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Psychometric properties of the SECMH questionnaire "Pediatric Symptom Checklist for Youth"

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Kokkuvõte

Käesoleva uurimistöö eesmärk oli analüüsida eestikeelse laste ja noorukite enesehinnangulise küsimustiku PSC-17-Y psühhomeetrilisi omadusi. Uurimuses kasutati LVTU 2024. aasta uuringu andmestikku (Tuvi jt, 2024) ja käesoleva uurimistöö analüütiline valim koosnes 389 eesti keeles vastanud 11-19-aastasest vastajast (387 vastas PSC-17-Y ja 389 vastas RCADS-25-le). Konstruktivaliidsuse hindamiseks kasutati konfirmatoorset faktoranalüüsi ning konvergentset valiidsust kontrolliti seoste kaudu RCADS-25 küsimustikuga. Tulemused kinnitasid algset kolmefaktorilist struktuuri (tähelepanu-, internaliseerivad ja eksternaliseerivad probleemid), näidates väga head mudeli sobivust. Küsimustiku sisemine usaldusväärsus oli üldiselt kõrge, kuid eksternaliseeriv alaskaala näitas madalamat reliaablust. Tugev positiivne korrelatsioon RCADS-25 skooridega näitas PSC-17-Y konvergentset valiidsust. Uurimistööst saab järeldada, et eestikeelne PSC-17-Y on valiidne ja usaldusväärne hindamisvahend laste ja noorukite vaimse tervise sümptomaatika varajaseks tuvastamiseks.

Märksõnad: PSC-17-Y, psühhomeetriline analüüs, noorukid, lapsed, vaimne tervis

Psychometric properties of the SECMH questionnaire "Pediatric Symptom Checklist for Youth"

Abstract

The aim of this research was to analyse the psychometric properties of the Estonian PSC-17-Y self-assessment tool for children and adolescents. Data from the SECMH 2024 study was used (Tuvi et al., 2024) and the analytical sample of the current study was 389 respondents of version in Estonian aged 11-19 years (387 responded to PSC-17-Y and 389 responded to RCADS-25). Construct validity was evaluated using confirmatory factor analysis, and correlations with the RCADS-25 were used to test its convergent validity. The results showed a good model fit and validated the original three-factor structure (attention, internalizing, and externalizing problems). The internal reliability of the questionnaire was generally high, though the externalizing subscale showed lower reliability. A strong positive correlation with RCADS-25 values showed the convergent validity of PSC-17-Y. This suggests that the Estonian version of the PSC-17-Y is a valid and reliable assessment tool for the early detection of mental health symptomatology in children and adolescents.

Keywords: PSC-17-Y, psychometric analysis, adolescents, children, mental health

Introduction

The widespread occurrence of mental health problems (WHO, 2022) significantly impairs people's quality of life and the ability to cope with daily functioning. More than half of the participants over the age of 21 in a 20-year longitudinal study met the DSM-IV criteria for at least one psychiatric condition. Between 10-15% of people afflicted reported their illness has caused functional impairment (Jaffee et al., 2011). These results emphasize the importance of closely monitoring children's and adolescents' mental health and wellbeing, because mental health issues that emerge at a young age might have a negative impact on their development and future. Many developed countries have made considerable progress in child and adolescent mental health services. However, with the focus being mostly on children, it leaves adolescents with emerging mental health disorder symptoms, which are distinct from children's symptoms, without receiving early and adequate intervention. The delay in support increases the risk of neglect and is associated with elevated suicide rates (Patel et al., 2007). For this reason, regular screening of the youth population with effective and validated assessment tools has become an activity in many countries that aims to reduce the risk of development of mental disorders that may also lead to suicide.

The Pediatric Symptom Checklist (PSC), created by Dr. Michael S. Jellinek, is a widely used psychosocial screening tool. It is designed to assist the early identification of cognitive, emotional and behavioural problems in children and adolescents, thereby supporting timely intervention (Murphy et al., 2016). The PSC is not a detailed list of psychiatric symptomatology but rather focuses on children's and adolescents' daily functioning and adaptability in different settings. It helps to provide a good and general picture of the psychosocial well-being of children and adolescents (Jellinek, 2020). The original PSC is composed of 35 questions rated by parents on a three-tiered frequence scale: "never", "sometimes" and "often" (Murphy et al., 2016). The PSC was validated over thirty years ago and has been translated into more than 24 languages (Murphy et al., 2016). A major advantage of the PSC test is its free availability, which has contributed to its widespread use and validation in different cultural settings (Jellinek & Murphy, 2015).

Over time, different versions of the PSC have been developed to improve its applicability and accuracy. The most widely used shortened version is the Pediatric Symptom Checklist-17 (PSC-17), which was developed from the original PSC test using exploratory factor analysis in a study conducted between 1994 and 1999 (Murphy et al., 2016). The PSC-17 consists of 17 questions, clearly distinguished by three factors, which have evolved into

three subscales of the test: internalizing problems, externalizing problems and attention problems. As in the original PSC, parents rate the PSC-17 questions on a scale: “never” (0), “sometimes” (1) and “often” (2). Furthermore, since the development of the PSC and the PSC-17, there have also been developed two image-based versions and a youth self-assessment form, the Pediatric Symptom Checklist-17 (PSC-17-Y) (Murphy et al., 2016). The PSC-17-Y is intended for children and adolescents from the age 11 and takes about 5-10 minutes to complete, being statistically equivalent to both the PSC and the PSC-17 (Piqueras et al., 2021).

The PSC test is scored by summarising the scores of the answers. For the PSC-17, the total score ranges from 0-34, with the higher scores indicating a higher risk of psychosocial problems (Murphy et al., 2016). In terms of interpretation, exceeding the cut-off point for the composite score signals the need for further assessment of the child or adolescent. For the PSC-17, the global mental health risk indicator is a cutoff value of ≥15 for the total score. In addition, cutoff values for subscales are defined as: ≥7 for attention and externalizing problems and ≥5 for internalizing problems (Murphy et al., 2016). In the United States, the cutoff value for the PSC is set at ≥28, but psychometric studies have shown the need for adjusted cutoff scores in different cultures to fit differences in mean symptom scores. For example, for children and adolescents in the Netherlands, the most appropriate cutoff value has been found to be ≥22. That’s because the mean symptom scores were lower in the Netherlands than in the USA (Reijneveld et al., 2006). This suggests that cultural validation is important before using any assessment tools.

A careful multi-step cultural validation is necessary to adapt psychological assessment tools to a new cultural context. This is essential to ensure the relevance, adequacy and reliability of the test. Typically, the cultural validation of an assessment tool involves several stages, which can be broken down into four: translation, peer review, pre-testing in the target group (pilot study) and psychometric analysis. Additional steps may be necessary, like adapting the testing procedures or establishing norms for the target culture. The first step is the translation of the assessment tool into the target language, often by using the back translation method. This means that the original assessment tool is translated into the desired language, after which a person proficient in the original language translates the resulting version back into the original language. This helps to ensure conceptual equivalence and identify potential translation errors. The second step is to evaluate the translated version by an expert committee. This committee typically includes experts in culture and the measured

construct. The task of the committee is to analyse the cultural appropriateness of the translation to ensure that the content of the assessment tool retains its original meaning and is relevant in the respective culture. The third stage is about pre-testing the assessment tool with representatives of the target group. This gives initial feedback on the tool's comprehensibility, clarity and possible cultural connotations, which is necessary for further adaptation of the tool. The final stage is psychometric analysis. It involves assessing the statistical properties of the tool based on the collected data, such as its reliability and validity in the target culture. This will help determine whether the assessment tool is fit for the culture, if it functions as intended and if it is comparable to the original version (Borsa et al., 2012). These steps are a part of cultural validation process, which is important to ensure that the assessment tool is reliable and effective in the target culture.

The PSC has good psychometric properties that support its widespread clinical and scientific use. The high internal consistency of the test is confirmed, for example, by the Cronbach's alpha value of 0.89 for the Dutch version of the PSC (Reijneveld et al., 2006). Similar results have been found for the PSC-17, with an overall Cronbach's alpha score of 0.87 and subscales ranging from 0.78 to 0.82 (Murphy et al., 2016). In terms of validity, the PSC has a high ability to correctly classify children and adolescents with and without problems, which has been confirmed in comparison with other validated tests such as the Child Behaviour Checklist (CBCL). A large-scale replication study confirmed the relevance of the three-factor structure of the PSC-17 and the reliability of the assessment tool. The original derivation study found positive scores and reliability indicators (Murphy et al., 2016). In the Spanish PSC-17-Y validation study, confirmatory factor analysis also supported a correlative three-factor structure (Piqueras et al., 2021). Studies have shown that PSC test detection rates are higher than clinical assessment of psychosocial disorders (Jellinek, 2020).

Despite its strengths, the PSC also has certain limitations. The test may not cover all specific behavioural problems, such as alcohol or drug (ab)use, which require more specific assessment tools (Reijneveld et al., 2006). However, an important advantage of the PSC is that, as has been shown for other assessment tools (e.g. the SDQ or Strengths and Difficulties Questionnaire, (Kuhn et al., 2017)), comparing parent and child/adolescent perspectives increases the validity and overall usefulness of the questionnaire in assessing mental health (Kuhn et al., 2017). It is therefore suggested that assessment tools should use a similar structure, including both child and parent questionnaires. The PSC, its shortened version, the

PSC-17 and the shortened youth version, the PSC-17-Y, also use this approach, providing both parent and child/adolescent self-assessment forms (Murphy et al., 2016).

In 2024, the Study of Estonian Children's Mental Health (SECMH) was conducted in Estonia, with the aim of developing a methodology for further monitoring of children's mental health. For example, the questionnaire of this study included questions from the RCADS-25 (Revised Children's Anxiety and Depression Scale, (Chorpita et al., 2000; Ebesutani et al., 2012)). which measures features characteristic of depression and anxiety disorders and the PSC-17-Y for measuring attention and behavioural problems, among many other tests. In addition to these, the study also included questions to assess symptoms indicative of eating disorders and self-harm (Tuvi et al., 2024). PSC has shown to be useful for early detection of emotional and behavioural problems in children and adolescents in different cultures, with satisfactory reliability and internal consistency across different countries (Wijekoon et al., 2024). It is important to assess its performance and psychometric properties specifically among Estonian children and adolescents. While global studies, including the Spanish validation of the PSC-17-Y provide reliable evidence of its reliability and validity (Piqueras et al., 2021), the unique cultural and linguistic context of Estonia requires local validation. Therefore, the aim of this research is to analyse the data from the SECMH to analyse psychometric properties of the PSC-17-Y and culturally validate the questionnaire. The main research question is: What are the psychometric properties of the Estonian "Youth Pediatric Symptom Checklist" (PSC-17-Y)?

The hypothesises are:

H1: The factor structure of the Estonian PSC-17-Y questionnaire is similar to that of the English PSC-17-Y questionnaire, which would suggest good construct validity.

H2: The results of the Estonian PSC-17-Y questionnaire correlate positively with the results of the RCADS-25 questionnaire also used in the SECMH study.

Method

Sample

The sample for the SECMH study was put together from several stages, including a main sample and a late additional sample due to low participation (Tuvi et al., 2024). The sample consisted of randomly selected schools from seven Estonian regions, and two regions had additional Russian-speaking samples. The aim was to estimate the prevalence of mental health problems in youth population. At first, 89 schools were approached for the main sample, of which 44 agreed to participate. Study invitations were sent out to the parents of 2953 students, and 575 (19.5%) agreed. Due to low participation rate, an additional sample was drawn from 59 schools. Of this additional sample, 34 schools agreed to participate, and invitations were sent to the parents of 2807 students. Of them, 489 (17.4%) agreed. Across both samples, a total of 77 from 148 schools participated and approximately 361 classes agreed to participate. The sample of SECMH consisted of 681 children and adolescents. The participants' age ranged from 8 to 19 years: 52.1% were girls, 46.7% boys and 1.2% did not wish to disclose their gender (Tuvi et al., 2024). The responses given to Russian version of the survey and also the youngest respondents (8-10 years old), who responded to the version of survey without PSC-17-Y and RCADS-25 questionnaires, were excluded. The analytical sample of the current study was 389 respondents of version in Estonian aged 11-19 years (387 responded to PSC-17-Y and 389 responded to RCADS-25). Of those participants, 52.7% were girls and 46.0% boys while 0.8% did not wish to disclose their gender.

Ethics

The Estonian Children's Mental Health Survey (SECMH) is a large-scale project commissioned by the Ministry of Social Affairs and carried out in cooperation with the University of Tartu, the Institute for Health Development and Turu-uuringute AS. This research (planned to be longitudinal research), which deals with sensitive issues of children's and adolescents' mental health requires the collection of personal data and has been conducted in strict compliance with ethical principles and research practices. All phases of the study protocol were approved by the Institute for Health Development's Human Research Ethics Committee (reference no. 1239). Due to the vulnerability of the underage participants, the active and informed consent of the parents or legal guardians was essential, as it is indispensable for the processing of personalised health data and ensures the legitimacy of data collection. Prior to the data collection, participants and their legal representatives were provided with clear information about the survey via the school information systems and

offered the possibility to obtain further information. In order to ensure data protection and ethical data collection, the specific objectives and analyses of each survey wave are agreed with the Ethics Committee. Where necessary, specific active consent will be also sought for the linking of registry data. The consent collection procedures were carefully designed to promote representativeness of the sample, using communication strategies and considering school-specific factors, such as the collection of consents at the meetings beginning of the school year. The content of the questionnaire was tailored to specific age groups. The survey was conducted as a web-based questionnaire, avoiding invasive procedures and anonymity of participants was ensured. Participants were not remunerated for taking part in the survey (Tuvi et al., 2024).

Variables

The study collected self-reported demographic background data from children 8-19 years old in addition to self-reported information about mental health. Since the SECMH questionnaire varied for three age groups (8-10, 11-14 and 15-19), the content changed accordingly. The study had also parent questionnaire that was filled out by parents of all children. SECMH collected information from children about demographic variables, attention problems, externalizing and internalizing problems, anxiety and depression symptoms, self-harm, eating disorders and general risk & health behaviours, positive mental health, family conflicts, home crises, social relationships and issues, self-esteem, emotion regulation, bullying, physical activity, substance use, alcohol consumption and awareness of mental health services. For these, assessment tools such as WHO-5, the Danish MeHLA questionnaire, Kidscreen-52 and the Difficulties in Emotion Regulation Scale were used. In the current paper only anxiety and depression symptoms (RCADS-25) questionnaire responses and diagnose information is used for validation of PSC-17-Y.

Demographic variables

Information collected at the beginning of the SECMH questionnaire about the child's age, gender, home language, family type, household, and parent(s)' education and socioeconomic background.

Externalizing, internalizing and attention problems

PSC-17-Y test questions were used for children aged 11-19, while their parents completed the parent version of the PSC-17 questionnaire. The questionnaire was translated into both Estonian and Russian for this study. The number of respondents to the Russian version of PSC-17-Y was very small (n=109), therefore this version is not analyzed in the

current paper. Questions were rated on a three-point frequency scale: “never” (0), “sometimes” (1) and “often” (2).

Depression and anxiety symptoms

For children aged 11-19, RCADS-25 was used to assess depression and anxiety symptoms. An Estonian version was already available, but a Russian version was created specifically for this study.

The RCADS-25 (Revised Child Anxiety and Depression scale) is designed to assess symptoms of anxiety and depression in children and adolescents (Chorpita et al., 2000; Ebesutani et al., 2012). The 25-item self-assessment scale is derived from the original 47-item RCADS based on the Spence Children’s Anxiety Scale. Unlike the original version, the RCADS-25 assesses general anxiety and depression without measuring anxiety subtypes (Carlander et al., 2024). There are versions of the RCADS that can be completed by both the children (RCADS-25-C) and the parents (RCADS-25-P). A systematic review and meta-analysis involving 146 studies has confirmed the good psychometric properties of different versions of RCADS, including shorter versions (Piqueras et al., 2017). The overall reliability of RCADS as a mental health assessment tool is widely supported in several settings. This makes the RCADS-25 a suitable and validated tool for assessing anxiety and depression in children and adolescents (Carlander et al., 2024).

Procedure (SECMH)

Pilot study

Prior to the main study a pilot study was conducted to ensure the suitability and comprehensibility of the questionnaire for the target group and to optimise data collection procedures. The pilot study consisted of two phases: individual interviews and class testing. Individual interviews were conducted in three schools based on a convenience sample. The interviews were conducted and the students recruited by school psychologists who were part of the pilot study team. All interviews were audio-recorded with prior consent. In the first part of the interviews, the children were introduced to the instructions and the content of the questionnaire and asked to comment on any points that were not understood or to suggest rewording. Data collectors rated the comprehensibility of each item on a scale of 1-3. The feedback received was collected and analysed to identify the lowest rated statements and questions. After that, suggestions were made by the research team to improve the wording of the questionnaire. The second phase of the pilot study took place in the classroom, with the

aim of refining the questionnaire's self-completion by the children, determining the additional instructions needed and the average time taken to complete it. Procedural and technical aspects were also assessed. The sample for class testing was also selected based on convenience sampling in the same school where the interviews took place, however, ensuring that the students did not previously also participate in the interviews (Tuvi et al., 2024).

Main study

The SECMH study data collection was conducted digitally, using the LimeSurvey application. The entire process was divided into two parts: obtaining consents and engaging children and parents, then conducting the questionnaires. To begin, school contact persons forwarded information about the study along with a consent form to parents. In addition, consent was also requested for the storing of personal data, as well as re-contacting for the purpose of follow-up studies. Parents who agreed to their child's participation then accessed the parent questionnaire. The collected data was saved as data files in the LimeSurvey account. After obtaining parental consent, the children's survey was conducted by an interviewer instructed by Turu-uuringute AS. Tablets were used, either provided by the school or Turu-uuringute AS. Parents were provided with slips containing unique codes based on their children's names, which were necessary for accessing the questionnaire. Children also provided two consents: for participation in the study and for re-contacting for the purpose of follow-up studies. The surveys took place in classrooms over 45 minutes. A detailed observation protocol was prepared for each survey.

Statistical analysis

The data related to the PSC-17-Y and RCADS-25 questionnaires were extracted from the SECMH survey dataset. Psychometric analysis of the data was done using JASP (0.19.1) software. The analysis included the following steps, aimed at testing the hypotheses of this research: data preparation, reliability analysis, factor structure analysis and correlation analysis. A primary check and cleaning of the data (listwise deletion) in JASP was performed, including the identification of missing values (e.g. substitution/exclusion) and possible inaccuracies. There were missing data, which were handled by using the listwise deletion method. In addition, the normal distribution of the data and the presence of possible outliers were checked to ensure the applicability of the statistical methods chosen.

Reliability analysis

The internal consistency of the PSC-17-Y was assessed, indicating the extent to which the individual items of the scale measure the same construct. Internal consistency was

calculated using Cronbach's alpha coefficient for both the overall PSC-17-Y scale and its three subscales. Cronbach's alpha values were estimated according to generally accepted criteria (≥0.70) (Tavakol & Dennick, 2011).

Factor structure analysis

In order to assess the construct validity of the Estonian PSC-17-Y questionnaire (whether the scale measures what it is supposed to measure) and to compare its underlying factor structure with the known three-factor structure of the original English version, a confirmatory factor analysis (CFA) was conducted in JASP. Due to the ordinal nature of the data and the non-normal distribution of the items, the Weighted Least Squares Mean and Variance adjusted (WLSMV) estimator was used. The fit of the model to the data was assessed based on a number of fit indexes that provide different perspectives on the goodness of the model:

- Relative chi-square – the ratio of chi-square and degrees of freedom ($\chi 2/df$) - has been argued to be better index of fit than $\chi 2$ and degrees of freedom separately. Values between 5.0 and 2.0 indicate acceptable fit, lower values (<3) indicate a good fit (Hooper et al., 2008).
- Tucker-Lewis Index (TLI): values ≥0.95 indicate a good fit (robust) (Brosseau-Liard & Savalei, 2014).
- Root Mean Square Error of Approximation (RMSEA): values ≤0.10 indicate an acceptable fit (robust) (Brosseau-Liard & Savalei, 2014).

Correlation analysis

To assess the validity of the convergent nature of the Estonian PSC-17-Y questionnaire (whether it correlates positively with another assessment tool measuring similar psychopathological symptoms, the RCADS-25), a Pearson correlation analysis was performed. The correlations of the PSC-17-Y total score and its three subscales with the RCADS-25 total score and its subscales were assessed. Positive and statistically significant correlations would indicate good convergent validity.

Results

The average symptom level varied between male and female participants, but the direction depended on the specific subscale (Table 1). PSC-17-Y total scores were significally higher for the female participants (M=12.18, SD=1.53) than for the male participants (M=10.57, SD=5.94), and this difference was statistically significant. Similar results were found for the internalizing and attention subscales, where the female participants also had

higher scores (M=4.94, SD=2.66; M=4.72, SD=2.47). However, the externalizing subscale provided a contrast, with boys having statistically significantly more behavioral problems than girls (M=3.12, SD=2.13).

The internal consistency of the PSC-17-Y subscales was assessed using Cronbach's α (Table 1). The reliability coefficient for all PSC-17-Y scales ranged from 0.60 (EXT, male) to 0.86 (Total, female). Though, the reliability of the Total score was high for both genders (α=0.86, female & α=0.85, male). The lowest score was found on the EXT subscale (α=0.60, male; α=0.68, female). This subscale also showed the lowest inter-item correlation (M=0.21; min=0.18; max=0.25).

Confirmatory Factor Analysis (CFA) was used to assess the PSC-17-Y three-factor (ATT, INT and EXT) model's fit. Due to the ordinal nature of the data and non-normal distribution, the WLSMV estimator was used. The model fit indices showed a very good fit (TLI=0.96, RMSEA=0.05, $\chi 2/df=2.00$), exceeding the common thresholds for a good fit. The factor loadings for all 17 items (ranging from 0.52-0.87) are shown in Table 2. All factor loadings were positive and statistically significant ($p<0.001$), confirming that each question contributes significantly to its distinct factor. In addition, the factor covariances (Table 2) ranged from 0.47-0.74, supporting the distinctiveness of the subscales.

The correlations between the PSC-17-Y subscales and the RCADS-25 scales were assessed by using the Pearson's correlation coefficient (Table 3). The PSC-17-Y and RCADS-25 correlation values showed all positive and statistically relevant correlations ($p<0.001$).

The PSC-17-Y Total had the highest values among all the correlations, highest being with the RCADS Total (r=0.81). In addition, the RCADS anxiety and RCADS depression subscales also showed a strong positive correlation with the PSC-17-Y total (r=0.73, r=0.80). The PSC-17-Y INT subscale showed strongest correlations with the RCADS Total and RCADS depression subscales (r=0.81, r=0.79). In contrast, the correlation with the RCADS anxiety subscale was slightly lower, though it still within the acceptable range (r=0.75). The PSC-17-Y ATT subscale had a moderate correlation with the RCADS scales (r=0.64-0.69), indicating that the ATT subscale is different from internalizing and externalizing factors. The PSC-17-Y EXT subscale and the RCADS scales had the weakest correlations (r=0.35-0.43), which was expected as the RCADS-25 focuses primarily on the assessment of internalizing symptoms.

Table 1

Descriptive statistics and internal reliability of PSC-17-Y and RCADS-25

Name of scale	Cronbach α (95% CI)		Interitem correlations			McDonald ω (95% CI)		Score, mean (SD)	
	Female	Male	Mean	Min	Max	Female	Male	Female	Male
PSC-17-Y ATT	0.73 (0.67-0.79)	0.77 (0.72-0.82)	0.39	0.34	0.44	0.73 (0.68-0.79)	0.76 (0.71-0.81)	4.72** (2.47)	3.97 (2.45)
PSC-17-Y INT	0.81 (0.77-0.85)	0.79 (0.75-0.84)	0.47	0.43	0.52	0.80 (0.75-0.84)	0.79 (0.74-0.84)	4.94*** (2,66)	3.46 (2.66)
PSC-17-Y EXT	0.68 (0.62-0.75)	0.60 (0.51-0.68)	0.21	0.18	0.25	0.67 (0.59-0.74)	0.58 (0.49-0.68)	2.52 (2.13)	3.12** (2.13)
PSC-17-Y Total	0.86 (0.83-0.89)	0.85 (0.81-0.88)	0.25	0.21	0.28	0.86 (0.84-0.89)	0.85 (0.81-0.88)	12.18** (1.53)	10.57 (5.94)
RCADS Anxiety	0.87 (0.84-0.90)	0.86 (0.83-0.89)	0.25	0.22	0.28	0.87 (0.85-0.90)	0.86 (0.83-0.89)	13.22 (7.34)	8.84 (6.31)
RCADS Depression	0.90 (0.88-0.92)	0.88 (0.86-0.91)	0.43	0.40	0.47	0.89 (0.87-0.91)	0.88 (0.85-0.90)	9.94 (5.93)	7.65 (5.46)
RCADS Total	0.93 (0.92-0.94)	0.93 (0.91-0.94)	0.30	0.27	0.33	0.93 (0.92-0.94)	0.92 (0.91-0.94)	23.16 (12.55)	16.49 (11.08)

Note. *p<0.05, **p<0.01, ***p<0.001

Table 2
Factor loadings of PSC-17-Y

Factor	Indicator	Std. estimate	Std. Error	z-value	95% Confidence Interval Lower	Upper
ATT	Y_PSC_1	0.78	0.04	22.43	0.70	0.84
	Y_PSC_3	0.58	0.05	12.88	0.49	0.67
	Y_PSC_17	0.80	0.03	26.34	0.74	0.86
	Y_PSC_13	0.58	0.05	12.33	0.49	0.67
	Y_PSC_7	0.87	0.02	37.71	0.83	0.92
INT	Y_PSC_2	0.85	0.03	30.60	0.79	0.90
	Y_PSC_15	0.78	0.03	25.18	0.72	0.84
	Y_PSC_9	0.72	0.04	19.07	0.65	0.79
	Y_PSC_11	0.68	0.04	16.08	0.59	0.76
	Y_PSC_6	0.87	0.03	32.17	0.82	0.92
EXT	Y_PSC_4	0.56	0.06	10.31	0.46	0.67
	Y_PSC_12	0.61	0.06	10.80	0.50	0.73
	Y_PSC_16	0.57	0.09	6.26	0.39	0.74
	Y_PSC_14	0.57	0.07	8.17	0.43	0.71
	Y_PSC_5	0.62	0.06	10.86	0.51	0.74
	Y_PSC_10	0.61	0.06	9.64	0.49	0.74
	Y_PSC_8	0.52	0.08	6.93	0.37	0.67
Factor Covariances of PSC-17-Y factors						
ATT↔INT		0.74	0.03	22.50	0.68	0.81
ATT↔EXT		0.67	0.05	13.82	0.57	0.76
INT↔EXT		0.47	0.06	8.09	0.35	0.58

Note. $p<0.001$

Table 3

PSC-17-Y and RCADS-25 Pearson correlations

Variable	RCADS Total	RCADS Anxiety	RCADS Depression	PSC_17_Y Total	PSC_17_Y INT	PSC_17_Y ATT	PSC_17_Y EXT
RCADS Total	1	—	—	—	—	—	—
RCADS Anxiety	0.96	1	—	—	—	—	—
RCADS Depression	0.93	0.79	1	—	—	—	—
PSC_17_Y Total	0.81	0.73	0.80	1	—	—	—
PSC_17_Y INT	0.81	0.75	0.79	0.84	1	—	—
PSC_17_Y ATT	0.69	0.64	0.68	0.87	0.62	1	—
PSC_17_Y EXT	0.42	0.35	0.43	0.71	0.34	0.48	1

Note. $p<0.001$

Discussion

The aim of this research was to analyse the psychometric properties and conduct a cultural validation of the Estonian PSC-17-Y assessment tool, using data from the SECMH study (Tuvi et al., 2024).

Factor structure similarities between the Estonian PSC-17-Y and English PSC-17-Y

For the first hypothesis, the factor structure similarities between the Estonian PSC-17-Y and English PSC-17-Y were measured using the CFA. As predicted in H1, the CFA confirmed that the three-factor structure (ATT, INT, EXT) of the Estonian PSC-17-Y is consistent with the English version. The values obtained (RMSEA=0.05, TLI=0.96, $\chi 2/df$ =2.00) were within the academically accepted range (RMSEA ≤ 0.10, TLI ≥ 0.95, $\chi 2/df < 3$ (Brosseau-Liard & Savalei, 2014; Hooper et al., 2008)). These results confirm the validity of the model and are consistent with previous studies, including the Spanish validation study (Piqueras et al., 2021) and the original English study (Murphy et al., 2016). All factor loadings were positive and significant ($p<0.001$), this confirms that each subscale measures a specific construct. In addition, the factor covariances (ranging from 0.47-0.74) indicated that each subscale measured a distinctive construct. This supports the first hypothesis, showing good construct validity of the Estonian PSC-17-Y among Estonian children and adolescents.

In addition to the construct validity, the scale showed good internal reliability. Both males and females had high reliability coefficients in the ATT, INT subscales and the total score (0.73-0.86), being consistent with previous findings by Murphy et al. (2016). Though, the values were lower for the EXT subscale (males=0.60, females=0.68), with the low inter-item correlations (mean=0.21, min=0.18, max=0.25). This suggests that the questions in the EXT subscale measure too many different symptoms. This can often be an issue in shorter assessment tools, where each item carries a heavy load.

Correlation between the Estonian PSC-17-Y and the RCADS-25 questionnaires

For the second hypothesis, the correlations between the Estonian PSC-17-Y and the RCADS-25 assessment tools were analysed using the Pearson's correlation coefficient. The results showed statistically significant positive correlations between both scales total scores (RCADS & PSC-17-Y Total r=0.81), supporting the convergent validity of the Estonian PSC-17-Y. This means that the assessment tool measures similar symptoms to the RCADS-25. For example, the PSC-17-Y Total and INT subscale correlated strongly with all RCADS-25 scales (PSC total & RCADS Anxiety r=0.73, INT & RCADS Total r=0.81), though the correlation between INT and RCADS Anxiety subscale was slightly lower while still staying

within the acceptable range (r=0.75). This indicates that the PSC-17-Y is a great tool for assessing internalizing symptoms (like depression and anxiety symptoms). Analysis showed weaker correlations between the PSC-17-Y ATT subscale and the RCADS-25 scales, though it was still in the acceptable range (r=0.64-0.69). In contrast, the PSC-17-Y EXT subscale correlated quite weakly with the RCADS-25 scales (r=0.35-0.43). Though, a lower correlation was expected as the RCADS-25 assessment tool focuses more on internalizing symptoms. This shows discriminant validity, meaning that the items of PSC-17-Y all measure different symptoms (both externalizing and internalizing), as intended.

The results of this paper have shown that the Estonian PSC-17-Y is a reliable and valid short assessment tool in identifying mental health issues among Estonian children and adolescents. The results of CFA supported the first hypothesis, confirming the good fit of the original English three-factor structure with the Estonian PSC-17-Y data (TLI=0.96, RMSEA=0.05, $\chi 2/df = 2.00$). Similarly, the second hypothesis found confirmation through its positive and statistically significant correlation with the RCADS-25 assessment tool (PSC-17-Y Total and RCADS-25 Total r=0.81), supporting the convergent validity of PSC-17-Y. The results of this study show that the Estonian PSC-17-Y is a suitable short assessment tool to measure internalizing and externalizing symptoms in Estonian children and adolescents with its strong internal reliability, convergent validity and construct validity.

Limitations

The first limitation is the low participation rate despite the sample size of 681 children and adolescents. Only 11.8% of the invited students were included in the sample, with 19.5% from the main sample and 17.4% from the additional sample agreeing to participate (Tuvi et al., 2024). Because of the low participation rate, there is a chance that study participants will differ from non-participants due to selection bias. Additionally, since PSC-17-Y is a self-assessment tool (with a parent form), participants' social desirability bias may also have an impact on their answers. Another limitation is the reliability of the PSC-17-Y externalizing subscale. Although the overall validity of the assessment tool was good, the lower scores on the EXT subscale indicate that this scale is not very homogeneous. This means that the scale may measure too many different behavioural problems, which limits its accuracy. In addition, it was difficult to measure the convergent validity of the PSC-17-Y EXT subscale, because the RCADS-25 mainly measures internalizing symptoms. The last limitation to mention is that in this research, the PSC-17-Y scale was compared with only one other assessment tool.

The validity of PSC-17-Y could be further confirmed by comparing it with the scores of other relevant assessment tools or objective indicators (e.g., clinically relevant diagnoses).

Future research

The construct validity and convergent validity of the Estonian PSC-17-Y among Estonian children and adolescents has been validated by the psychometric analysis of this study, but some topics still require more research. First, the consistency of the PSC-17-Y over time should be studied. One way to assess changes in symptoms during the children's development is to conduct longitudinal research with regular assessment intervals. It is also important to assess the consistency of the information provided by the child or adolescent and their parents. This helps to improve the generalizability and leads to better knowledge of the child's mental wellbeing. Lastly, since the externalizing subscale had low internal consistency, an analysis of its convergent validity should be conducted. This could be done by comparing the Externalizing subscale's results with assessment tools that specifically measure externalizing symptoms.

Contribution

Author's contribution was analysis of the data, drawing conclusions, writing all parts of the text. SECMH study research team collected data, cleaned the data, stored the data and shared the necessary parts of the datafile with the author. Supervisor's contribution was discussion of the idea, analysis, review of the text and review of all stages of this research, including the data collection.

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