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RESEARCH ARTICLE

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Validating the Ontario Child Health Study Emotional Behavioural Scales-Brief Version (OCHS-EBS-B) in children with chronic physical illness

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Abstract

Background: A substantial proportion of children have a physical illness; these children commonly experience physical–mental comorbidity. To assess child mental health, brief scales that can be used in clinical and research settings are needed. This study assessed the validity and reliability of parent-reported Ontario Child Health Study Emotional Behavioural Scale-Brief Version (OCHS-EBS-B) scores.

Methods: Data come from a longitudinal study of children aged 2–16 years with a physical illness recruited from outpatient clinics at a pediatric hospital. Confirmatory factor analysis and McDonald's coefficient assessed the factor structure and internal consistency reliability of the OCHS-EBS-B, respectively. Point biserial correlations assessed agreement between the OCHS-EBS-B and Mini International Neuropsychiatric Interview for Children and Adolescents (MINI-KID), a structured diagnostic interview. The Wilcoxon rank sum test compared OCHS-EBS-B scores between children with versus without physical–mental comorbidity (known-group validity).

Results: The three-factor structure of the OCHS-EBS-B was replicated in this sample of children with physical illness ($\chi^2 = 196.23(272)$, $p < 0.001$; CFI = 0.98; TLI = 0.98; SRMR = 0.06; RMSEA [90% CI] = 0.034 [0.027, 0.044]). It had excellent internal consistency reliability ($\omega = 0.86–0.92$) and was moderately correlated with the MINI-KID (baseline: $r_{pb} = 0.43–0.51$; 6 months: $r_{pb} = 0.55–0.65$). OCHS-EBS-B scores were significantly higher among children with versus without physical–mental comorbidity.

Conclusions: Findings confirm psychometric evidence that the OCHS-EBS-B is a valid and reliable measure of mental health in children with chronic physical illness. Its brevity and robust psychometric properties make the OCHS-EBS-B a strong candidate for routine use in integrated pediatric physical and mental health services.

KEYWORDS
agreement, chronic disease, measurement, mental health, reliability, validity

1 | INTRODUCTION

The presence of chronic physical illness, such as asthma, diabetes mellitus and epilepsy, is common among children. Research conducted in the United States suggests that approximately 25% of children have a chronic physical illness (Van Cleave et al., 2010), which is an independent risk factor for the development of mental illness (i.e. physical–mental comorbidity) (Adams et al., 2019). The prevalence of mental comorbidity among children with chronic physical illness is variable, dependent on sampling methods (population vs. clinical), measures (structured interview vs. self-administered checklist) and included illnesses. Current estimates suggest prevalence is between 30% and 60% and effects are pervasive (Butler et al., 2018; Ferro et al., 2022; Tegethoff et al., 2015).

The chronicity of physical–mental comorbidity shows stable and persistent homotypic and heterotypic continuity in children (Ferro et al., 2024), and the negative impact of childhood chronic physical illness on mental health extends into young adulthood (Ferro et al., 2015). Relatedly, presence of a chronic physical illness compounds the need for mental health services. In reference to healthy controls, whereas young people with a mental illness were approximately eight times more likely to report using mental health services, those with physical–mental comorbidity were nearly 13 times more likely to report using such services (Reaume et al., 2021). Effects of physical–mental comorbidity on psychosocial health are also prominent in children. Evidence suggests that although physical and mental illness independently have negative influences on child health-related quality of life and self-concept (Ferro & Boyle, 2013; Silva et al., 2019), effects are compounded in children with physical–mental comorbidity in a dose–response manner across morbidities (Ferro, Dol, Patte, et al., 2023; Ferro, Qureshi, et al., 2021). Levels of physical activity in children with physical–mental comorbidity are also compromised, especially among children experiencing mood or anxiety disorders who are less likely to meet physical activity guidelines (Bedard et al., 2023). Physical–mental comorbidity often does not affect a child insolation—negative effects permeate the health and well-being of members of the family. For instance, parents and siblings of children with physical–mental comorbidity have poorer mental health and quality of life compared to population norms (Qureshi et al., 2022; Reed et al., 2023). Given the physical, mental and psychosocial health impacts experienced by these children, the need to integrate physical and mental health services within pediatric settings is pressing (Das et al., 2016; Fazel et al., 2021; Schwartz & Feudtner, 2019).

Fundamental to the successful implementation of integrated health services is the ability to routinely assess child mental health validly, reliably and efficiently. Diagnostic interviews have been treated as the gold standard to generate clinical diagnoses of child mental illness. However, they are often time consuming, financially costly, require training, have shown only moderate reliability and, given the nature of their administration, may be prone to social desirability bias. In contrast, self-reported checklists are relatively quick and inexpensive to administer, reducing individual and clinic burden; are easy to score, providing information more readily for treatment-related decisions; afford individual privacy during data collection, which may reduce information biases; and often measure symptom severity, which can help delineate changes in mental health over time and be used as outcome measures when evaluating responses to intervention. Importantly, recent evidence suggests psychometric equivalence of parent-reported checklists and structured diagnostic interviews, both for validity and reliability, in the context of assessing child mental health (Boyle et al., 2017, 2023). A recent study also showed that semi-structured interview classifications were not statistically different to classifications derived from symptom checklists in terms of test accuracy and predictive validity for life outcomes (Hoffmann et al., 2024).

Key Messages

- Because children with physical illness are at increased risk of developing a comorbid mental illness, valid and reliable tools to assess mental health that can be incorporated into routine care are critical.
- The Ontario Child Health Study Emotional Behavioural Scales-Brief (OCHS-EBS-B) is a 25-item self-report checklist measuring symptoms of emotional, behavioural and attentional problems.
- The factor structure of the OCHS-EBS-B was replicated, internal consistency was excellent, and agreement with a structured interview was moderate and improved over time
- Children with physical–mental comorbidity had higher OCHS-EBS-B scores (vs. those with physical illness only).
- The OCHS-EBS-B showed evidence of robust psychometric properties in children with physical illness.

One self-reported checklist that holds promise for supporting efforts in integrating pediatric physical and mental health services is the Ontario Child Health Study Emotional Behavioural Scales-Brief Version (OCHS-EBS-B) (Boyle et al., 2022). This 25-item checklist was developed from the 52-item OCHS-EBS and has been assessed among children aged 4–17 years. The OCHS-EBS-B has a correlated three-factor structure reflecting the mental health symptoms of emotional, behavioural and attentional problems. Reliability with regard to internal consistency ($\alpha = 0.81–0.87$) and test–retest of the OCHS-EBS-B ($r = 0.81–0.91$) is sound, as is its agreement with a structured diagnostic interview ($\kappa = 0.73–0.90$) (Boyle et al., 2022). Further, the OCHS-EBS-B offers considerable advantages over other established self-reported checklists that assess the mental health of children with chronic physical illnesses (Thabrew et al., 2017). For instance, compared to the Child Behavior Checklist/Youth Self Report, the OCHS-EBS-B is freely available and takes substantially less time to complete (3 min vs. 15 min) and, in contrast to the Strengths and Difficulties Questionnaire, is aligned with diagnostic criteria.

To extend the psychometric evidence base of the OCHS-EBS-B, we investigated the extent to which scores were valid and reliable for assessing the mental health of children with physical illness.

Specifically, we attempted to replicate its factor structure and confirm its reliability and validity in terms of internal consistency, agreement with a structured diagnostic interview and comparison between children with versus without physical–mental comorbidity. We hypothesized that the correlated three-factor structure of the OCHS-EBS-B would be replicated in our sample of children with physical illness; internal consistency would be good ($\omega > 0.70$), and agreement with the Mini International Neuropsychiatric Interview for Children and Adolescents (MINI-KID), a structured interview, would be good using point biserial correlation ($r_{pb} \geq 0.30$); differences in OCHS-EBS-B scores between children with versus without physical–mental comorbidity (as measured using the MINI-KID) would be at least small in magnitude ($d \geq 0.20$); and correlations between the OCHS-EBS-B subscales and World Health Organization Disability Assessment Schedule (WHODAS) 2.0, a proxy for somatic health, would be at least medium in magnitude ($\rho \geq 0.30$).

2 | METHODS

2.1 | Sample and design

This study was a secondary analysis of data collected in Multimorbidity in Children and Youth across the Life-course (MY LIFE), an ongoing longitudinal survey of the mental health of children with chronic physical illness (Ferro et al., 2019; Ferro, Lipman, et al., 2021). Children aged 2–16 years diagnosed with a physical illness and their primary caregiving parent were recruited from outpatient clinics at a pediatric hospital in Canada and completed assessments at baseline, 6, 12, 24 and 48 months. In total, 508 eligible children were identified, of which 294 (along with their parents) consented to participate and 263 were enrolled. Only baseline data from the 263 children enrolled in MY LIFE were used in these analyses. There were no missing data. Informed consent (parents and children aged 16 years) and assent (children aged 7–15 years) were obtained. Parents consented on behalf of children who were ≤6 years. Parent-reported data were used in this study. Approval was obtained from the Waterloo Human Research Ethics Board (#31010) and Hamilton Integrated Research Ethics Board (#2797).

2.2 | Instruments

The OCHS-EBS-B is a 25-item parent-reported measure assessing symptoms of mental health problems in children <18 years of age (Boyle et al., 2022). It was developed using a subset of items from the original 52-item OCHS-EBS within an item response theory framework (Boyle et al., 2019; Duncan et al., 2019). Using a 3-point response scale (0–2; *never or not true*, *sometimes or somewhat true*, and *often or very true*), parents rate symptoms across problem domains classified as emotional (eight items), behavioural (10 items) and attentional (seven items). Parents are instructed to consider each symptom in the context of 'Now or within the past 6 months my child …'. Raw scores are summed across disorder type to generate subscale scores whereby higher scores indicate a greater severity or frequency of symptoms of mental problems.

Mental disorder, based on symptoms experienced during the past 6 months was measured using the parent-reported MINI-KID (Sheehan et al., 2010), a structured diagnostic interview aligned with the Diagnostic and Statistical Manual of Mental Disorders 5 and International Statistical Classification of Diseases and Related Health Problems 10. The mental disorders assessed using the MINI-KID were emotional disorders (major depression, generalized anxiety, separation anxiety, social phobia, specific phobia), behavioural disorders (oppositional defiant, conduct) and attentional disorders (attention-deficit hyperactivity [all subtypes]). Because all children in MY LIFE had a physical illness, children were classified as having physical–mental comorbidity if they screened positive for ≥1 mental disorder on the MINI-KID.

The 12-item parent-reported WHODAS 2.0 was used as a measure of child disability and proxy for somatic health (Üstün et al., 2010). It assesses disability across the six domains of cognition, mobility, self-care, getting along, life activities and participation, resulting in a higher-order factor structure, whereby disability represents the second-order factor whose score is a function of the six first-order factors (i.e. domains). Preceded by the statement, 'In the past 30 days, how much difficulty did you have in …', parents were asked to respond to each of the items using a five-point scale from 1 (*none*) to 5 (*extreme/cannot do*). Composite WHODAS 2.0 scores were calculated as the sum of the items (Üstün et al., 2010). Response options 4 (*severe*) and 5 (*extreme/cannot do*) were collapsed for each item due to sparse data. The WHODAS 2.0 has demonstrated robust psychometric properties in clinical and epidemiological samples of children with and without chronic illnesses (Ferro, Basque, Elgie, & Dol, 2023; Ferro, Dol, Basque, & Elgie, 2023; Ferro, Elgie, Dol, & Basque, 2023; Tompke et al., 2020).

2.3 | Analysis

Baseline characteristics were described using frequencies (%) for categorical variables and mean (standard deviation) for continuous variables, the latter being reported to capture the mean and variability in participant responses. Confirmatory factor analysis (CFA) using weighted least square mean and variance adjusted estimation was used to assess the fit of the previously reported OCHS-EBS-B factor structure (Boyle et al., 2022). Acceptable model fit was determined using the following indices: Comparative fit index (CFI) and Tucker–Lewis index (TLI) ≥ 0.90 were acceptable and ≥0.95 was excellent, standardized root mean squared residual (SRMR) < 0.08 was excellent, and root mean square error of approximation (RMSEA) ≤ 0.05 was excellent (Bentler, 1990; Bollen, 1989; Hu & Bentler, 1999). Consistent with previous reports (Ferro, Dol, Basque, & Elgie, 2023; Zelman & Ferro, 2018), adequate model fit was achieved if ≥3 indices met these thresholds. χ^2 goodness-of-fit was included for completeness but was not used in the determination of model fit.

Internal consistency of OCHS-EBS-B scores was assessed using McDonald's coefficient (ω), a more robust metric for evaluating the internal consistency of items in multidimensional scales compared to Cronbach's α. McDonald's ω has a range of 0–1, and ω > 0.7 indicates good internal consistency (Trizano-Hermosilla et al., 2021).

Measurement validity of OCHS-EBS-B scores was assessed with two approaches. First, we examined agreement between the OCHS-EBS-B and MINI-KID on the classification of child mental health problems at baseline and 6 months using point biserial correlations (r_{pb}), with $r_{pb} \geq 0.30$ and $r_{pb} \geq 0.50$ indicating good and very good agreement, respectively. Second, we assessed known-group validity of OCHS-EBS-B scores between children with versus without physical–mental comorbidity (as measured using the MINI-KID) using the Wilcoxon rank sum test. Effect sizes (Cohen's *d* with associated 95% confidence intervals [CI]) were calculated, with d ≥ 0.20 indicating that between-group differences were at least small in magnitude. Finally, associations between the three subscales of OCHS-EBS-B and WHODAS 2.0 were assessed using Spearman rank correlations (ρ). All hypothesis tests were two-sided conducted at $\alpha = 0.05$. Analyses were conducted in R v4.2.0.

3 | RESULTS

Of the 263 children included in these analyses, 125 (47.5%) were female and their mean age was 9.4 (4.2) years. The most common physical illnesses in children were rheumatological (73 [27.8%]), respiratory (54 [20.5%]) and endocrine (38 [14.4%]). A total of 100 (38.2%) children had physical–mental comorbidity as measured using the MINI-KID; classified by problem domain, the distribution shows that having multiple mental health problems was common: emotional ($n = 75$), behavioural ($n = 17$) and attentional ($n = 41$). Parents were mostly female ($n = 237$ [90.1%]); their mean age was 40.5 (6.5) years. Additional sample characteristics are described in Table 1.

Summed score means and standard deviations are shown in Table 1. Initial CFA of the OCHS-EBS-B provided excellent fit to the data ($\chi^2 = 196.23(272)$, $p < 0.001$; CFI = 0.98; TLI = 0.98; SRMR = 0.06; RMSEA [90% CI] = 0.034 [0.027, 0.044]). The factor structure and model parameters of the OCHS-EBS-B are illustrated in Figure 1.

As shown in Table 2, internal consistency of the subscales ranged between $\omega = 0.86$ and $\omega = 0.92$, meeting our criteria for establishing internal consistency of OCHS-EBS-B subscale scores at baseline and 6 months. Point biserial correlations between the OCHS-EBS-B subscales and MINI-KID ranged between $r_{pb} = 0.43$–0.51 at baseline and improved to $r_{pb} = 0.55$–0.65 at 6 months (Table 2). As shown in Table 3, mean OCHS-EBS-B scores for each subscale were significantly higher for children with physical–mental comorbidity versus children with physical illness only, and these differences were of medium magnitude, as quantified by Cohen's *d*. Finally, the correlations between the OCHS-EBS-B subscales (emotional, behavioural and attentional) and the WHODAS 2.0 were $\rho = 0.47$, $\rho = 0.37$ and $\rho = 0.43$, respectively.

TABLE 1 Baseline characteristics of the study cohort ($n = 263$).

Characteristic	*n* (%)
Sociodemographics	
Child age, years (mean, SD)	9.4 (4.2)
Parent age, years (mean, SD)	40.5 (6.5)
Female child	125 (47.5)
Female parent	237 (90.1)
Partnered parent (common law/married)	228 (86.7)
Parent education (postsecondary degree)	200 (76.0)
Household income (≥$90 000)	156 (59.8)
Physical illnesses	
Dermatological	23 (8.7)
Endocrine	38 (14.4)
Gastroenterological	34 (12.9)
Haematological	29 (11.0)
Neurological	12 (4.6)
Respiratory	54 (20.5)
Rheumatological	73 (27.8)
Mental health problems	
OCHS-EBS-B	
Emotional (mean, SD)	3.3 (3.4)
Behavioural (mean, SD)	2.9 (3.1)
Attentional (mean, SD)	3.8 (3.4)
MINI-KID	
Emotional	75 (28.5)
Behavioural	17 (6.5)
Attentional	41 (15.6)

Notes: Data are frequency (proportion) unless indicated as mean (SD). For the MINI-KID, emotional problems included major depressive episode, generalized anxiety, separation anxiety, social phobia and specific phobia disorders; behavioural problems included oppositional defiant and conduct disorder; and attentional problems included attention-deficit hyperactivity disorder (all subtypes).
Abbreviations: MINI-KID, Mini International Neuropsychiatric Interview for Children and Adolescents; OCHS-EBS-B, Ontario Child Health Study Emotional Behavioural Scales-Brief Version.

Because our sample included children younger than the target age range for the OCHS-EBS-B, we conducted additional analyses on children who were ≥4 years of age ($n = 230$) and did not find any noteworthy changes in the estimates or inferences from these analyses compared to our initial analyses on the full sample ($n = 263$). We have reported results from the full sample of children 2–16 years of age to expand the generalizability of the findings.

4 | DISCUSSION

We examined the psychometric properties of a brief measure of mental health problems—the OCHS-EBS-B—in children with chronic physical illness. Overall, there was evidence that OCHS-EBS-B scores are

FIGURE 1 Factor structure of OCHS-EBS-B with standardized estimates.

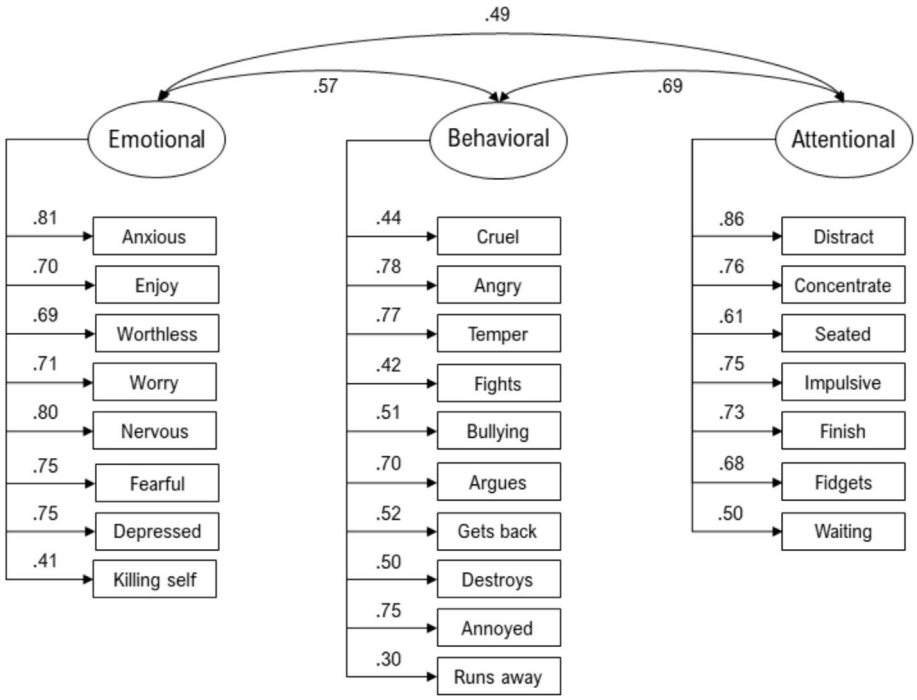

TABLE 2 Reliability and validity estimates of the OCHS-EBS-B scores.

	Internal consistency (ω)		Agreement with MINI-KID (r_{pb})	
Subscale	**Baseline**	**6 months**	**Baseline**	**6 months**
Emotional	0.91 (0.89, 0.93)	0.92 (0.90, 0.93)	0.51 (0.42, 0.60)	0.65 (0.57, 0.71)
Behavioural	0.86 (0.83, 0.90)	0.88 (0.85, 0.91)	0.43 (0.33, 0.53)	0.55 (0.46, 0.63)
Attentional	0.88 (0.85, 0.90)	0.88 (0.85, 0.91)	0.51 (0.42, 0.60)	0.59 (0.51, 0.67)

Note: Results in parentheses are 95% confidence intervals.

TABLE 3 Known-group validity of OCHS-EBS-B between comorbidity statuses.

Subscale	Comorbid	Not comorbid	Cohen's *d*	*p* value
Emotional	7.4 (3.7)	2.5 (2.8)	0.43	<0.001
Behavioural	7.5 (4.7)	2.3 (2.7)	0.32	<0.001
Attentional	7.2 (3.3)	2.8 (2.8)	0.45	<0.001

Note: Data are mean (SD) of OCHS-EBS-B scores.

valid and reliable for measuring the mental and behavioural health of children with physical illness.

Findings are consistent with previous research reporting the initial development and psychometric evaluation of the OCHS-EBS-B in population and clinical samples of children. It has previously shown evidence of robust test–retest reliability and internal consistency reliability (Boyle et al., 2022). The OCHS-EBS-B also showed strong agreement with the MINI-KID (Boyle et al., 2022, 2023; Duncan et al., 2019). Research suggests there are no substantial differences in the validity and reliability of structured diagnostic interviews and checklists for parent-reported child mental health (Boyle et al., 2023; Dirks & Boyle, 2010).

Efforts to adopt integrated pediatric services requires the use of brief, psychometrically sound measures. The OCHS-EBS-B is quick and easy to administer and can be readily adapted for electronic data collection and real-time incorporation into electronic medical records. In generating subscale scores across the domains of emotional, behavioural and attentional mental health, the OCHS-EBS-B avoids constraints associated with measures that generate a global score, which may mask multidimensional impacts on mental health. Importantly, it has been used during intake assessments to identify children needing additional supportive health services (e.g. comprehensive assessment with allied health), ensuring timely and appropriate access to care (Halladay et al., 2023). Routine use of the OCHS-EBS-B and comparing subscale scores to population norms can help healthcare providers, families and children understand their symptoms compared to children and youth of the same age and sex in the general population. The tool can also be used as an independent outcome measure for examining response to treatment or as part of epidemiological surveillance. Regarding this latter point, work is needed to develop validated thresholds using the minimal clinically important difference for the OCHS-EBS-B, which would further strengthen its clinical utility. In this regard, adopting COSMIN criteria in further evaluating the validity of the OCHS-EBS-B would be useful (Mokkink & Terwee, 2024).

This study included a broad age range of children diagnosed with an array of physical illnesses, enhancing the generalizability of the findings. However, there are limitations to this study that warrant consideration. First, the over-represented socioeconomically advantaged and non-marginalized families who were recruited from one academic pediatric hospital; thus, findings may not reflect the experience of the broader population of children with physical illness. Second, this study used parent reports only. Research suggests that parent reports of mental and psychosocial health often differ from child self-reports (McDonald et al., 2021); however, parent–child agreement tends to increase over time within families whose children have a physical illness (Qadeer & Ferro, 2018). Third, validity testing was limited to a convergent validity with the MINI-KID (a structured interview) and no examination of divergent validity. Fourth, given the relatively limited sample size of the study, an exploratory factor analysis as the initial step of model validation (i.e. before conducting CFA) was not feasible. Instead, we evaluated the theoretical three-factor structure as proposed in the initial development of the OCHS-EBS-B, which ultimately provided a good fit to our study data.

5 | CONCLUSION

This study provided evidence that the OCHS-EBS-B demonstrates acceptable validity and reliability in measuring mental and behavioural health in children with chronic physical illness. Assessing child mental health in a psychometrically robust and efficient manner is critical in supporting integrated physical and mental services within pediatric care settings. The OCHS-EBS-B satisfies these necessary criteria, and pending additional research with larger and more heterogeneous samples should be considered a viable measure in these efforts.

AUTHOR CONTRIBUTIONS

Mark A. Ferro: Investigation; supervision; funding acquisition; project administration; resources; writing - original draft; writing - review and editing; conceptualization. **Olayinka I. Arimoro:** Methodology; formal analysis; investigation; writing - original draft; writing - review and editing. **Olawale F. Ayilara:** Methodology; supervision; writing - review and editing. **Gurkiran K. Dhuga:** Writing - original draft; writing - review and editing; conceptualization. **Laura Duncan:** Methodology; investigation; writing - original draft; writing - review and editing. **Tolulope T. Sajobi:** Conceptualization; methodology; formal analysis; writing - original draft; writing - review and editing.

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CONFLICT OF INTEREST STATEMENT

Dr Ferro is an Associate Editor of *Child: Care, Health and Development*. None of the remaining authors has conflicts of interest relevant to this article to disclose. The data presented in this manuscript are not publicly available due to restrictions imposed by the institutional review boards. All authors have read and agreed to the published version of the manuscript.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

ETHICS STATEMENT

Ethics approval for this study was obtained from the Waterloo Human Research Ethics Board (#31010) and Hamilton Integrated Research Ethics Board (#2797). Informed consent was obtained from all participants involved in this study.

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