Psychometric validation of the Chinese version of the Shirom-Melamed Burnout Questionnaire among parents of children with cancer

Jing Liao [a], Ting Zhong [b], RuiQing Cai [c], DongYan Tang [d], WenJie Sun [e], RunTing Yu [d], Li Zhou [f], LiHong Wan [a,*]

[a] Nursing School, Sun Yat-sen University, China
[b] Pediatric Department, Sun Yat-sen Memorial Hospital, China
[c] Pediatric Oncology Department, Sun Yat-sen Cancer Center, China
[d] Pediatric Oncology Department, Sun Yat-sen Memorial Hospital, China
[e] Nursing Department, Jiangxi Provincial Children's Hospital, China
[f] Paediatric Oncology Department, University of Hong Kong-Shenzhen Hospital, China

ARTICLE INFO

ABSTRACT

Purpose: Although burnout recently emerged as a harmful syndrome in parents, no instrument has been validated to suitably assess burnout among parents of children with cancer in China. In this study, we aimed to psychometrically validate the Shirom-Melamed Burnout Questionnaire (SMBQ) among Chinese parents of children with cancer.

Design and methods: We conducted a cross-sectional survey of 380 parents of children with cancer to psychometrically validate the SMBQ. Content validity, construct validity, convergent validity, discriminant validity, criterion-related validity, diagnosis accuracy, internal consistency, and test-retest reliability were evaluated.

Results: The Chinese version of the SMBQ demonstrated adequate internal consistency, good test-retest reliability, good content validity, excellent convergent and discriminant validity, and appropriate criterion-related validity. Using the parental burnout assessment as a reference criterion, the area under the curve was 0.903. The optimal cut-off point for the SMBQ was 4.833. The factor model of the SMBQ used in Chinese parents of children with cancer had a good fit. The survey revealed that Chinese parents of children with cancer experienced a high level of burnout (3.86 ± 1.03).

Conclusions: The Chinese version of SMBQ was reliable and valid for assessing burnout in parents of children with cancer. Parents of children with cancer experienced a high level of burnout in China.

Implications for practice: This SMBQ can be used in Chinese clinical and research settings to investigate burnout in parents who have children with cancer. Further research could examine the predictive validity and validity.

© 2023 Published by Elsevier Inc.

Background

The phenomenon of burnout has always existed among parents; however, burnout has recently emerged as an important global health problem in parents (Mikolajczak et al., 2021). A global cross-cultural survey reported the global occurrence of burnout among parents in general, with an average prevalence of 2.68% (ranging from 0.1% to 8.1%), and the prevalence of burnout in Chinese parents was 1.4% (Roskam et al., 2021). Previous studies (Mrosková et al., 2020) have revealed that caring for sick children is a risk factor for burnout of parents. The prevalence of burnout in parents of sick children ranges from 36.0% to 79.3% in European countries, which is much higher than that in the general parent population (Lindström et al., 2010; Samardakiewicz et al., 2015). The prevalence of burnout in Chinese parents of children with cancer remains unknown.

Childhood cancer, a life-threatening condition, is the leading cause of disease-related death in children worldwide (Heron, 2019). Its treatment and prognosis rely heavily on parents' support and care (Molassiotis & Wang, 2022). Parents, as informal caregivers with no salary for caregiving, play a critical complementary role in health care, especially under the current context of global shortages in formal care service resources, including in China (Given, 2019; Marć et al., 2019). Parents invest much energy in caring for their children with fragile physical and mental conditions, cooperating with the healthcare team for the administration of treatment and care, and monitoring treatment complications as well as cancer recurrence (Çınar et al., 2021). In the long run, this exposes parents to burnout (Mrosková et al., 2020).

* Corresponding author at: School of Nursing, Sun Yat-Sen University, 74#, Zhongshan Road II, Guangzhou, China.
E-mail address: wanlh@mail.sysu.edu.cn (L. Wan).

Burnout in parents is an exhaustion syndrome resulting from physical, emotional, and cognitive activities wherein parents confront overwhelming stress without enough stress-coping resources (Melamed et al., 2006; Mikolajczak & Roskam, 2018; Norberg, 2007). A previous study (Lam et al., 2022) showed that parents of children with cancer experience high levels of stress in China, and thus it is supposed that they also experience burnout; however, there is a lack of a valid scale to measure the burnout level. Burnout in parents is a significant predictor of physical sickness, sleep disturbance, and chronic disease in parents (Basaran et al., 2013). More than half of parents of children with cancer reportedly experience burnout (Norberg, 2007); this may lead to neglecting patient treatment and care, which can worsen the disease prognosis (Mikolajczak et al., 2019). However, no instrument has been fully tested and validated for measuring burnout levels in this specific population. Therefore, it is urgent and essential to develop a credible instrument for this purpose. Early detection is also an imperative prerequisite for timely intervention to alleviate burnout, help improve the health of the parents, and ensure the recovery of children with cancer.

The Maslach Burnout Inventory (MBI) is an instrument used to measure individual burnout levels (Maslach & Jackson, 1981). Although it has various versions for different populations, no version of the MBI is specific for parents of children with cancer. The Parental Burnout Assessment (PBA) is another instrument that was formulated to measure burnout levels among parents in the general community (Roskam et al., 2018), however, it emphasises the measurement of parental role-related burnout levels resulting from childbearing in a general context (Bornstein, 2020). For example, parents usually do everything to care for their cancer children, even if it results in burnout (Öhman et al., 2020). Nevertheless, some items in PBA such as "I don't enjoy being with my child(ren)", "I can't take being a parent anymore", and "I do what I'm supposed to do for my child(ren), but nothing more" may not accurately reflect the specific complex feelings of parents with cancer children, as the items may only represent the general feelings of the parents who have healthy but naughty children.

The Shirom-Melamed Burnout Questionnaire (SMBQ) was developed by Shirom and Melamed in 1992 to test the burnout levels of individuals confronting stressful situations (Kushnir & Melamed, 1992; Melamed et al., 1992). Norberg (Norberg, 2007) first used the SMBQ to measure the specific burnout levels among parents of children with cancer and reported good internal consistency reliability (Cronbach's α coefficients were 0.98 and 0.89–0.97 for the SMBQ total scale and subscales, respectively). Subsequently, the SMBQ was successively used among parents of children with cancer (Norberg, 2010; Norberg et al., 2014; Samardakiewicz et al., 2015). It was found to be a sensitive instrument for burnout level measurement in this specific population, although the construct validity had not been hitherto confirmed in this population. The original SMBQ evaluated the core elements of burnout including four subscales (physical fatigue/emotional exhaustion, cognitive weariness, listlessness, and tension) and 22 easy-to-understand items, which can be completed within a few minutes. Eventually, the original authors updated the physical fatigue/emotional exhaustion subscale and divided it into the physical fatigue and emotional exhaustion subscales (Toker et al., 2012); hence, the current SMBQ has five subscales. The SMBQ may be the most suitable instrument for burnout level measurement in parents of children with cancer. Thus, in this study, we proposed a psychometric validation of the SMBQ for measuring burnout levels in parents of children with cancer in China.

Methods

Study design

A cross-sectional survey was conducted in paediatric oncology departments of four tertiary hospitals across Guangzhou, Shenzhen, and Nanchang in mainland China. The paediatric oncology departments have a good reputation for childhood cancer treatment technology and for admitting paediatric oncology patients nationwide. Convenience sampling was used to enroll parents whose children were admitted from November 2021 to May 2022. To satisfy the statistical power of at least a 5:1 participant-to-item ratio (there are 22 items in this study, and thus the sample size was 110) for exploratory factor analysis (EFA) (Gorsuch, 2013), and a reqirement of 150 or more samples for confirmatory factor analysis (CFA) (Muthén & Muthén, 2002), this study needed at least 260 samples.

The inclusion criteria were as follows: (1) parents aged ≥18 years and who were the main caregivers, and (2) children aged ≤18 years and diagnosed with cancer for at least 1 month. Moreover, we excluded parents with cognitive impairment. This study was approved by the Institutional Review Board of our university. Parents provided informed consent and filled out the questionnaires containing sociodemographic and burnout information. Disease-related data were collected from medical records.

Measures

Demographic and disease-related questionnaire

We designed a questionnaire to collect parent and children demographic data such as gender and age as well as children's disease-related data such as cancer diagnosis and disease course.

SMBQ

The SMBQ comprises 22 scored statements using a 7-point Likert scale, wherein the parents choose response from 1 (almost never) to 7 (almost always) in the past 30 days. The SMBQ comprises five subscales: physical fatigue, cognitive weariness, emotional exhaustion, listlessness, and tension (Melamed et al., 1992; Toker et al., 2012). The burnout score is the average score of all items, and a score of 3.75 or more indicates clinical burnout (Norberg, 2007).

The forward and backward translation of the SMBQ was performed according to the guideline proposed by Brislin (Brislin, 1970). First, two bilingual native speakers independently translated the English version of the SMBQ into Chinese. One of the translators was familiar with the terms and concepts evaluated, whereas the other was unfamiliar with the terms and concepts. After fully discussing differences in the translation process, an agreement was reached on the final translated version of the questionnaire. Subsequently, the Chinese version of the questionnaire was back-translated by two other translators (Ph.D. students in English-speaking countries) who were unfamiliar with the concepts explored. Forward and backward translations were compared and discussed by a committee of experts, including paediatric oncologists, nurses, psychometric analysts, and translators. The committee reached a consensus and confirmed that the Chinese version of the questionnaire demonstrated semantic, customary, and conceptual equivalence. Furthermore, 30 parents participated in a pilot investigation to evaluate acceptability.

To evaluate the language consistency and cultural relevance of the items of the Chinese SMBQ version, a 4-point Likert scale was distributed to five Chinese-English bilingual nurses, with 1–4 points representing "highly inconsistent, inconsistent, consistent, and highly consistent" in language consistency and "very irrelevant, irrelevant, relevant, and highly relevant" in cultural relevance. The 22 items showed 100% agreement of language consistency and cultural relevance. Due to the treatment schedule, a retest was performed on 40 parents 4 weeks after the first test.

PBA

The PBA was used to measure burnout levels to test the criterion-related validity of SMBQ. The original PBA is a 23-item scale consisting of four components: exhaustion in one's parental role, contrast with previous parental self, feelings of being fed up with one's parental role, and emotional distancing from one's children (Roskam et al., 2018). However, the Chinese version of the PBA was found to have a

single dimension (Cheng et al., 2020) and a good internal consistency coefficient (Cronbach's α) of 0.938–0.952 (Cheng et al., 2020). Items are rated on a 7-point frequency scale: never (1), a few times a year or less (2), once a month or less (3), a few times a month (4), once a week (5), a few times a week (6), and every day (7). The burnout score is the average of all item scores; the higher the score, the more severe the burnout. A score threshold of 5 indicate clinical burnout (Roskam et al., 2017).

Perceived stress scale (PSS)

Parents' perceived stress was measured using the 14-item PSS (Cohen et al., 1983), which was applied as another test of the criterion-related validity of SMBQ. It contains two dimensions: psychological and physiological symptoms. The PSS is a 5-point Likert score scale, with 0–4 representing "never, almost never, sometimes, fairly often, and very often", respectively. The PSS score is the total score of the 14 items after reversing the scores of seven positive items. The higher the PSS score, the higher the perceived stress level. Score ranges of 14–28, 29–42, 43–57, and 57–70 represent low, moderate, high, and extremely high perceived stress levels, respectively. We used the Chinese version of the PSS, which confirmed by previous studies to have good reliability and validity, with a Cronbach'α coefficient range of 0.78–0.79 (Yang & Huang, 2003).

Psychometric evaluation

Validity

Content validity was determined using the content validity index (CVI). Five nurses appraised the content, with CVI > 0.78 for each item and CVI > 0.9 for the total scale, indicating that the scale was acceptable (Almanasreh et al., 2019). Construct validity was tested by factor analysis. First, the potential structure was explored by EFA using randomised group 1 data ($n = 198$). Thereafter, CFA was used to test the explored model and to estimate its fitting using group 2 data ($n = 182$).

Convergent validity was evaluated using the composite reliability (CR) and the average of variance extracted (AVE). A CR value >0.7 indicates good convergent validity, and an AVE value range of 0.36–0.5 and > 0.5 represents acceptable and good convergent validity, respectively. After determining the convergent validity, the discriminant validity was evaluated (Hair et al., 2010). The criterion-related validity of the SMBQ was evaluated using the Spearman correlation coefficient, with values of 0.3–0.49 and > 0.5 indicating moderate and strong correlations, respectively (Khamis, 2008). The consistency between the SMBQ and PBA was determined using the kappa test. Kappa coefficients of 0.41–0.60 and 0.61–0.80 indicated moderate and substantial consistency, respectively.

Reliability

Internal consistency reliability was tested using Cronbach's α and Guttman's split-half reliability coefficients. A coefficient value >0.7, 0.8, or 0.9 indicated acceptable, good, or excellent internal consistency, respectively (Bland & Altman, 1997). Measurement stability was verified by test-retest reliability with intra-class correlation coefficient (ICC) using the retest data based on children's treatment course. ICC values ranging from 0.4 to 0.75 and > 0.75 were considered to represent good and excellent measurement stability, respectively (Rosner, 2010).

Statistical analysis

Statistical analysis was performed using SPSS 25.0 (IBM Corp. in Armonk, NY.). Continuous variables are described by mean standard deviation and categorical variables are described by frequency percentages. The Chi-Square tests were used to compare group differences in sociodemographic and disease-related data. Cronbach's α and split-half reliability coefficients were used to determine the internal

consistency of the SMBQ. Spearman correlation analysis was used for criteria validity since the data of PBA and PSS scores constituted a non-normal distribution. For convergent and criterion-related validity, correlation coefficients of 0.30–0.49 and 0.50–1.0 indicated moderate and strong correlations, respectively (Khamis, 2008). Diagnostic accuracy was established using receiver-operating characteristic (ROC) curve analysis. The Area Under the Curve (AUC) was calculated for showing the discriminative property of the scale, and the optimal cut-off point was determined by the maximum Youden index (sensitivity + specificity-1). Sensitivity and specificity values >0.70 indicated that the scale could be validated as a screening tool (Habibzadeh et al., 2016). Differences and consistency between the SMBQ and PBA were determined using the chi-square and kappa tests (kappa coefficients of 0.41–0.60 and 0.61–0.80 indicated moderate and substantial consistency, respectively).

Data were randomised into two groups using the SPSS software. Group 1 and 2 data were used to perform EFA and CFA, respectively. Both factor analyses were performed using Mplus 8.0 (Muthén & Muthén, Los Angeles, California) to explore and verify the structure of the Chinese version of the SMBQ used in parents of children with cancer. First, EFA with oblique rotation of GEOMIN extraction method was used to determine the potential structure of the SMBQ after Bartlett's Test. Subsequently, CFA was performed to test the validity of the factor structures explored during EFA. We developed a CFA model and assessed its fitting to the data.

Five indexes were used to report the factor analysis model fitting: χ^2/df, root-mean-square error of approximation (RMSEA), comparative fit index (CFI), Tucker-Lewis index (TLI), and standardized root-mean-square residual (SRMR). χ^2/df denotes the likelihood that the model is correct. Although there is no agreement on the optimal χ^2/df value, a cut-off value of 5 or less is acceptable (Pasquarella et al., 2018). The CFI and TLI values ranged from 0 to 1; values closer to 1 represent a better fit, and values >0.90 indicate an adequate fit (Zayed et al., 2021). RMSEA values were used to evaluate misfits, with 0, < 0.05, 0.05–0.08, 0.08–0.10, and > 0.10 indicating perfect, close, reasonable, acceptable, and poor fits, respectively. An SRMR value <0.10 indicates a good fit (Bentler & Bonett, 1980).

Results

Participant characteristics

Of 430 eligible parents, 387 (response rate, 90.0%) parents of children with cancer agreed to participate in the survey, and 380 parents completed the survey. Their demographic characteristics are presented in Table 1. Most (80.5%) parents who participated in this study were mothers, and more than half (58.2%) were parents aged 30 to 40 years. The average age of parents was 35.8 (standard deviation, 6.0; range, 21–55) years. The most common diagnosis of children was leukaemia (30.9%), and the treatment duration was 1–148 (median, 6.3) months. No statistically significant differences in demographics were observed between the two randomised data groups (Supplementary Table A).

Table 1
Participant characteristic($n = 380$).

Variables	n (%)	Variables	n (%)
Parents' gender		Children's Gender	
Male	74(19.5)	Male	220(57.9)
Female	306(80.5)	Female	160(42.1)
Parents' age(years)		Children's age(years)	
21–30	58(15.2)	1–3	54(14.2)
31–40	220(57.9)	4–6	106(27.9)
41–50	96(25.3)	7–12	153(40.3)
51–55	6(1.6)	13–18	67(17.6)

Adaptation of the SMBQ

Minor modifications were made for measuring burnout among parents in China. For example, the appellation phrase "my child" was added in items of the referential relationship. And the expression "I feel like my 'batteries' are 'dead'" was translated to "I feel like my body is 'out of battery'", according to the Chinese culture. The adapted SMBQ was reviewed and evaluated by the 30 parents who participated in the pilot investigation. Moreover, 24 and 6 of the parents were mothers and fathers, respectively, with a mean age of 37 (range, 27–52) years. The most common diagnosis of their children was leukaemia (309%), and the treatment duration was 1–75 (median, 6.0) months. During the questionnaire completion procedure, we observed if the items were acceptable to parents and did not generate ambiguity or discomfort. After each item was completed, the parents were asked whether the item was simple to understand and reply to.

Validity

Content validity

The CVI values of each item ranged from 0.80 to 1.00, and the CVI of the total scale was 0.91, indicating that the content validity of the questionnaire was acceptable. Parents of children with cancer in the pilot investigation reported no difficulties, uncertainty, or discomfort in reading the questionnaire, and it took approximately 5–8 min to complete the questionnaire.

Construct validity

The Bartlett's test of sphericity and Kaiser-Meyer-Olkin (KMO) index values were high (KMO = 0.913, χ^2 = 3077.783, and $p < 0.001$), indicating that the data were suitable for EFA (Pituch & Stevens, 2016). Using factor numbers from 1 to 5, EFA results suggested the 5-factor model was optimal (Table 2). Furthermore, according to the factor loading (≥ 0.4) shown in Supplementary Table B, most items were loaded in five factors, which was the same for items in the original scale, barring three items (items 12, 18, and 20). Item 12, "I feel I am unable to be sensitive to the needs of my child", had a factor loading (0.390) that was close to 0.40, and there was a significant correlation between item 12 and the rest of the items of the factor ($r = 0.426, 0.529$) (Supplementary Table C); thus, item 12 was retained as an emotional exhaustion factor. Item 18, "I feel sleep", could not be loaded in any factor and had a factor loading >0.40; hence, it was deleted. Although item 20, "I feel relaxed", was loaded in the listlessness factor, the correlations between item 20 and items in the listlessness (r range, 0.335–0.485, $p < 0.001$) and tension (r range, 0.333–0.429, $p < 0.001$) factors were almost equal. Therefore, item 20 was retained in the tension factor, based on its clinical meaning.

Based on the factor structures explored by EFA, CFA was performed to confirm the five-factor structures using group 2 data (n = 182). Fig. 1 shows the CFA standard factor coefficient, and the index of the model fitness indicated that the five-factor structure (21 items) was good for burnout level measurement in Chinese parents of children with cancer.

Convergent and discriminant validity

The CRs of physical fatigue, cognitive weariness, emotional exhaustion, listlessness, and tension factors were 0.912, 0.944, 0.763, 0.775, and 0.817, respectively. The AVEs were 0.636, 0.772, 0.519, 0.536, and 0.541 for physical fatigue, cognitive weariness, emotional exhaustion, listlessness, and tension factors, respectively. The above-mentioned parameters indicated that the Chinese version of the SMBQ had good convergent validity.

The coefficient of internal correlation of the physical fatigue factor with the square root of AVE was 0.798, which was higher than the coefficients of external correlation with other factors with the square root of AVE (range, 0.541–0.744). The square root of AVE of cognitive weariness, emotional exhaustion, listlessness, and tension factors was also stronger than the correlation coefficient with external factors (Supplementary Table D). These results indicated that the Chinese version of the SMBQ had good discriminant validity.

Criterion-related validity

The criterion-related validity between the SMBQ, PBA, and PSS was tested using Spearman correlation analysis ($n = 229$). The coefficients correlation of the SMBQ total scale as well as the physical fatigue, cognitive weariness, emotional exhaustion, listlessness, and tension subscales with the PBA were 0.793 as well as 0.782, 0.639, 0.553, 0.405, and 0.490, respectively. Moreover, the coefficients of correlation the SMBQ total scale as well as the physical fatigue, cognitive weariness, emotional exhaustion, listlessness, and tension subscales with the PSS were 0.719 as well as 0.617, 0.605, 0.482, 0.508, and 0.588, respectively; all the findings were statistically significant. These results indicated a strong consistency between the SMBQ (total scale and subscales) and PBA in terms of burnout of parent level measurement, with only two subscales (listlessness and tension) showing moderate consistency. Furthermore, the kappa coefficient was 0.646 ($p < 0.001$), indicating a substantial consistency between the SMBQ and PBA. In addition, the strong consistency between the SMBQ and PSS proved that burnout of parents levels were consistent with the stress levels confronted by parents.

Reliability

The Cronbach's α coefficients of the Chinese version of the SMBQ were 0.936 for the total scale and 0.911, 0.941, 0.772, 0.758, and 0.793 for the physical fatigue, cognitive weariness, emotional exhaustion, listlessness, and tension factors, respectively. The Guttman split-half coefficient of the Chinese version of the SMBQ was 0.838. In addition, test-retest reliability was confirmed as good, with an ICC value of 0.767 (F = 7.572, $p < 0.001$).

Diagnostic accuracy

ROC analysis results demonstrated that the AUC showed good diagnostic accuracy (0.903, 95% confidence interval [0.844, 0.962]) (Fig. 2). When the cut-off scores of the SMBQ (PBA as reference) increased from 1.452 to 6.500, the sensitivity decreased from 1 to 0.033, and the specificity increased from 0.005 to 1. Based on the maximum Youden
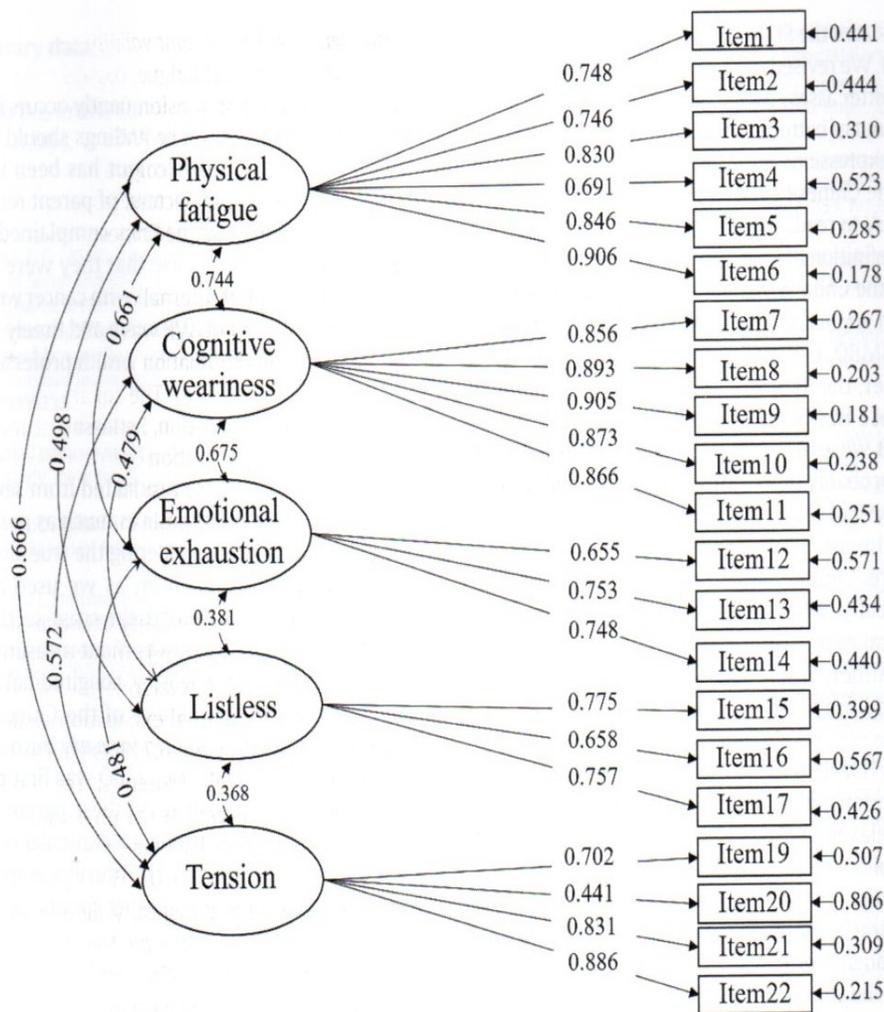
Table 2
goodness-of-fit indices for EFA Models ($n = 198$).

Factor structure	χ^2	df	χ^2/df	RMSEA (90% CI)	CFI	TLI	SRMR
1-factor	947.050	209	4.531	0.134 (0.125, 0.142)	0.665	0.630	0.100
2-factor	678.222	188	3.608	0.115 (0.106, 0.124)	0.777	0.727	0.077
3-factor	933.489	168	5.556	0.152 (0.142, 0.161)	0.653	0.522	0.058
4-factor	367.577	149	2.467	0.086 (0.075, 0.097)	0.901	0.846	0.043
5-factor	260.973	131	1.992	0.071 (0.058, 0.083)	0.941	0.896	0.030

Abbreviations: CFI, Comparative Fit Index; *df*, degree of freedom; RMSEA, root-mean-square error of approximation; SRMR, standardized root mean square residual; TLI, Tucker-Lewis Index.

Fig. 1. The final CFA model of the Chinese version of SMBQ: $\chi^2/df = 1.810$, RMSEA $= 0.067$, 90% CI (0.055, 0.078), TLI $= 0.926$, CFI $= 0.913$, SRMR $= 0.063$.

index (0.702), the optimal cut-off score was 4.833, with sensitivity and specificity of 0.767 and 0.935, respectively, indicating that the SMBQ was a good screening tool for burnout in parent. The frequency of

burnout (setting 5 score points which means at least once a week as PBA) measured using the SMBQ (15.72%) was higher than that measured using the PBA (13.10%), and the difference was statistically significant ($\chi^2 = 96.785$, $p < 0.001$).
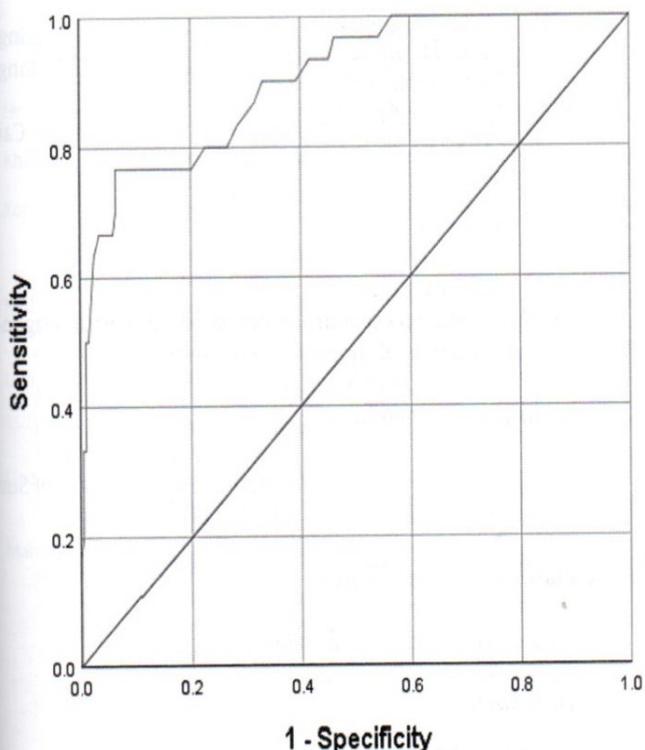
Descriptive Chinese version of the SMBQ

The mean score and standard error of the Chinese version of the SMBQ was 3.86 ± 1.03, and the mean scores and standard errors were 3.66 ± 1.33, 3.84 ± 1.42, 3.14 ± 1.35, 4.21 ± 1.16, and 4.49 ± 1.14 for the physical fatigue, cognitive weariness, emotional exhaustion, listlessness, and tension subscales, respectively. After using the original SMBQ cut-off score 3.75 suggested for clinical burnout by Grossi et al. (Grossi et al., 2003), the frequency of burnout in this study was 58.68% (223/380).

Discussion

To the best of our knowledge, this was the first study to translate and psychometrically examine the use of the SMBQ in Chinese parents of children with cancer. Parents play an important role in childhood cancer care during complex and long-term treatment as well as during the entire life of their children. Thus, parents form an indispensable alliance with formal care providers. The good reliability and validity of the Chinese version of the SMBQ showed that it is a suitable instrument for measuring burnout levels among Chinese parents of children with cancer. The instrument could help with early burnout identification and the evaluation of the efficacy of an intervention. Chinese parents of children with cancer experienced high levels of burnout which could benefit from intervention.

Fig. 2. ROC of SMBQ based on PBA as reference.

In this study, we translated the SMBQ strictly based on the proposed guidelines (Brislin, 1970). We revised the appellations of some items regarding parent roles to better assess parent feelings. Item 5 was revised to "I feel like my body is 'out of battery", based on the suggestions of experts regarding Chinese expressions, customs, and culture. Based on the good content validity, the Chinese version of the SMBQ proved to be highly acceptable and easy to read, and thus accurately reflects the domains and operational definition of burnout.

Five factors underlie the Chinese version of the SMBQ, as indicated by the EFA results, which was inconsistent with the factors' number of factors in the original SMBQ, but was consistent with the updated original SMBQ. Moreover, the final 21-item factor structures were almost the same as those in the original SMBQ (Lindström et al., 2010); only a few items were different. Item 18, "I feel sleep", did not load in any factor, probably due to the difficulty in distinguishing "feeling sleep" (physical fatigue) from "just feeling sluggish" (listlessness) and "could not rise to the occasion but not lacking sleep" in Chinese culture. Chinese people are less likely to express their emotions; specifically, when expressing negative emotions, they tend to use physical expressions instead (Chan et al., 2004). In a previous study (Almén & Jansson, 2021), the item, "I feel sleep", was also overlappingly loaded in both the physical fatigue and listlessness factors.

Furthermore, item 20, "I feel relaxed", had low and high factor loading coefficients in the tension and cognitive weariness factors, respectively. The item, "I feel relaxed", is an opposite expression of tension, which is similar to the following items in the listlessness factor: item 15, "I feel full of vitality/Vitalis"; item 16, "I feel alert"; and item 17, "I feel active". However, phrasing items in opposite directions is associated with some methodological problems (Widhiarso, 2012), suggesting that this factor may be developed ascribed to the similarity of opposite expressions rather than the similarity of question content. Thus, based on its clinical meaning and its considerable correlation coefficient, item 20 was retained in the tension factor.

The CFA results showed good convergent validity for each factor of the Chinese version of the SMBQ. In addition, the high CR and AVE values indicated good discriminant validity for discriminating factors. Criterion-related validity (both the PBA and PSS) was also good for the Chinese version of the SMBQ.

The Chinese version of the SMBQ was a good screening tool for burnout in parent, as indicated by the ROC analysis result. Compared to the frequency of burnout symptoms in Chinese parents in the general population of 1.5–1.8% (Cheng et al., 2020), a much higher frequency of 15.72% was found for Chinese parents of children with cancer in this study. Furthermore, a previous study, using the original SMBQ burnout cut-off score point of 3.75, demonstrated that Chinese parents of children with cancer experienced more burnout compared with Swedish parents of children with chronic illness (58.68% vs. 36%) (Lindström et al., 2010). Moreover, the burnout level (mean score, 3.86) in Chinese parents of children with cancer is reportedly higher than those of Swedish (Norberg, 2007) and Polish parents (Samardakiewicz et al., 2015). Given the high prevalence, level, and significance of burnout in Chinese parents of children with cancer, it is critical to monitor burnout and provide these parents with adequate and timely support.

The internal consistency reliability was excellent (Cronbach's α coefficient = 0.936) and moderate (Cronbach's α coefficient > 0.7) for the Chinese version of the SMBQ total scale and subscales, respectively, which corroborated with the findings of previous studies using the SMBQ to measure burnout levels in parents of children with cancer (Norberg, 2007, 2010; Norberg et al., 2014). In addition, the split-half reliability coefficient (0.838) showed good reliability. The test-retest reliability proved to be excellent, with ICC scores of 0.767. These results confirmed that the Chinese version of the SMBQ was reliable for burnout level measurement among Chinese parents of children with cancer.

Clinical implications

We found that burnout frequently occurs in Chinese parents of children with cancer and these findings should be highlighted by health professionals. Although burnout has been widely recognised in the work area, data on the burnout of parent remain scarce (Mikolajczak et al., 2020). Although parents complained of physical discomfort, they did not seem to realise that they were developing burnout. We proved that parents of children with cancer were vulnerable to burnout. This study provides an imperative and timely monitoring and intervention evaluation instrument for health professionals.

Study limitations

First, participants were recruited from several paediatric oncology departments to minimise bias as much as possible; nevertheless, some bias may exist, when considering the true situation of burnout in parents of children with cancer, as we used a convenience sampling method in this study. Second, the cross-sectional study design has an advantage of quick access to burnout measurement-related data; however, it lacks predictive validity. Longitudinal studies are needed to ascertain the predictive validity of the Chinese version of the SMBQ. Lastly, due to the urgent need for early burnout assessment in parents of children with cancer, the SMBQ was first psychologically validated for measuring burnout levels in these parents. A measurement instrument can be valid in examining a particular population in a specific situation (Kottner et al., 2011). Future research needs to examine the validity of the instrument in other specific populations.

Conclusions

The Chinese version of the SMBQ is a reliable and valid measurement tool that can be used in clinical research to identify burnout in parents of children with cancer; moreover, it may help in the evaluation of the efficacy of future nursing interventions aimed at alleviating burnout in parents of children with cancer.

Authorship contribution

Conception and design: Jing Liao, Ting Zhong, RuiQing Cai, DongYan Tang, WenJie Sun, RunTing Yu, Li Zhou, LiHong, Wan;

Provision of study material or patients: Jing Liao, Ting Zhong, RuiQing Cai, Dongyan Tang, Wenjie Sun, Runting Yu, Li Zhou, LiHong, Wan;

Analysis and interpretation: Jing Liao, Ting Zhong, RuiQing Cai, Dongyan Tang, Wenjie Sun, Runting Yu, Li Zhou, LiHong, Wan;

Manuscript writing: Jing Liao, Lihong, Wan.

Funding

Ethical approval

This study was approved by the Institutional Review Board of Sun Yat-Sen University (reference # 2021ZSLYEC-447).

Declaration of Competing Interest

The authors have no conflict of interest to declare.

Acknowledgments

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.pedn.2023.01.004.

References

Almanasreh, E., Moles, R., & Chen, T. F. (2019). Evaluation of methods used for estimating content validity. *Research in Social and Administrative Pharmacy*, 15(2), 214–221. https://doi.org/10.1016/j.sapharm.2018.03.066.

Almén, N., & Jansson, B. (2021). The reliability and factorial validity of different versions of the Shirom-Melamed Burnout Measure/Questionnaire and normative data for a general Swedish sample. *International Journal of Stress Management*, 28(4), 314–325. https://doi.org/10.1037/str0000235.

Basaran, A., Karadavut, K. I., Uneri, S. O., Balbaloglu, O., & Atasoy, N. (2013). The effect of having a children with cerebral palsy on quality of life, burn-out, depression and anxiety scores: A comparative study. *European Journal of Physical and Rehabilitation Medicine*, 49(6), 815.

Bentler, P. M., & Bonett, D. G. (1980). Significance tests and goodness of fit in the analysis of covariance structures. *Psychological Bulletin*, 88(3), 588–606. https://doi.org/10.1037/0033-2909.88.3.588.

Bland, J. M., & Altman, D. G. (1997). Statistics notes: Cronbach's alpha. *BMJ*, 314(7080), 572. https://doi.org/10.1136/bmj.314.7080.572.

Bornstein, M. H. (2020). "Parental burnout": The state of the science. *New Directions for Child and Adolescent Development*, 2020(174), 169–184. https://doi.org/10.1002/cad.20388.

Brislin, R. W. (1970). Back-translation for cross-cultural research. *Journal of Cross-Cultural Psychology*, 1(3), 185–216. https://doi.org/10.1177/135910457000100301.

Chan, B., Parker, G., Chan, B., & Parker, G. (2004). Some recommendations to assess depression in Chinese people in Australasia. *The Australian and New Zealand Journal of Psychiatry*, 38(3), 141–147. https://doi.org/10.1080/j.1440-1614.2004.01321.x.

Cheng, H., Wang, W., Wang, S., Li, Y., Liu, X., & Li, Y. (2020). Validation of a Chinese version of the parental burnout assessment. *Frontiers in Psychology*, 11. https://doi.org/10.3389/fpsyg.2020.00321.

Çınar, S., Boztepe, H., Ay, A., Yılmaz, P., Güllü, H., Karadavut, B., Burhanoğulları, D., Solmaz, M., & Akyüz, C. (2021). Predictors of parenting stress in parents of children with cancer. *European Journal of Oncology Nursing*, 54, Article 102022. https://doi.org/10.1016/j.ejon.2021.102022.

Cohen, S., Kamarck, T., & Mermelstein, R. (1983). A global measure of perceived stress. *Journal of Health and Social Behavior*, 24(4), 385–396.

Given, C. W. (2019). Family caregiving for cancer patients: The state of the literature and a direction for research to link the informal and formal care systems to improve quality and outcomes. *Seminars in Oncology Nursing*, 35(4), 389–394. https://doi.org/10.1016/j.soncn.2019.06.014.

Gorsuch, R. L. (2013). *Factor analysis* (0 ed.). Psychology Press. https://doi.org/10.4324/9780203781098.

Grossi, G., Perski, A., Evengård, B., Blomkvist, V., & Orth-Gomér, K. (2003). Physiological correlates of burnout among women. *Journal of Psychosomatic Research*, 55(4), 309–316. https://doi.org/10.1016/S0022-3999(02)00633-5.

Habibzadeh, F., Habibzadeh, P., & Yadollahie, M. (2016). On determining the most appropriate test cut-off value: The case of tests with continuous results. *Biochemia Medica*, 26(3), 297–307. https://doi.org/10.11613/BM.2016.034.

Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2010). Structural equation modeling overview. In I. J. F. Hair, W. C. Black, B. J. Babin, & R. E. Anderson (Eds.), *Multivariate data analysis: vol. 7th ed* (pp. 541–598). Prentice Hall.

Heron, M. (2019). Deaths: Leading causes for 2017. *National Vital Statistics Reports*, 68(6). https://doi.org/10.15620/cdc:104186.

Khamis, H. (2008). Measures of association: How to choose? *Journal of Diagnostic Medical Sonography*, 24(3), 155–162. https://doi.org/10.1177/8756479308317006.

Kottner, J., Audige, L., Brorson, S., Donner, A., Gajewski, B. J., Hróbjartsson, A., ... Streiner, D. L. (2011). Guidelines for reporting reliability and agreement studies (GRRAS) were proposed. *International Journal of Nursing Studies*, 48(6), 661–671. https://doi.org/10.1016/j.ijnurstu.2011.01.016.

Kushnir, T., & Melamed, S. (1992). The Gulf war and its impact on burnout and well-being of working civilians. *Psychological Medicine*, 22(4), 987–995. https://doi.org/10.1017/s0033291700038551.

Lam, W., Leung, D. Y. P., Li, S. -F., Yi, Y. -Z., Wang, H. -X., Zhou, L., ... Wong, F. K. Y. (2022). Parental stress as the mediator between symptom burden and the quality of life of Chinese children with cancer. *Cancer Nursing*, 45(5), E775–E781. https://doi.org/10.1097/NCC.0000000000001032.

Lindström, C., Åman, J., & Norberg, A. (2010). Increased prevalence of burnout symptoms in parents of chronically ill children. *Acta Paediatrica*, 99(3), 427–432. https://doi.org/10.1111/j.1651-2227.2009.01586.x.

Marć, M., Bartosiewicz, A., Burzyńska, J., Chmiel, Z., & Januszewicz, P. (2019). A nursing shortage—A prospect of global and local policies. *International Nursing Review*, 66(1), 9–16. https://doi.org/10.1111/inr.12473.

Maslach, C., & Jackson, S. E. (1981). The measurement of experienced burnout. *Journal of Organizational Behavior*, 2(2), 99–113. https://doi.org/10.1002/job.4030020205.

Melamed, S., Kushnir, T., & Shirom, A. (1992). Burnout and risk factors for cardiovascular diseases. *Behavioral Medicine*, 18(2), 53–60. https://doi.org/10.1080/08964289.1992.9935172.

Melamed, S., Shirom, A., Toker, S., Berliner, S., & Shapira, I. (2006). Burnout and risk of cardiovascular disease: Evidence, possible causal paths, and promising research directions. *Psychological Bulletin*, 132(3), 327–353. https://doi.org/10.1037/0033-2909.132.3.327.

Mikolajczak, M., Gross, J. J., & Roskam, I. (2019). Parental burnout: What is it, and why does it matter? *Clinical Psychological Science*, 7(6), 1–11. https://doi.org/10.1177/2167702619858430.

Mikolajczak, M., Gross, J. J., & Roskam, I. (2021). Beyond job burnout: Parental burnout! *Trends in Cognitive Sciences*, 25(5), 334–336. https://doi.org/10.1016/j.tics.2021.01.012.

Mikolajczak, M., Gross, J. J., Stinglhamber, F., Norberg, A. L., & Roskam, I. (2020). Is parental burnout distinct from job burnout and depressive symptoms? *Clinical Psychological Science*, 8(4), 673–689. https://doi.org/10.1177/2167702620917447.

Mikolajczak, M., & Roskam, I. (2018). A theoretical and clinical framework for parental burnout: The balance between risks and resources (BR2). *Frontiers in Psychology*, 9, 886. https://doi.org/10.3389/fpsyg.2018.00886.

Molassiotis, A., & Wang, M. (2022). Understanding and supporting informal cancer caregivers. *Current Treatment Options in Oncology*, 23(4), 494–513. https://doi.org/10.1007/s11864-022-00955-3.

Mrosková, S., Reľovská, M., & Schlosserová, A. (2020). Burnout in parents of sick children and its risk factors: A literature review. *Central European Journal of Nursing and Midwifery*, 11(4), 196–206. https://doi.org/10.15452/cejnm.2020.11.0015.

Muthén, L. K., & Muthén, B. O. (2002). How to use a Monte Carlo study to decide on sample size and determine power. *Structural Equation Modeling: A Multidisciplinary Journal*, 9(4), 599–620. https://doi.org/10.1207/S15328007SEM0904_8.

Norberg, A. L. (2007). Burnout in mothers and fathers of children surviving brain tumour. *Journal of Clinical Psychology in Medical Settings*, 14(2), 130–137. https://doi.org/10.1007/s10880-007-9063-x.

Norberg, A. L. (2010). Parents of children surviving a brain tumor: Burnout and the perceived disease-related influence on everyday life. *Journal of Pediatric Hematology/Oncology*, 32(7), e285–e289. https://doi.org/10.1097/MPH.0b013e3181e7dda6.

Norberg, A. L., Mellgren, K., Winiarski, J., & Forinder., U. (2014). Relationship between problems related to child late effects and parent burnout after pediatric hematopoietic stem cell transplantation. *Pediatric Transplantation*, 18(3), 302–309. https://doi.org/10.1111/petr.12228.

Öhman, M., Woodford, J., Essen, L., Al Omari, O., Roach, E. J., Shakman, L., ... Joseph, M. A. (2020). The lived experiences of mothers who are parenting children with leukemia. *Cancer Nursing*, E374–E381 Publish Ahead of Print(6) https://doi.org/10.1097/NCC.0000000000000898.

Pasquarella, C., Ciorba, V., & Arnoldo, V. (2018). Hospital hygiene in Italy: The GISIO-SItI survey. *Annali Di Igiene Medicina Preventiva Di Comunità*, 5, 7–14. https://doi.org/10.7416/ai.2018.2246.

Pituch, K. A., & Stevens, J. (2016). Applied multivariate statistics for the social sciences. *Analyses with SAS and IBM's SPSS* (6th ed.). Routledge/Taylor & Francis Group.

Roskam, I., Aguiar, J., Akgun, E., Arikan, G., Artavia, M., Avalosse, H., ... Mikolajczak, M. (2021). Parental burnout around the globe: A 42-country study. *Affective Science*, 2(1), 58–79. https://doi.org/10.1007/s42761-020-00028-4.

Roskam, I., Raes, M. -E., & Mikolajczak, M. (2017). Exhausted parents: Development and preliminary validation of the parental burnout inventory. *Frontiers in Psychology*, 8. https://doi.org/10.3389/fpsyg.2017.00163.

Roskam, S., Brianda, M. -E., & Mikolajczak, M. (2018). A step forward in the conceptualization and measurement of parental burnout: The parental burnout assessment (PBA). *Frontiers in Psychology*, 9. https://doi.org/10.3389/fpsyg.2018.00758.

Rosner, B. (2010). Fundamentals of biostatistics (7th ed.). Cengage Learning.

Samardakiewicz, M. E., Barsow, S., & Kowalczyk, J. R. (2015). 1405 burnout of parents having children with cancer. *European Journal of Cancer*, 51, S199. https://doi.org/10.1016/S0959-8049(16)30577-9.

Toker, S., Melamed, S., Berliner, S., Zeltser, D., & Shapira, I. (2012). Burnout and risk of coronary heart disease. *Psychosomatic Medicine*, 74(8), 840–847. https://doi.org/10.1097/PSY.0b013e31826c3174.

Widhiarso, W. (2012). *Reverse scored items, should we use it on psychology scale or not? (SSRN scholarly paper no. 2015048)*. Social Science Research Network. https://papers.ssrn.com/abstract=2015048.

Yang, T. Z., & Huang, H. T. (2003). An epidemiological study on stress among urban residents in social transition period. *Chinese Journal of Epidemiology*, 9, 11–15.

Zayed, K. N., Omara, E. N., Al-Rawahi, N. Y., Al-Shamli, A. K., Al-Atiyah, A. A., Al-Haramleh, A. A., ... Hassan, M. A. (2021). Psychometric properties of the Arabic version of the basic psychological needs satisfaction-frustration scale (BPNSFS). *BMC Psychology*, 9(1), 15. https://doi.org/10.1186/s40359-020-00506-1.