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Should we use the Parental Stress Index-Short Form in parents of children with ASD? A French validation study

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Title: Should we use the Parental Stress Index - Short Form in parents of children with ASD? A French validation study

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Abstract: Background. Parents of children with Autism Spectrum Disorder (ASD) exhibit higher levels of parental stress than parents of typically developing children. The most frequently used tools to assess parental stress is the Parenting Stress Index (PSI) or its Short Form (PSI-SF). Aims. This study was designed to test the validity of the PSI-SF in French parents of children with ASD (N = 370). Methods and Procedures. First, a confirmatory factor analysis was conducted to test the initial 3-factor structure (36 items) which indicate a poor model fit. Then, an exploratory factor analysis was performed and convergent validity was assessed. Outcomes and Results. A 3-factor structure (21 items) explaining 44% of the variance was observed. Dimensions were moderately correlated and exhibited good internal consistency. Convergent validity was checked through the PSI-SF association with anxiety and depression (HADS), quality of life (WHOQOL-Brief) and appraisal of being a parent of a child with ASD (ALES). Conclusions and Implications. Future research should use the full version of the PSI-SF and examine its factor structure. More studies on the factor structure of the PSI-SF are needed to find out if it is a suitable tool for measuring stress in parents of children with ASD in France.

What this paper adds?

Whereas, the PSI-SF is widely used to assess parental stress in parents of children with ASD, there is little information on its psychometric properties among this population. Only three validation studies (Canada, Jordan) have been conducted with various methodological limitations (small sample size, few fathers, limited child age range). It is an important research question because the PSI-SF was initially developed in the general population and its validity for use in parents of children with ASD should not be taken for granted without proper examination. It is particularly relevant in France where a growing number of studies are

conducted in this research area without using validated questionnaires to assess parental stress.

The PSI-SF original version used in most studies was found to be unsuitable for parents of children with ASD. A modified version of this questionnaire (21 items) was obtained. This version seems more conform to both the specificities of ASD and the French context. However, more studies on the psychometric properties of the PSI-SF are needed to find out if it is a suitable tool to assess the stress levels of French parents of children with ASD.

Title: Should we use the Parental Stress Index - Short Form in parents of children with ASD? A French validation study

1. Introduction

Autism spectrum disorder (ASD) is a neurodevelopmental disorder including impairments in social communication and reciprocal interaction and limited and repetitive patterns of behavior (American Psychiatric Association, 2015). It requires the implementation of multidisciplinary interventions and high parental involvement (Burrell & Borrego, 2012). Parents of children with ASD are family caregivers because they support their child in carrying out activities of daily living, considering his/her developmental and chronological age. While this role can be a source of fulfillment (e.g. McConnell et al., 2015), it can also be an important source of stress (e.g. Derguy et al., 2016; Koegel et al., 1992).

Previous studies have shown that parents of children with ASD experience higher levels of stress than those observed in the general population (e.g. Gau et al., 2012; McStay et al., 2014; Ruiz-Robledillo & Moya-Albiol, 2013). In addition, stress is much higher for ASD than for other developmental disorders (intellectual disability, Down's syndrome or language disorders) (Estes et al., 2009). Thus, about 1/3 of parents of children with ASD exceed the clinical cut-off of stress (Davis & Carter, 2008). Some physiological markers of stress, such as high cortisol levels and elevated blood pressure, have been observed in parents of children with ASD (e.g. Dykens & Lambert, 2013; Gallagher & Whiteley, 2012; Lopata et al., 2008). Abidin (1995) defined parental stress (PS) as a complex construct that refers to a person's appraisal of his or her role as a parent, in other words the stress the parent feels when raising his/her child. Specifically, PS is a difficulty in adjusting to the parenting role and a discrepancy between the needs of the child and the resources available to the parent. According to Abidin's stress model (1992), many variables, such as the child's and parents' characteristics and the environment, could have an effect on PS. It is essential to prevent PS

from becoming chronic because it could have harmful consequences for both the parent and the child such as decreased parenting efficacy, and an increase in child's symptoms severity (Baker-Ericzen & Brookman-Frazee, 2005; Bekhet et al., 2012; Karst & Hecke, 2012).

Professionals need specific and validated tools to assess PS accurately and specially to evaluate the effectiveness of support programs for parents. This is a vital issue, especially in France, where various psycho-educative programs have emerged in recent years (Sankey et al., 2019) in accordance with French authorities guidelines (Haute Autorité de Santé & Agence nationale de l'évaluation et de la qualité des établissements et services sociaux et médico-sociaux, 2012; *Stratégie nationale pour l'Autisme au sein des troubles du neurodéveloppement*, 2018). In addition, French parents of children with ASD report high levels of PS similar to those observed in parents of children with ASD in other countries (e.g. Derguy et al., 2016).

According to Barroso, Mendez, Graziano, & Bagner (2018), in 75% of studies among parents of children with developmental and clinical disorders, PS is assessed using the Parenting Stress Index (PSI) or its Short Form (PSI-SF) (Abidin, 1995). The original version of the PSI is a self-reported questionnaire with 101 items and three scores (child characteristics, parental characteristics, situation and demographic factors). The PSI has demonstrated good psychometric qualities (e.g. reliability, convergent validity, discriminant validity) (Marc Bigras et al., 1996, 1996). The short form (PSI-SF) was obtained from a factor-analysis of the long form. Analyses showed a strong correlation between the two versions (long and short form) for the total stress score ($r = 0.94$, $p < .001$; Abidin 1995). The PSI (either the third or fourth edition and in the short or full version) is the most commonly used tool to measure the impact of interventions on the family of children with ASD (e.g. Kuhaneck et al., 2015; Lichtlé et al., 2019). Previous studies have shown that all the scores of the PSI-SF are sensitive to changes (e.g. Research Units on Pediatric Psychopharmacology

(RUPP) Autism Network, 2007; Samadi et al., 2013; Wong & Kwan, 2010). Moreover, previous studies have reported negative associations between PS and parent's quality of life and, positive associations between PS and anxiety and depression scores (Dardas & Ahmad, 2014a; Falk et al., 2014; Ingersoll & Hambrick, 2011; Padden & James, 2017; Rezendes & Scarpa, 2011; Weitlauf et al., 2014).

Although the PSI and the PSI-SF have been translated into French (only into Canadian French and Belgium French), the validation studies were conducted with parents of children with cystic fibrosis and in a general population (Bigras et al., 1996; Touch  que et al., 2016). In addition, to our knowledge, only three studies have investigated the psychometric properties of the PSI-SF, in a sample of parents of children with ASD. These validation studies were carried out using the English and Arabic versions of the PSI-SF (Dardas & Ahmad, 2014b; Zaidman-Zait et al., 2010, 2011). Zaidman-Zait et al. (2011) found a 6-factor model with all the original items and Dardas & Ahmad (2014a) found a 3-factor model with only 30 items. These two previous studies suffered from limitations regarding adequate sample size to conduct a factor analysis (only 184 parents for 36 items, Dardas & Ahmad, 2014) and sample composition (only 8.8% of fathers, Zaidman-Zait et al., 2011).

To sum up, the PSI-SF is the most widely used tool to assess PS in parents of children with ASD. However, no validation study has been carried out with French-speaking parents of children with ASD living in France. So, the objective of this study was to evaluate the factor structure and psychometric properties of the PSI-SF in French parents of children with ASD.

2. Materials and methods

2.1 Participants

Twelve cross-sectional samples of parents of children with ASD were merged. Those samples were pooled to ensure an adequate sample size (N=370) to perform subsequent

statistical analyses. Data were gathered with two main objectives. The first one was to evaluate the effectiveness of various parents' support programs on parental stress (four samples; 154 participants). The second one was to investigate the individual and environmental determinants of parental stress (eight samples; 216 participants). The participants came from different regions of France and are distributed as follows: Île de France (five samples; 126 participants); Nouvelle Aquitaine (three samples; 131 participants); Centre Val-de Loire (one sample; 26 participants); Bretagne (one sample; three participants); Normandie (one sample; 11 participants). We cannot provide the location for some participants recruited online (73 participants). The four biggest samples (71.4%) and the remaining polled smaller (<7%) samples (28.6%) are compared in Table 1. No difference was observed regarding parents' age, number of children, presence of another child with a disability or child gender. However, some differences were observed regarding parents' gender, child age, diagnostic delay, education, marital status and working status.

Participant characteristics are presented in Table 2 (N = 370). The participants were, on average, 39 years old. Their children, mostly boys, were aged about seven years and six months and had been diagnosed with ASD according to international classification criteria (DSM or CIM). All study participants are French-speaking living in France. All participants were either the father or mother of the child with ASD. A large majority (90%) lived as a couple under the same roof with the child. To participate, the parent had to have regular contact with the child (shared custody), if he did not live all week with the child (separated parents). Some of them were parents of the same child (N=110, 55 dyads). Participants could answer either a paper version (50.6%) or an online version (49.4%) of the questionnaire.

All participants received an information letter and signed an informed consent form. All procedures were performed in accordance with the 1964 Helsinki declaration and its later amendments.

[INSERT TABLE 1]

[INSERT TABLE 2]

2.2 Measures

2.2.1 Parenting Stress Index - Short Form (PSI-SF)

The French translation of the original version of Abidin's PSI-SF (Abidin, 1983; Loyd & Abidin, 1985) was used. This 36-item scale is intended for parents of children aged from 1 month to 12 years and is widely used for studying PS in parents of children with ASD (Barroso, Mendez, Graziano, & Bagner, 2018). The PSI-SF has been translated into French (Canada and Belgium) for use in general populations (Bigras et al., 1996; Touch  que et al., 2016). A French-language validation of the PSI-SF has also been performed with Belgian parents of children with cystic fibrosis (Touch  que et al., 2016). The PSI-SF contains 36 items divided into three subscales, each composed of 12 items:

1/ "Parental distress" (PD) refers to the distress felt by the parent in his/her parental role (e.g. *"Since having this child, I have been unable to do new and different things"*).

2/ "Parent-child dysfunctional interaction" (PCDI) refers to the level of satisfaction perceived by the parent in the relationship with his/her child (e.g. *"My child does not seem to learn as quickly as most children"*).

3/ "Difficult child" (DC) refers to the degree of difficulty experienced by the parent regarding the child's behavior (e.g. *"There are some things my child does that really bother me a lot"*).

Each item is rated from 1 (*strongly disagree*) to 5 (*strongly agree*). Only 2 items (22 and 33) have specific response format. The PSI-SF gives three subscores and a total score (sum of all items). Higher scores reflect significant stress associated with the parental role. A total score at the 90th percentile (score of 114/115) reflects a "clinically significant" level of PS (Abidin, 1995). The Francophone validation of Touch  que et al. (2016) among parents of

children with cystic fibrosis and among a general population showed good psychometric properties (Cronbach's alphas $> .79$).

2.2.2 Hospital Anxiety and Depression Scale (HADS)

The HADS has been given to 139 participants. The HADS has been validated in France (Lepine et al., 1985; Zigmond & Snaith, 1983). To our knowledge, the HADS has not been validated in parents of children with ASD. However, it has been already used in a sample of parents of children with ASD with high internal consistency (e.g. Hamlyn-Wright et al., 2007; Hastings & Brown, 2002). This scale contains 14 items assessing depressive symptoms (7 items) and anxious symptoms (7 items). Each item is offered with 4 possible responses rated from 0 to 3. The HADS shows good psychometric validity (Bjelland et al., 2002). In our sample, Cronbach's alpha for both factors were satisfactory ($> .70$).

2.2.3 The World Health Organization Quality of Life Instrument - Short Form (WHOQOL-BREF)

The WHOQOL-BREF has been given to 139 participants. The WHOQOL-BREF has been validated in France (Baumann et al., 2010; Leplege et al., 2000) and consists of 26 items, subdivided into four domains: physical, psychological, social relationships and environment. The 26 questions are scored using a five-point Likert scale ("*strongly agree*" to "*strongly disagree*"). It has good acceptability and satisfactory validity with parents of children with ASD (Dardas & Ahmad, 2014c). Cronbach's alpha obtained by Dardas & Ahmad (2014b) ranged from .67 to .84. In our sample, Cronbach's alpha was satisfactory ($> .80$).

2.2.4 Appraisal of Life Events Scale (ALES)

THE ALES has been given to 109 participants. The ALES (Ferguson et al., 1999) has been translated, adapted for parents having a child with ASD, and validated in French by Cappe et al. (2017). Its instructions were adapted to assess PS related to having a child with ASD. The ALES was constructed to operationalize the notion of "primary appraisal" and the

dimensions of perceived stress (threat, loss and challenge) as described by Lazarus and Folkman (1984). Perceived stress is the assessment of the situation in terms of its nature, severity and duration, but also the assessment of the resources (personal and social) available to the individual to cope. Thus, several people confronted with the same stressful event may react differently depending on their assessments of the situation and their resources. A situation may be perceived as a threat or a loss compared to the previous situation or, on the contrary, as a challenge. Folkman & Lazarus (1985) defined the threat dimension as being related to the potential for harm, while the loss dimension is linked to the harm affecting health, friendships, or self-esteem. The challenge dimension refers to beneficial stress (Seyle, 1974). For example, parents who give up their jobs to care for their child with ASD might perceive this as a threat to their social status or a financial loss, or as a positive opportunity to be closer to their child (Cappe et al., 2019). Participants were asked to assess their parental experience using 16 adjectives reflecting the characteristics of primary appraisals as described by Lazarus and Folkman (1984). For each adjective, they were asked to rate the extent to which they characterized their experience as being a parent of a child with ASD on an intensity scale ranging from 0 (“*not at all*”) to 5 (“*extremely*”). Three scores were calculated: experience perceived as a threat (e.g. “fearful”, 6 items), a loss (e.g. “painful”, 4 items) and a challenge (e.g. “stimulating”, 6 items). The scale has good psychometric properties for use with parents having a child with ASD (Cappe et al., 2017). In our sample, Cronbach’s alphas were satisfactory (> .70).

2.3 Statistical Analyses

All statistical analyses were performed with R studio (1.1.463).

Confirmatory and exploratory factor analyses were carried out. For such analyses, 10 participants per item are needed (Costello & Osborne, 2005, 2005; Loyall, 2016) so that, as the

PSI-SF contains 36 items, at least 360 participants were required. Our sample (N = 370) was sufficient. Outliers were checked with Grubbs' Test.

First, to test the match between our data and the initial 3-factor model, a Confirmatory Factor Analysis (CFA) was performed. The Unweighted Least Squares (ULS) extraction method was chosen because the data were not normal (Coughlin, 2013). In accordance with current recommendations (Hooper et al., 2008; Loyal, 2016), the following model fit indicators were examined : χ^2/df [Normed Chi Square] (< 2), RMSEA [Root Mean Square Error of Approximation] (< 0.07), AGFI [Adjusted Goodness of Fit Index] (> 0.95), SRMR [Standardized Root Mean Squared Residual] (< 0.08), CFI [Comparative Fit Index] (> 0.95) and NNFI [Non-Normed Fit Index] ($> .95$). Factor loadings were also observed (≥ 0.4) (Henson & Roberts, 2006; Tabachnick & Fidell, 2007).

Second, owing to poor CFA results, an Exploratory Factor Analysis (EFA) was performed to examine the factor structure without *a priori* expectations regarding the model (Costello & Osborne, 2005; Henson & Roberts, 2006; Loyal, 2016). To assess the suitability of our data for such an analysis, the Kaiser-Meyer-Olkin value (KMO) (≥ 0.8) and the Bartlett test ($p < 0.05$) were examined. The eigenvalues scree plot was observed and the VSS (Very Simple Structure) criterion was computed to determine how many factors should be extracted. Correlation matrix was computed on raw data (Pearson). The ULS extraction method was chosen because the data were not normal (Coughlin, 2013).. The Oblimin rotation method was chosen because factors were assumed to be non-orthogonal (correlated). To be satisfactory, an item has to exhibit one sufficient factor loading (≥ 0.4) and a simple solution (≥ 0.2 points of difference between loadings) (Henson & Roberts, 2006; Tabachnick & Fidell, 2007). Items that did not meet one of these two requirements were dropped, until a satisfactory factor structure was obtained. For each factor and the global score, explained

variance and internal consistency were recorded. Spearman correlations between each factor and the global score were computed.

Third, as our sample included non-independent data (N=110, 55 dyads of parents of the same child) we have performed additional sensitivity analyses that examine the impact of clustering on the study conclusions. Indeed, we have performed an EFA without parental dyads and also check if individual factor scores were influenced by inclusion of non-independent data and data from mothers or fathers. Moreover, an intra-class coefficient was computed to investigate agreement between raters of a same dyad.

Finally, the scale convergent validity was examined through its association (Spearman correlations) with various scales assessing anxiety and depression symptoms (Hospital Anxiety and Depression Scale, HADS), quality of life (WHOQOL-Brief, World Health Organization Quality of Life - Brief) and appraisal of the event (having a child with ASD) (Appraisal of Life Events Scale, ALES). In some samples, parents had taken the HADS and the WHOQOL-Brief (n = 139) while in other ones they had taken the ALES (n = 109). Correlations and means differences between parents of the same children were computed when possible (N=110, 55 dyads).

It was hypothesized that: H1. PSI-SF scores would be positively correlated with anxiety and depression ($r \geq .50$). Indeed, previous studies have shown moderate ($r \geq .50$) to strong ($r \geq .70$) significant associations between PS and anxiety and depression (e.g. Falk et al., 2014; Hamlyn-Wright et al., 2007; Ingersoll & Hambrick, 2011; Rezendes & Scarpa, 2011) H2. PSI-SF scores would be negatively associated with quality of life with higher correlations for parental distress and global scores ($r \geq .50$), in accordance with Dardas & Ahmad (2014c). H3. PSI-SF scores would be positively associated with perception of threat and loss and negatively associated with challenge perception ($r \geq .40$) (Akoglu, 2018; Lazarus & Folkman,

1984). H4. It was hypothesized that positive correlations would be observed between parents of the same children ($r \geq .40$) (Akoglu, 2018).

3. Results

3.1 Confirmatory factor analysis

The model fit was unsatisfactory ($\chi^2/df = 6.63$, RMSEA = 0.127, AGFI = 0.933, SRMR = 0.088, CFI = 0.903 and NNFI = 0.897). Moreover, 5 items (items 14, 18, 22, 29, and 36) exhibited low loadings (< 0.40). These results highlighted a poor model fit. Our data did not conform to the expected 3-factor model.

3.2 Exploratory factor analysis

The KMO value (0.88) and the Bartlett test ($p < 0.05$) were satisfactory. There were enough correlations in our data to perform an EFA. The scree plot examination (Figure 1) as well as the VSS suggested that 3 factors should be extracted. An EFA was performed and 15 unsatisfactory items were removed: items 1, 2, 6, 13, 14, 18, 20, 21, 22, 24, 25, 26, 27, 31 and 33. The final structure was obtained with the fourth iteration of the EFA (see Supplemental Material). Factor loadings, explained variance and Cronbach's alphas are presented in Table 3. The scale explains 44% of the variance. Cronbach's alphas were satisfactory ($> .70$). Descriptive statistics were computed for Parental Distress ($M = 2.73$, $SD = 0.93$), Parent-Child Dysfunctional Interaction ($M = 2.58$, $SD = 0.96$), Difficult Child ($M = 3.61$, $SD = 0.76$) and the total score ($M = 3.01$, $SD = 0.64$). A total score (sum) at the 90th percentile (score ≥ 74) could reflect a "clinically significant" level of PS. Finally, correlations between scores were computed (Table 4).

[INSERT FIGURE 1]

[INSERT TABLE 3 and 4]

3.3 Psychometric properties

First, the convergent validity was checked through the scale association with other measures (Table 5). As expected, all PSI-SF scores were positively associated with anxiety and depression scores. However, most associations were lower than expected ($r \leq .50$). The strongest association were observed between parental distress and anxiety ($r = .71$) and, between total score and both anxiety ($r = .60$) and depression ($r = .50$) scores. Thus, our first hypothesis (H1) is only partly confirmed. Moreover, as expected, quality of life was negatively associated with all PSI-SF scores and more strongly associated with parental distress ($r = -.57$) and the total score ($r = -.50$). Thus, our second hypothesis (H2) is confirmed. Finally, as expected, all PSI-SF scores were associated positively with perception of threat and loss and negatively with challenge perception. However, most correlations were lower than expected ($r \leq .40$). The strongest correlations were observed between loss perception and both total score ($r = .60$) and parental distress ($r = .54$) and between threat perception and total score ($r = .50$). Thus, our third hypothesis (H3) is only partly confirmed.

Inter-rater correlations between mothers and fathers of the same child ($n=110$) have been computed. Correlations between parents' ratings were significant for parental distress ($r = .56, p < .01$), dysfunctional interactions ($r = .33, p < .01$), difficult child ($r = .49, p < .01$) and global stress ($r = .52, p < .01$). As hypothesized, parents' ratings were positively associated, although correlations between dysfunctional interactions scores were lower than expected ($r \geq .40$). Thus, our fourth hypothesis (H4) is only partly confirmed. In addition, no mean difference was observed between parents scores. Finally, we have computed an intra-class correlation coefficient (ICC) for the PD scale (.73), the DI scale (.52), the DC scale (.70) and the overall score (.71). According to current recommendations, ICC ranging from .50 to .75 are indicating a moderate agreement between raters (Grawitch & Munz, 2004; Koo & Li, 2016).

Finally, we have performed an EFA without parental dyads ($n=110$) to be sure that the structure was not, or very lightly, influenced by non-independent data. The results show that the three factors structure was mainly identical. Only Items 3 and 7 had cross-loadings with a second factor (.31 and .34). However, these two items were showing sufficient loadings (respectively .48 and .46). Moreover, we have performed another analysis to check if individual factor scores were influenced by inclusion of non-independent data and parents' gender. This analysis was performed with the initial 36 items pool and our 21 items version. The table 6 shows the correlations between individual factor scores when including all participants and subsets. All correlations were significant and higher than 0.93. In other words, individuals' position on factors were almost not influenced by exclusion of non-independent data or parents of one gender or another.

[INSERT TABLE 5 & 6]

4. Discussion

The aim of this study was to validate the PSI-SF among a sample of French parents of children with ASD. The present study was conducted in order to better inform researchers and clinicians about the PSI-SF validity among French parents of children with ASD. This is very important because the PSI-SF is widely used in French-speaking research (e.g. Derguy et al., 2016). To our knowledge, this is the first study investigating the psychometric properties of the French version of the PSI-SF in a sample of parents of children with ASD in France.

In the first step, the CFA failed to validate the original 3-factor model (36 items). This result is in line with the previous two validation studies among parents of children with ASD. Zaidman-Zait et al. (2011) found a 6-factor model and Dardas & Ahmad (2014a) a 3-factor model with only 30 items.

In the second step, the EFA resulted in a 3-factor model after removing 15 items (1, 2, 6, 13, 14, 18, 20, 21, 22, 24, 25, 26, 27, 31 and 33). The final model included 21 items

assessing Parental Distress (PD, 9 items), Parent–Child Dysfunctional Interaction (PCDI, 5 items), and Difficult Child subscales (DC, 7 items). Most removed items appeared to function differently in parents of children with ASD than they do in parents of typically developing children (see Table 7). Indeed, the PSI-SF was initially validated among parents of typically developing children. However, ASD features can profoundly change the understanding and relevance of some items. For example, items 18 and 20 (PCDI subscale) refer to the perceived gap between one’s own child and other children. These items could not be truly relevant for the majority of parents of children with a developmental disability because the majority of them perceive such a gap (De Giacomo & Fombonne, 1998; Lee et al., 2008). In addition, several removed items refer to features that often occur in ASD such as social withdrawal (e.g. item 14 – “*Sometimes I feel my child doesn’t like me and doesn’t want to be close to me*”), challenging behavior (e.g. item 33 – “*Think carefully and count the number of things which your child does that bothers you*”), emotional dysregulation (e.g. item 27 – “*I feel that my child is moody and easily upset*”) or developmental delay (e.g. item – “*It takes a long time and it is really hard for my child to get used to new things*”). This issue has already been mentioned by previous validation studies among parents of children with ASD in Canada (English-version) and Jordan (Dardas & Ahmad, 2014b; Zaidman-Zait et al., 2011). In fact, 4 items removed in the present study (items 22, 24, 31, and 33) were also removed in the study of Dardas & Ahmad (2014a).

[INSERT TABLE 7]

Additionally, Dardas & Ahmad (2014a) highlighted the importance of considering cultural differences that could influence parents’ responses. In the present study, 2 items (items 2 and 22) were removed presumably because of French context features. Item 2 refers to a sacrificial dimension associated with being a parent, which might be less valued in French society than in other western cultural contexts (e.g. Suizzo, 2004). One previous study

showed that French parents of children with ASD emphasized the importance of their other roles, such as spouse, colleague, and friend, beyond that of parent (Derguy et al., 2015). In addition, item 22 (“*I feel that I am: 1. a very good parent to 5. not very good at being a parent*”) might be less relevant in France where guilt theories about parents of children with ASD still exist (Chamak et al., 2011; Sankey et al., 2019). One can hypothesize that it would be very difficult for French parents to answer this question freely without feeling judged. Besides, for this item the majority of parents chose the median answer (51.1%). This item also displays the lowest standard deviation (see Table 8). It might reflect either parents their difficulty in positioning themselves or their need to answer within the norm. Therefore, this item had to be excluded because it certainly measures something other than what it was originally created for.

[INSERT TABLE 8]

Finally, among the items removed, some included unique rating compared to all others items (items 22 et 33). As mentioned in a previous validation of the PSI-SF in general population, these items offered a middle choice (e.g. item 22 : I feel that I am very good - not very good at being a parent; middle choice: an average parent) whereas the middle option was not offered for the other items (Whiteside-Mansell et al., 2007). Thereby, these differences in response options may have influenced the analysis (Furr, 2011).

Differences between our results and previous ones (Dardas & Ahmad, 2014b; Zaidman-Zait et al., 2011) could also be explained by sample characteristics. Our sample was composed of parents of children older ($M = 71.18$ months, $SD = 28.91$) than those in Zaidman-Zait et al.’s study ($M = 41.60$, $SD = 10.26$). The age range was also wider in our study (12 to 144 months) than in Zaidman-Zait et al.’s study (20.5 to 72 months). This wide age range is one of the strengths of our study because the PSI-SF was designed to be used with parents of children aged between 1 and 12 years (144 months) old. This is particularly

important because differences in PS have been observed depending on the age of the child with ASD (e.g. Duarte et al., 2005; Falk et al., 2014; Rivard et al., 2014).

Finally, we investigated the convergent validity of the scale. As expected, higher PSI-SF scores were associated with higher anxiety and depression scores, and more threat and loss perception. Secondly, higher PSI-SF scores were associated with lower quality of life and less challenge perception. These results are in accordance with previous studies (e.g. Dardas & Ahmad, 2014c; Falk et al., 2014; Lazarus & Folkman, 1984). Moreover, as reported by Dardas & Ahmad (2014c) our results show stronger associations between quality of life and both parental distress ($r = -.57$) and the total score of PSI-SF ($r = -.50$). Moreover, parents' ratings were moderately associated ($r = .33$ to $.56$). These results are indicative of a promising convergent validity.

The strongest correlation ($r = .71$) indicates a 50% shared variance between PD and anxiety (HADS-A). This result shows that the PD scale exhibits a unique variance because it does not fully overlap with the measure of anxiety. It seems interesting to note that the score on the PD subscale is more associated with the anxiety score (HADS-A, $r = .71$) than with the depression one (HADS-D, $r = .48$). Previous studies conducted among parents of children with ASD have shown that high levels of stress can be a risk factor of anxious and/or depressive symptoms (e.g. Bitsika & Sharpley, 2000; Siman-Tov & Kaniel, 2011). However, in practice, it is very difficult to distinguish anxious and depressive manifestations (Rivas-Vazquez et al., 2004). Our study suggests that parental distress might be associated more with anxious features (worry, restlessness, etc.) than with depressive features (sadness, anhedonia, etc.). This result should be confirmed in further research and might be considered when designing support programs for parents of children with ASD.

Regarding our sample, dyads of parents participated in the study, which implies a bias of overrepresentation of some families and non-independence of observations. This bias is

very frequent in studies that focus on both mothers and fathers, although it is very rarely clearly addressed. We have decided to consider each parent as a single statistical individual and it could be considered as a limitation of our study. However, it seemed important to us to include fathers (and not only mothers) in our samples (Johnson & Simpson, 2013). Consequently, we have performed additional analyses to address this potential bias. Our results show that individual factor scores were almost not influenced by exclusion of non-independent data or parents of one gender or another. This finding argues for using this version of the PSI-SF with both mothers and fathers.

In further research, it will also be essential to study more deeply the psychometric properties of the French version of the PSI-SF. CFA could be performed on another sample to confirm the factor structure obtained in the present study in samples of mothers and fathers separately. Secondly, the temporal stability of the scale (test-retest) and its predictive validity should be explored in a longitudinal study. Thirdly, changing the structure of the PSI-SF from a 36-items structure to a 21-items one also implies lack of comparability with existing norms. Further studies are needed to establish norms for the 21 items PSI-SF. Moreover, relying on the 90th percentile to choose a cut-off is highly arbitrary and future studies should use ROC Curve Analyses to define an adequate cut-off to distinguish efficiently parents functioning well and parents crippled by stress (Streiner & Cairney, 2007).

To conclude, our results should be interpreted with caution. In the future, researchers should use the full version of the PSI-SF (36 items) but when adequate sample size is reached, should examine its factor structure. More studies on the factor structure of the PSI-SF are needed to find out if it is a suitable tool for measuring stress in parents of children with ASD in France.

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Table 1. Samples Description

Sample	Size	Characteristics	Anova or Fisher Exact Test (FET)
1	n=99 26.8%	Paper version Younger child Shorter diagnostic delay More frequently divorced	100% (M=58.47, SD=15.65) ; F(4,365)=6.38** (M=13.37, SD=11.35) ; F(3,270)=6.60** 14% vs 8% ; FET = 33.22** ^b
2	n=89 24.1%	Paper version	100%
3	n=40 10.8%	Online version More fathers More frequently married Less frequently working Lower education (no high school diploma)	100% 38.4% vs 26.8% ; FET = 11.67* 94.9% vs 89.5% ; FET = 33.22** 28.3% vs 40.2% ; FET = 12.71* 27.3% vs 19% ; FET = 28.63**
4	n=36 9.7%	Paper version More frequently single	100 (13.9% vs 1.9%) FET = 33.22*
5 ^a	n=106 28.6%	Paper or Internet version Less frequently working Higher education (> bachelor degree) Less medium education (bachelor degree)	31.1% and 68.9% respectively 44.2% vs 59.8% ; FET = 12.71* 42.9% vs 24.4% ; FET = 28.63** 21.4% vs 36% ; FET = 28.63**

Note. ^a Sample 5 is composed of 8 smaller samples (<7%). ^b For Instance, according to Fisher Exact Test, Sample 1 has more divorced parents (14%) than expected when regarding all samples (8%). *p<.05 and **p<.01. No difference was observed regarding parents age, number of children, presence of another child with a disability, child gender, or scores for the Appraisal of Life Events Scale (ALES), Hospital Anxiety and Depression Scale (HADS) or Quality of Life (WHOQOL).

Table 2. Participant characteristics

	M (SD) [min-max] or %	Missing data
Parent gender		0%
Female	73.2%	
Male	26.8%	
Data available for both parents of the same child	29.7%	
Parent age ^a	37.73 (6.08) [22-66]	3.2%
Living as a couple	89.5%	2.2%
Education level		34.6%
No high school diploma	19%	
High school diploma	2.7%	
Bachelor degree	36%	
Higher than a bachelor degree	24.4%	
Working	40.2%	17.3%
Number of siblings		23%
0	24.9%	
1	46.3%	
2	19.3%	
3 or more	9.5%	
Other child(ren) with a disability		30%
	11.2%	
Child with ASD gender		0%
Male	78.4%	
Female	21.6%	
Child with ASD age ^b	71.18 (28.91) [12-144]	0%
Age of child at diagnosis ^b	48.14 (24.27) [10-132]	25.9%
Time since diagnosis ^b	20.50 (21.89) [0-102]	25.9%
Data collection		0%
Online version	46.5%	
Paper version	53.5%	

Note. N = 370. ^a in years. ^b in months. Descriptive statistics were performed after exclusion of missing data.

Table 3. Exploratory Factor Analysis

Items	Abbreviated content	PD	DC	PCDI
3	Trapped by parenting	0.46	0.24	0.04
4	Cannot do new things since having this child	0.55	0.10	0.07
5	Cannot do things I like since having this child	0.60	0.14	0.05
7	Things bother me	0.48	0.25	-0.12
8	Problems with spouse	0.45	0.09	0.05
9	Feel alone	0.82	-0.05	-0.08
10	Bad time at party	0.69	-0.11	0.08
11	Less interest in people	0.70	-0.11	0.02
12	Enjoy things less	0.76	0.01	0.02
15	My child smiles less at me	-0.02	0.05	0.75
16	Efforts for my child are not appreciated	0.16	0.11	0.50
17	Giggles/laughs less when playing	-0.02	-0.05	0.76
19	Smiles less	-0.03	0.06	0.71
23	Expected closer feelings for my child	0.10	0.13	0.59
28	My child does things that bother me a great deal	0.01	0.70	0.08
29	My child reacts strongly	-0.04	0.55	-0.06
30	My child gets upset easily	0.05	0.58	-0.02
32	Getting my child to do something is hard	-0.08	0.58	0.11
34	My child does some things that bother me a lot	-0.06	0.69	0.03
35	My child's behavior is more of a problem than expected	0.14	0.57	0.11
36	My child makes more demands on me	0.05	0.52	-0.12
Variance explained		18	14	12
Cronbach's alphas for subscales		0.86	0.8	0.82
Cronbach's alpha for the whole scale			0.87	

Note. $N = 370$. Extraction ULS (Unweighted Least Squares) and Oblimin rotation. Factorial loadings greater than 0.40 are in **bold**. PD: Parental Distress; PCDI: Parent–Child Dysfunctional Interactions; DC: Difficult Child

Table 4. Inter-factor correlations (21 items PSI).

	PD	PCDI	DC
Parental Distress (PD)	--		
Parent–Child Dysfunctional Interactions (PCDI)	.34**	--	
Difficult Child (DC)	0.33**	0.34**	--
Total score	0.83**	0.68**	.69**

Note. Spearman correlations. ** $p < .01$ and * $p < .05$. $N = 370$.

Table 5. Convergent validity (21 items PSI).

	HADS-A	HADS-D	WHOQOL Brief	ALES-T	ALES-L	ALES-C	PSI-SF (36 items)
Parental Distress	0.71 **	0.48 **	- 0.57 **	0.37 **	0.54**	-0.20 *	0.98**
Parent–Child Dysfunctional Interaction	0.28 **	0.33 **	- 0.34 **	0.31**	0.40 **	-0.36 **	0.99**
Difficult Child	0.36 **	0.36 **	- .22 **	0.41**	0.37 **	-0.05	0.92**
Total score	0.60 **	0.50 **	- 0.50 **	0.50 **	0.60 **	-0.23 *	0.98**

Note. Spearman correlations. ** $p < .01$ and * $p < .05$. HADS-A/D: Hospital Anxiety and Depression Scale - Anxiety/Depression. WHOQOL-Brief: World Health Organization Quality of Life Scale. ALES - T/L/C: Appraisal of Life Events Scale - Threat/Loss/Challenge. Sample size: HADS and WHOQOL (N = 139); ALES (N = 109).

Table 6. Correlations between individual factor scores when including all participants and subsets

	36 items			21 items		
	F1	F2	F3	F1	F2	F3
Excluding Parents Dyads (N=260)	.99**	.99**	.99**	.99**	.99**	.99**
Women only (N=271)	.99**	.99**	.99**	.99**	.99**	.99**
Men only (N=99)	.99**	.97**	.99**	.99**	.98**	.93**

Note. ** $p < .01$. For instance, when using the 21 items PSI, the individual factor scores for Factor 3 were strongly correlated when including all participants or only fathers (.93).

Table 7. Rational for Removing Items

Item number	Item label	Item category in Zaidman-Zait et al. (2010)	Theoretical reasons for removing the item
1	I often have the feeling that I cannot handle things very well	A	French context Item less relevant in France where guilt theories about parents of children with ASD still exist (Chamak et al., 2011; Sankey et al., 2019). It would be very difficult for French parents to answer this question freely without feeling judged.
2	I find myself giving up more of my life to meet my child's needs than I ever expected	B ^e	French context Refers to a sacrificial dimension associated with being a parent, which might be less valued in French society than in other western cultural contexts (e.g. Suizzo, 2004).
6	I am unhappy with the last purchase of clothing I made for myself	C ^h	Not related to parenting This item is the only one that is not directly related to parenting. It may not be relevant in the case of French parents of children with ASD because their priority needs are mostly related to their child's education (Derguy et al., 2015).
13	My child rarely does things for me that make me feel good	C ^h	ASD features Item related to ASD features particularly social withdrawal and social reciprocity disorders (American Psychiatric Association, 2013)
14	Most times I feel that my child likes me and wants to be close to me	C ^h	ASD features Item related to ASD features particularly social withdrawal (American Psychiatric Association, 2013)
18	My child doesn't seem to learn as much as most children	B ^e	ASD features Perceived gap between one's own child and other children. Not truly relevant for the majority of parents of children with a developmental disability because the majority of them perceive such a gap (De Giacomo & Fombonne, 1998; Lee et al., 2008).
20	My child doesn't seem to smile as much as most children.	B ^e	ASD features Perceived gap between one's own child and other children. Not truly relevant for the majority of parents of children with a developmental disability because the majority of them perceive such a gap (De Giacomo & Fombonne, 1998; Lee et al., 2008).
21	It takes a long time and it is really hard for my child to get used to new things	B ^e	ASD features Item related to developmental delay often associated to ASD (Baio et al., 2018)
22	I feel that I am: (being a parent)	B ^{h*}	French context Item less relevant in France where guilt theories about parents of children with ASD still exist (Chamak et al., 2011; Sankey et al., 2019). It would be very difficult for French parents to answer this question freely without feeling judged.
24	Sometimes my child does things that bother me just to be mean	C ^h	ASD features Item related to challenging behavior often observed in ASD (Matson et al., 2009)

French validation of the PSI-SF in autism

25	There are some things my child does that really bother me a lot.	A	ASD features	Item related to challenging behavior often observed in ASD (Matson et al., 2009)
26	My child generally wakes up in a bad mood	C ^h	ASD features	Item related to ASD features particularly emotional dysregulation (American Psychiatric Association, 2013)
27	I feel that my child is very moody and easily upset	B ^h	ASD features	Item related to ASD features particularly emotional dysregulation (American Psychiatric Association, 2013)
31	My child's sleeping and eating schedule was much harder to establish than I expected	B	ASD features	Item related to sleeping and feeding disorders often associated to ASD (Malow et al., 2016; Twachman-Reilly et al., 2008)
33	Think carefully and count the number of things which your child does that bothers you.	B ^h	ASD features	Item related to challenging behavior often observed in ASD (Matson et al., 2009)

Note. Category A: items that function relatively well; Category B: items that function less well; Category C: poorly functioning items. (h): item was relatively hard to endorse; (e): item was relatively easy to endorse; *: This item also displays the lowest standard deviation (see Table 5).

Table 8. Descriptive Statistics by Items

Items	M(SD)	Items	M(SD)	Items	M(SD)	Items	M(SD)
1	3.37 (1.17)	11	2.84 (1.33)	21	3.38 (1.18)	31	3.01 (1.43)
2	3.79 (1.2)	12	2.77 (1.29)	22	2.68 (0.95)	32	3.74 (1.18)
3	3.20 (1.34)	13	2.14 (1.14)	23	2.68 (1.34)	33	2.46 (1.30)
4	2.81 (1.27)	14	1.99 (1.18)	24	2.16 (1.23)	34	3.36 (1.22)
5	2.96 (1.26)	15	2.46 (1.31)	25	3.20 (1.38)	35	2.95 (1.20)
6	2.07 (1.19)	16	2.63 (1.20)	26	2.20 (1.19)	36	3.96 (1.13)
7	3.28 (1.27)	17	2.30 (1.17)	27	3.05 (1.35)		
8	2.78 (1.37)	18	3.79 (1.30)	28	3.19 (1.20)		
9	2.51 (1.3)	19	2.82 (1.33)	29	3.99 (1.01)		
10	2.49 (1.29)	20	3.09 (1.33)	30	3.67 (1.19)		

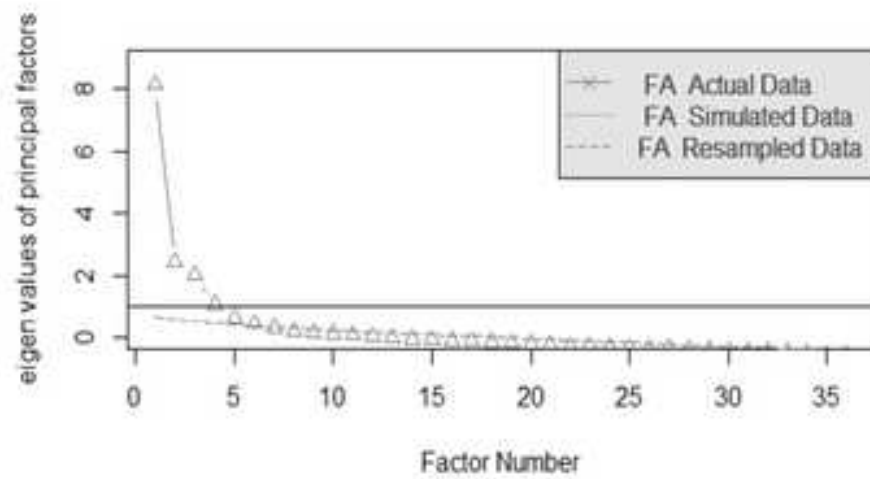
Figure 1. Eigenvalue scree plot (First EFA, 36 items)

Note. Eigenvalues are on the vertical axis. Number of factors is represented on the horizontal axis. Factors below the horizontal line have an eigenvalue lower than 1. “Simulated data” and “Resampled data” lines indicate factors that could be extracted at random.

Highlights

- Parents of children with ASD report high level of parental stress
- The PSI (or its short form) is the most used tool for assessing parental stress
- This study assessed the psychometric properties of the PSI-SF in ASD in France
- EFA gives a 3-factor model (21 items) with good structure and convergent validity
- Removed items were related to the specificities of ASD and the French context

Figure 1
[Click here to download high resolution image](#)



Supplement. Exploratory Factor Analyses Iterations (Unweighted Least Squares, Oblimin Rotation)

	First Iteration			Second Iteration			Third Iteration			Last Iteration		
	F1	F2	F3	F1	F2	F3	F1	F2	F3	F1	F2	F3
1 ^{ab(1)}	.33	.01	.28	-	-	-	-	-	-	-	-	-
2 ^{b(1)}	.49	-.19	.46	-	-	-	-	-	-	-	-	-
3	.56	-.05	.28	.47	.00	.25	.46	.24	.03	.46	.24	.04
4	.60	.05	.10	.55	.06	.10	.55	.10	.07	.55	.10	.07
5	.63	.05	.12	.59	.04	.15	.60	.14	.06	.60	.14	.05
6 ^{ab(1)}	.39	.39	-.30	-	-	-	-	-	-	-	-	-
7	.51	-.12	.24	.49	-.16	.27	.48	.26	-.13	.48	.25	-.12
8	.46	.09	.06	.45	.05	.09	.45	.09	.05	.45	.09	.05
9	.76	.02	-.11	.82	-.05	-.06	.82	-.05	-.07	.82	-.05	-.08
10	.64	.16	-.16	.68	.11	-.11	.69	-.11	.08	.69	-.11	.08
11	.65	.05	-.14	.70	.03	-.11	.70	-.11	.02	.70	-.11	.02
12	.76	.00	.00	.76	.01	.02	.76	.02	.02	.76	.01	.02
13 ^{b(2)}	.22	.53	-.10	.27	.46	-.02	-	-	-	-	-	-
14 ^{ab(1)}	.13	.37	-.25	-	-	-	-	-	-	-	-	-
15	-.02	.63	-.04	-.03	.72	-.06	-.02	-.04	.73	-.02	.05	.75
16	.11	.59	.06	.14	.54	.09	.16	.11	.51	.16	.11	.50
17	-.06	.67	.00	-.05	.76	-.05	-.03	-.06	.78	-.02	-.05	.76
18 ^{a(2)}	-.03	.01	.41	-.07	.02	.37	-	-	-	-	-	-
19	-.06	.58	.18	-.05	.67	.09	-.03	.06	.71	-.03	.06	.71
20 ^{ab(1)}	.06	.27	.27	-	-	-	-	-	-	-	-	-
21 ^{ab(1)}	.01	.26	.35	-	-	-	-	-	-	-	-	-
22 ^{ab(1)}	.21	.19	-.09	-	-	-	-	-	-	-	-	-
23	.07	.63	.07	.08	.62	.11	.10	.13	.59	.10	.13	.59
24 ^{a(2)}	-.01	.48	-.01	.05	.35	.07	-	-	-	-	-	-
25 ^{ab(2)}	.03	.52	.28	.08	.39	.33	-	-	-	-	-	-
26 ^{a(3)}	.10	.52	.02	.16	.43	.04	.18	.05	.38	-	-	-
27 ^{b(1)}	.03	.40	.37	-	-	-	-	-	-	-	-	-
28	.01	.29	.54	.00	.13	.68	.00	.70	.08	.01	.70	.08
29	-.06	.06	.56	-.04	-.05	.56	-.04	.55	-.06	-.04	.55	-.06
30	.00	.21	.52	.04	.02	.56	.05	.58	-.01	.05	.58	-.02
31 ^{ab(1)}	.08	.28	.30	-	-	-	-	-	-	-	-	-
32	-.05	.15	.56	-.08	.07	.59	-.09	.58	.10	-.08	.58	.11
33 ^{ab(1)}	.20	.38	.22	-	-	-	-	-	-	-	-	-
34	-.03	.14	.53	-.06	.00	.67	-.06	.69	-.04	-.06	.69	.03
35	-.16	.25	.49	.14	.13	.56	.14	.57	.12	.14	.57	.11
36	.11	-.19	.63	.05	-.18	.57	.05	.52	-.12	.05	.52	-.12

Note. N = 370. ^a Items removed because of low loading (<.40). ^b Items removed because of cross-loadings (difference <.20). ^(x) Items removed on the first, second or third iteration. Items in **Bold** have sufficient loadings (>.40) and no cross loadings (difference <.20)

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A French validation study

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