disorders or a disorder of sweating), nor more or less objective events (e.g. life event scale). Instead, the PSS assesses perceived stress which corresponds to the issue of the cognitive appraisal process, when a situation has been appraised both as (i) a threatening or demanding, and (ii) as taxing for resources. To conclude, the PSS items "were designed to tap the degree to which respondents found their life unpredictable, uncontrollable, and overloading"[1].

As a result, the authors considered that the PSS-14 was designed as a one-dimensional scale. Nevertheless, the factorial structure has sometimes been found to differ according to the different authors who analyzed it. This was for example the case of the 10-item French version who found 2 factors [14]. These are the reasons why we conducted an exploratory factor analysis (EFA) rather than a confirmatory factor analysis. Some authors interpret those two factors as reflecting "perceived helplessness" and "perceived self efficacy" dimensions [9]. But, for most authors, the second factor is a wording effect, and the PSS must be considered as a one-dimensional scale. Nonetheless, several authors have studied simultaneously the three versions [7,18]. As for the number of items, the EFA retained 2 factors or 1 factor. Consequently, the same items (such as the second one: "unable to control the important things in your life"), would form an assessment of the "perceived helplessness" for the 14-item version, or an one-dimensional assessment of perceived stress for the 4-item version..

The EFA we run on the 14- and 10-item versions retained also a 2-factor solution. But our results also showed that factors reflected rather the wording of the items (i.e. positively and negatively worded) than separate and meaningful dimensions. Indeed, in our study, the two factors are highly correlated (r = 0.43 and 0.50 for 14-item and 10-item version, respectively). Moreover, the scree plots showed a clear break after the first factor, supporting the one-dimensionality of the scale. In summary, the results were consistent with the previous findings and support the one-dimensionality of the three versions of this scale, which is a "measure of the degree to which situations in one's life are appraised as stressful" [1]. We agree with the Cohen's theory which states that the "PSS can be used as an outcome variable, measuring people's experienced levels of stress as a function of objective stressful events, coping resources, personality factors, etc.", i.e. as an outcome variable of the Lazarus' transaction model. Consequently, like most authors, we believe that this scale must be used like a one-dimensional scale, i.e. with a single overall score and not with 2 subscale scores.

Cronbach's α were used to confirm the internal consistency and reliability of the three versions of the PSS. The Cronbach's α for the 14-item, 10-item, and 4-item versions were 0.84, 0.83, and 0.73, respectively. All three versions of the PSS had Cronbach's α coefficients that met the criteria for a mature scale [17], without being higher to the threshold of 0.9, which could be understood like a redundancy of several items.

All the three versions of the PSS were sensitive to age, perceived stress increasing as people get older. The two higher categories of age (41–50 years and over 50 years) have close stress levels. However, the analysis of variance showed significant inter-group differences for the three scales (for the 14-, 10- and 4-item, p-values were 0.002, 0.003 and 0.007, respectively). The 10-item version was characterized by the highest degree of significance (p-value = 0.003).

Similarly, participants who had children had a significantly higher level of perceived stress. This is particularly the

case of the 10-item version which presents the strongest effect.

Finally, only the PSS-10 was sensitive to gender. Although this higher level of stress for women is frequently described and well-documented in the literature, it was not found in the original study of Cohen and colleagues. Numerous hypotheses (social, cognitive and biological) could be brought forward. However, the 10-item version provides the best discriminative sensibility. No other inter-group effects have been found (i.e. marital status, occupational status). Bellinghausen found some differences in stress levels according to the occupational status [14]. Nevertheless, two points have to be considered here. First of all, the number of participants in this study was really high (N > 10 000), which consequently raised the statistical power. Secondly, we think that there was a selection bias. Indeed, the sample was selected in six large companies. Consequently, the authors not only measured the effect of occupational status, but also the working conditions in these few large companies. It is so difficult to conclude that an occupation is in itself more stressful than another given that the sample was selected only in a few big companies. Our sample was not selected in companies, but in occupational health care centers that group workers from numerous, very different companies. The effect of the company's type may then be reduced.

Even if the 3 scales highlighted increasing levels of perceived stress for blue collars, the effect was not significant. It may have been the case if we had a higher number of participants. A recent study showed a higher exposure to stressors for occupational activities of lower statuses (e.g. blue collars) [19]. A study with an important number of participants from a wide range of companies could clear the doubts in this respect and validate the hypothesis of an impact of occupational status on perceived stress assessed with the PSS.

CONCLUSION

Given the data we provided on the psychometric properties of the 3 versions of the PSS, we can say that all three can be used to assess perceived stress. However, this is the 10-item version that provides the best discriminative sensibility, and overall the best psychometric properties. The 4-item version is an interesting alternative as it keeps satisfying properties. It is important to note however that studies using real 10- and 4-item versions of the PSS, have to be conducted to confirm those results.

The PSS scale is a tool based on the transactional model of stress. Although it is well-known and widely used, scarce data has been published on its French versions. The study we have presented here showed that the psychometric properties of the scale are indeed satisfactory and in accordance with the literature. A 10-item version could also be an interesting alternative, given that other studies would confirm its properties. The 4-item version, even if satisfactory, presents the lowest properties. It could nevertheless, as proposed by Cohen et al. [1], be used in telephone interviews or other situations where a short instrument is required.

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