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The Child Behavior Checklist and Youth Self-Report in adolescents with epilepsy: Testing measurement invariance of the Attention and Thought Problems subscales

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ABSTRACT

The objective of this study was to test for the measurement invariance of the Attention and Thought Problems subscales of the Child Behavior Checklist (CBCL) and Youth Self-Report (YSR) in a population-based sample of adolescents with and without epilepsy. Data were obtained from the 14-year follow-up of the Mater University Study of Pregnancy in which 33 adolescents with epilepsy and 1068 healthy controls were included for analysis. Confirmatory factor analysis was used to test for measurement invariance between adolescents with and without epilepsy. Structural equation modeling was used to test for group differences in attention and thought problems as measured with the CBCL and YSR. Measurement invariance was demonstrated for the original CBCL Attention Problems and YSR Thought Problems. After the removal of ambiguous items ("confused" and "daydreams"), measurement invariance was established for the YSR Attention Problems. The original and reduced CBCL Thought Problems were noninvariant. Adolescents with epilepsy had significantly more symptoms of behavioral problems on the CBCL Attention Problems, $\beta = 0.51$, $p = 0.002$, compared with healthy controls. In contrast, no significant differences were found for the YSR Attention and Thought Problems, $\beta = -0.11$, $p = 0.417$ and $\beta = -0.20$, $p = 0.116$, respectively. In this population-based sample of adolescents with epilepsy, the CBCL Attention Problems and YSR Thought Problems appear to be valid measures of behavioral problems, whereas the YSR Attention Problems was valid only after the removal of ambiguous items. Replication of these findings in clinical samples of adolescents with epilepsy that overcome the limitations of the current study is warranted.

1. Introduction[1]

Having a chronic health condition in childhood and adolescence is a risk factor for behavioral problems, [1], and recent evidence suggests that patients with neurological conditions, including epilepsy, have the strongest association with behavioral problems compared with healthy controls and those with other chronic conditions [2]. While a variety of scales exist to quantify behavioral problems in adolescents with epilepsy, the most frequently used measures are the parent-reported Child Behavior Checklist (CBCL) and the adolescent-reported Youth Self-Report (YSR) because of their broad use, ease of administration, sound empirical grounding, and available norms [3]. Scoring the CBCL and YSR yields a total problem score, two broadband scores (internalizing and externalizing problems), as well as eight subscale scores for symptoms relating to withdrawn, somatic complaints, anxious/depressed, delinquent, aggressive, and social problems, attention problems, and thought problems [4]. The CBCL and YSR continue to be used widely in both clinical and research settings despite longstanding concerns about their validity in children and adolescents with chronic health conditions [5,6].

In a large meta-analytic review, researchers found that attention and thought problems appeared to be relatively specific to adolescents with epilepsy compared with adolescents with other chronic conditions [3]. Building from that work, other researchers have noted that several items of the CBCL and YSR, particularly those that are indicative of attention or thought problems, can be misinterpreted as seizure-related, and not behavioral, problems (Table 1) [7]. Endorsement of these potentially

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[1] CBCL, Child Behavior Checklist; CI, confidence interval; CFI, Comparative Fit Index; df, degrees of freedom; MUSP, Mater University Study of Pregnancy; RMSEA, Root Mean Square Error of Approximation; TLI, Tucker–Lewis Index; WRMR, Weighted Root Mean Square Residual; YSR, Youth Self-Report.

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Table 1
Items used to construct the CBCL and YSR Attention and Thought Problems subscales.

	CBCL		YSR	
Attention Problems	1.	Acts too young for his/her age	1.	I act too young for my age
	8.	Can't concentrate, can't pay attention for long	8.	I have trouble concentrating or paying attention
	10.	Can't sit still, restless, or hyperactive	10.	I have trouble sitting still
	13.	Confused or seems to be in a fog[a]	13.	I feel confused or in a fog[a]
	17.	Daydreams or gets lost in his/her thoughts[a]	17.	I daydream a lot[a]
	41.	Impulsive or acts without thinking	41.	I act without stopping to think
	61.	Poor school work	61.	My schoolwork is poor
	80.	Stares blankly[a]		
Thought Problems	9.	Can't get his/her mind off certain thoughts; obsessions	9.	I can't get my mind off certain thoughts
	18.	Deliberately harms self or attempts suicide	18.	I deliberately try to hurt or kill myself
	40.	Hears sounds or voices that aren't there	40.	I hear sounds or voices that other people think aren't there
	46.	Nervous movements or twitching[a]	46.	Parts of my body twitch or make nervous movements[a]
	58.	Picks nose, skin, or other parts of body	58.	I pick my skin or other parts of my body
	59.	Plays with own sex parts in public	66.	I repeat certain actions over and over
	60.	Plays with own sex parts too much	70.	I see things that other people think aren't there
	66.	Repeats certain acts over and over	76.	I sleep less than most kids
	70.	Sees things that aren't there	83.	I store up things that I don't need
	76.	Sleeps less than most kids	84.	I do things that other people think are strange[a]
	83.	Stores up things he/she doesn't need	85.	I have thoughts that other people would think are strange
	84.	Strange behavior[a]	100.	I have trouble sleeping
	85.	Strange ideas		
	92.	Talks or walks in sleep		
	100.	Trouble sleeping		

CBCL, Child Behavior Checklist; YSR, Youth Self-Report.
[a] Indicates items ambiguous with seizure characteristics. Additional ambiguous items (CBCL #107, "wets self during the day"; #108, "wets the bed") identified by Oostrom et al. [7] were not included as these items relate to other behavioral problems.

ambiguous items that may relate to seizure semiology may artificially elevate scores, resulting in misclassification when thresholds are used to identify risk of behavioral problems. Oostrom et al. demonstrated that among children with epilepsy, the proportion of children who achieved or surpassed threshold scores for behavioral problems on at least one of the CBCL subscales decreased from 46% to 23% when the seven ambiguous items were removed [7]. Similarly, in a study of children undergoing epilepsy surgery, Gleissner et al. found a reduction of 16% and 5% for the CBCL Attention and Thought Problems subscales, respectively, when ambiguous items were removed in the children's preoperative assessment [8]. However, Austin et al. showed that parents of children with epilepsy reported higher levels of child psychopathology when compared with parents of children in the general population, even after excluding child behaviors that reflected seizure semiology [9].

These previous studies have attempted to identify and remove potentially ambiguous items in order to validate the CBCL in children with epilepsy; however, not formally testing measurement invariance, such methods may discard useful information for understanding the mental health of this vulnerable population. Measurement invariance testing assesses the extent to which the psychometric properties of observed indicators are generalizable across groups to determine if the same construct is being measured in the same way. Often assumed, but rarely tested, violation of this assumption can result in biased comparisons between groups [10], whereas establishing measurement invariance enables the interpretation of group differences to be real and meaningful, rather than the product of differences in the interpretation of the measure. Although the CBCL and YSR are widely used in studies of adolescents with epilepsy, they have not undergone thorough assessments of validity and reliability to ensure measurement invariance in this population. If measurement invariance is established, clinicians and researchers can be confident in utilizing these scales in adolescents with epilepsy. However, if evidence suggests a lack of measurement invariance, this finding would provide the impetus for the development of more robust and invariant measures of child behavior.

Adolescents with epilepsy are at increased risk of attention and thought problems that might arise from epilepsy-related ambiguity among items. Accordingly, the objective of this study was to test for measurement invariance of the Attention and Thought Problems subscales of the CBCL and YSR in a population-based sample of adolescents with and without epilepsy. If measurement invariance was not established for either subscale, ambiguous items were removed and the subscales retested. Where measurement invariance was demonstrated, the effect of epilepsy on subscale scores, controlling for potential confounding factors, was examined.

2. Materials and methods

2.1. Data source

The Mater University Study of Pregnancy (MUSP) is a long-term study of mothers and their children that follows their social, psychological, and physical development from the prenatal period to early adulthood [11]. The MUSP was designed to collect information about factors that influence maternal and child health and to understand the impact of these factors on healthy development through the life course [12,13].

Mater University Study of Pregnancy recruited consecutive women who received public prenatal care from the Mater Misericordiae Hospital in Brisbane, Australia between 1981 and 1983 [11]. A total of $n = 8556$ women were invited to participate (1% declined participation). Women receiving privatized care and those transferred from other hospitals (often requiring intensive neonatal care) were excluded from the study. Mothers and their offspring were followed and completed assessments at 3–5 days, 6 months, and 5, 14, 21, and 30 years after the birth. The MUSP cohort consists of $n = 7223$ (85%) live singleton offspring for whom maternal data were available at discharge from the hospital.

2.2. Participants

The 14-year follow-up of the MUSP was used for the current analysis as it included mother- and offspring-reported health and behavioral assessments in early adolescence, an important developmental timepoint in the life course. A total of $n = 5171$ (72%) mothers and