




Convergent Validity of Myheartsmmap: A Pediatric Psychosocial Health Screening Tool

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Accepted: 26 July 2021 / Published online: 4 August 2021
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Abstract

Recognition of pediatric mental health concerns often depends on assessment by parents, educators, and primary care professionals. Therefore, a psychosocial screening instrument suitable for routine use in schools and primary care is needed. The Pediatric Quality of Life (PedsQL) and the Strengths and Difficulties Questionnaire (SDQ) are widely used for screening but lack adolescent-specific mental health measures. MyHEARTSMAP is an instrument assessing aspects of youth psychosocial health via four domains: *Psychiatry*, *Function*, *Social*, and *Youth Health*. We evaluated MyHEARTSMAP convergent validity with PedsQL and SDQ among 122 child-parent dyads participating in a larger concussion study. Convergent validity was assessed via correlations: MyHEARTSMAP *Psychiatry* and *Function* domains correlated strongly ($r \geq 0.44$) and *Social* domain correlated weakly ($r \leq 0.25$) to corresponding PedsQL and SDQ subscales, while *Youth Health* domain correlated moderately ($r \geq 0.31$) to the tools' total scales. In conclusion, MyHEARTSMAP converges with PedsQL and SDQ, and benefits from the inclusion of adolescent-specific psychosocial measures.

Keywords Pediatric mental health · Psychosocial screening · Self-assessment · Proxy-assessment · Convergent validity

Introduction

Youth mental health is a pressing public health issue [1]. Between 13 and 20% of youth in the United States and Canada are affected by mental illness each year [1, 2]. Despite

the prevalence of pediatric mental illness, less than half of children who meet the criteria for a psychiatric diagnosis are detected and, thus, treated [3]. The recognition of mental health concerns in children often depends on assessment by parents, guardians, educators, and primary care

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professionals. Unfortunately, parents, guardians, and teachers are not always able to identify mental health issues of children under their care, and primary care physicians are reported to identify only one in four children with mental health issues [4]. Undiagnosed and untreated mental health illness among children and youth leads to decreased productivity, increased substance use, and injury [5]. Thus, the development of assessment tools that help parents, families, teachers, and primary care physicians in the early screening of pediatric mental illnesses is imperative.

Several mental health screening tools for children are currently available. Some of them are specific to a single area of concern such as suicide risk or substance use and, therefore, have limited use for general mental health screening [6–14]. Additionally, these specific tools have been reported to have either high sensitivity or high specificity, but rarely both [15]. General mental health screening tools are equally abundant, but not devoid of drawbacks. For example, the Behaviour Assessment System for Children [16] covers a wide range of mental health needs (e.g., hyperactivity, aggression, conduct problems, anxiety, depression, somatization, social skills), but its length (20 min) makes it burdensome for routine use outside psychiatric or psychological practice (where lengthier instruments can be administered). A systematic review of mental health assessment found 11 screening tools that cover a broad range symptoms and ages [17]. The majority of these instruments, however, require licence fees, which pose a barrier for routine use in domestic, clinical or school settings [17]. For example, the Pediatric Quality of Life—PedsQL [18], which is frequently used in both clinical and academic settings, requires licensing fees, except for unfunded academic research. Although the PedsQL primarily assesses health-related quality of life and was originally designed for research purposes [19], some researchers have rendered the PedsQL into a screening tool, by establishing clinical cut-offs and norms for mental health assessment [20]. Another screening tool, the Strengths and Difficulties Questionnaire—SDQ, is used to identify emotional and behavioural problems in children and youth [21, 22] and has demonstrated good construct and criterion validity [23]. However, the SDQ is inadequate for general youth mental health screening as it lacks adolescent-specific psychosocial measures, such as assessments of alcohol/substance use and sexual health.

The MyHEARTSMAP is a recently developed online psychosocial screening tool for children and youth. It was designed to assess different aspects of psychosocial functioning, which contribute to a child's mental wellness: home, education and activities, alcohol and drugs, relationships and bullying, distressing thoughts and anxiety, safety (homicidal-ity and suicidality), sexual health, mood and function, abuse, and professional resources. Each of these sections map to one or more corresponding assessment domains: *Psychiatry,*

Function, Social, and Youth Health (Supplementary Fig. 1). Each section is scored from 0 (no concern) to 3 (severe) and users are prompted to indicate whether resources for the area have been accessed to assess the severity of the concern. Further, based on individual section scores and composite domain scores, an algorithm provides patient-specific mental health follow-up recommendations [24]. These recommendations are also accompanied by suggested time frames of access. Further details of the MyHEARTSMAP tool can be found in the Supplementary Materials. [25]. MyHEARTSMAP can be completed in 10 to 15 min or less, which makes it suitable for routine use in school and primary care settings. The PedsQL and SDQ are appropriate comparators for convergent validity because they include mental health subscales and have been validated in distinguishing between healthy children and children with mental health concerns or diagnoses [21, 22, 26–29]. The current study evaluated convergent validity and agreement in severity classification between MyHEARTSMAP domains and the psychosocial components of the PedsQL and the SDQ, using a convenience sample of patients with either an orthopedic injury or a concussion.

Methods

Design, Setting, and Population

This was a cross-sectional study conducted alongside the Advancing Concussion Assessment in Pediatrics (A-CAP) research project, which examines neurobiological and psychosocial markers of post-concussion outcomes among children [30]. The A-CAP study followed the health status of children one week, three months, and six months after a concussion or an orthopedic injury (OI), identified in acute emergency department (ED) visits. Data for the present study were collected at two institutions participating in the A-CAP study: the BC Children's Hospital in Vancouver, British Columbia, and the Alberta Children's Hospital in Calgary, Alberta. Both hospitals have access to tertiary-level psychosocial resources, and, each year, their EDs receive over 43,000 (BCCH) and 70,000 (ACH) patients, respectively.

Participants were children aged 8–16.99 years old who presented to the ED with either a concussion or an OI. Concussion participants were included if they had a head injury and one or more of the following: observed loss of consciousness, Glasgow Coma Scale score of 13 or 14, or displaying at least one symptom of concussion (e.g. post-traumatic amnesia, focal neurological deficits, headache, dizziness, or other mental status changes). Participants with an OI were included if they had upper or lower extremity fractures, sprains, or strains due to physical trauma

(Abbreviated Injury Scale of ≤ 4). Additional details of the A-CAP study have been published elsewhere [31].

Measures

MyHEARTSMAP is an online tool that uses a four-level severity scale to assess psychosocial functioning in four domains: *Psychiatry*, *Function*, *Social*, and *Youth Health*. Algorithms for mental health management recommendations are linked to each of these four domains, allowing for specific targeting of mental health needs based on severity and acuity [24]. MyHEARTSMAP showed high sensitivity in children and parents for identifying psychiatric concerns: 92.7% and 93.1%, respectively, and showed high specificity in children and parents for correctly assessing no or mild concerns: 98.5% and 98.9%, respectively [24]. Interrater reliability (self versus proxy) across its subscales (or domains) was excellent, ranging from $\kappa = 0.76$ to $\kappa = 0.98$ [25].

The PedsQL assesses health-related quality of life on a scale from 0 to 100, on four subscales: *Physical*, *Emotional*, *School*, and *Social* functioning. The four subscales generate two summary scores: *Physical Health Summary* (8 items from Physical subscale) and *Psychosocial Health Summary* (mean of 5 items each from *Emotional*, *School*, and *Social* subscales). The PedsQL is available in child- and parent-proxy forms and has acceptable internal consistency, $\alpha = 0.89$ child; $\alpha = 0.92$ parent [32]. The PedsQL has been used to measure health-related quality of life in pediatric concussion [33], is correlated with morbidity and illness burden, is responsive to changes in health status, and differentiates health-related quality of life between healthy, acutely ill, and chronically ill patients [18, 33, 34]. Based on analysis of content, we decided a priori to compare MyHEARTSMAP domain scores with the *Emotional*, *School*, and *Social* subscales of the PedsQL and with its *Psychosocial Health Summary*. The rationale for these choices is described in the Analysis Plan section. Both the child and the parent-proxy reports were used.

The SDQ is a behavioural screening tool that consists of *Emotional Problems*, *Conduct Problems*, *Peer Problems*, *Hyperactivity*, and *Prosocial* subscales (each scored 0–10). The SDQ does not assess adolescent-specific mental health measures, such as protective issues or alcohol and substance use [21, 22]. The *Total Difficulties* score (raw scores from

0 to 40) is the sum of all scores except the *Prosocial* subscale. The SDQ has 63.3% sensitivity and 94.6% specificity for psychiatric diagnosis [22]. Based on rational analysis of scale content, we decided a priori to compare MyHEARTSMAP domain scores with the *Emotional Problems*, *Conduct Problems*, and *Peer Problems* subscales of the SDQ and with the SDQ *Total Difficulties* score (see Table 1). These choices are justified in the Analysis Plan subsection below. Only the SDQ parent report was available.

Procedures

Child-parent dyads attending follow-up assessment for the A-CAP research project were approached to participate in this supplementary study. Those who consented were asked to complete the 10-min MyHEARTSMAP questionnaire using a mobile tablet. Since MyHEARTSMAP covers sensitive topics, children were given the option to complete their questionnaire without their parents present. Families also completed the PedsQL (children and parents) and the SDQ (parents only) as part of the A-CAP study. At enrollment, all families were offered information on how to access community mental health support, should the need arise. Participants with acute or severe mental health needs, as indicated by MyHEARTSMAP, underwent an assessment by an ED physician (BCCH) or a psychologist (ACH), and were directed to the ED or community service, as appropriate. Ethics approval was granted by the University of British Columbia Children's and Women's Research Ethics Board and the Conjoint Health Research Ethics Board at the University of Calgary. Written informed consent was obtained from a parent/legal guardian and assent from the participating youth prior to study enrollment.

Analysis Plan

Data were analyzed cross-sectionally. Descriptive statistics were used to summarize sample demographics and outcome measures. Convergent validity of MyHEARTSMAP domain scores was determined using Pearson's correlation coefficients. For correlations between MyHEARTSMAP and the PedsQL, both child and parent reports were used. For correlations between MyHEARTSMAP and the SDQ, only parent reports were used. To facilitate interpretation, we reversed

Table 1 Analysis plan: MyHEARTSMAP domains conceptually related with PedsQL and SDQ subscales

MyHEARTSMAP domain	PedsQL		SDQ	
	Subscale	Total scale	Subscale (s)	Total scale
Psychiatry	Emotional	Psychosocial summary	Emotional	Total
Function	School	Psychosocial Summary	–	Total
Social	Social	Psychosocial Summary	Conduct and peer	Total
Youth health	–	Psychosocial Summary	–	Total

the PedsQL scores to have the same directionality as the MyHEARTSMAP and the SDQ (i.e., higher scores indicate worse psychosocial concerns). Correlations near $r=0.10$ were considered weak, near $r=0.30$ were considered moderate, and near $r=0.50$ were considered strong [35]. The measures were expected to positively correlate once the PedsQL raw scores were reversed. A priori, we determined that at least moderate correlations (near $r=0.30$) would support convergence of the relevant subscales. Data analysis was conducted using Microsoft Excel 2018 Data Analysis ToolPak (Microsoft, Redmond, Washington) and MATLAB 2019a (MathWorks, Natick, Massachusetts).

We complemented analyses of convergent validity with an assessment of the level of agreement between the MyHEARTSMAP and the PedsQL and SDQ in terms of severity classification. In this way, we extended the analysis of convergent validity by examining how the severity classifications derived from the measures are related. This is important because two instruments may have high convergent validity (i.e., they assess the same psychological construct) and still lead to different severity diagnoses: a child may be classified as having psychosocial issues by one instrument but not the other. Agreement between MyHEARTSMAP severity classifications and those produced by the PedsQL and the SDQ was assessed using the mutual information method, which compares two diagnostic instruments that differ in the number and quality of severity categories [36]. MyHEARTSMAP produces four severity levels: no issues, mild, moderate, or severe; the PedsQL has two: “not at-risk” and “at-risk” [32]; and the SDQ produces four: close to average, slightly raised, high, or very high [37, 38].

As shown in Table 1, each MyHEARTSMAP domain was evaluated for convergent validity and agreement with the most closely related subscale of the PedsQL and the SDQ: (1) MyHEARTSMAP *Psychiatry* domain as well as *Emotional Problems* subscale of both the PedsQL and the SDQ evaluate fears, worries, sadness, nervousness, and low energy; (2) MyHEARTSMAP *Function* domain is related to PedsQL *School Functioning* subscale, as both cover grades, extracurricular activities, absences, schoolwork, friendships, and bullying; (3) MyHEARTSMAP *Social Functioning* domain is related to PedsQL *Social*, SDQ *Conduct Problems*, and SDQ *Peer Problems* subscales, as they evaluate social adjustment, as well as behavioural comportment and conflict. SDQ *Conduct* and *Peer* problems raw scores were summed prior to convergence analysis to cover a comprehensive measure of social functioning for comparison to the MyHEARTSMAP *Social* domain. MyHEARTSMAP *Youth Health* domain, which addresses substance use and sexual health, had no subscale counterpart in the PedsQL or SDQ; thus, it was compared only with the PedsQL *Psychosocial Summary* and the SDQ *Total Difficulties*. Additionally, we

calculated correlations between each MyHEARTSMAP domain, the PedsQL *Psychosocial Summary*, and the SDQ *Total Difficulties* scores (Table 1).

Results

Between May 2017 and January 2019, we approached 153 families; of these, 31 declined and 122 (80%) were enrolled in the study. Responses from four children (3%) and two parents (2%) were incomplete. Table 2 summarizes the sample characteristics as well as descriptive statistics of study measures: MyHEARTSMAP, PedsQL, and SDQ.

Table 3 summarizes the overall prevalence of child psychosocial concerns, determined by parent/guardian proxy- or child self-report. For child-parent pairs whose scores indicated differing severities of psychosocial concerns, the more severe concern is reported.

Most children had no worse than mild concerns across the MyHEARTSMAP domains. Although the PedsQL does not have established severity classifications, scores approximately one standard deviation below the population mean represent scores similar to children with severe chronic health conditions (e.g. children newly diagnosed with cancer [40] and children with rheumatic conditions [41]). Therefore, PedsQL subscale scores greater than one standard deviation below the population mean have been proposed to indicate that the child is at-risk for impaired health-related quality of life [32]. Most children (77% to 92%) scored in the not at-risk range across PedsQL subscales. The SDQ scores are categorized as close to average, slightly raised, high, and very high [37, 38]. The score ranges for each category differs between subscales and can be found on the SDQ website [39]. Most (83% to 88%) children had SDQ subscale scores close to average.

Convergence Between MyHEARTSMAP and PedsQL

Table 4 reports correlation coefficients for parent-reported MyHEARTSMAP domains and parent-reported PedsQL subscales and the combined *Psychosocial Summary*. Strong significant correlations were found between the MyHEARTSMAP *Psychiatry* and *Function* domains with the PedsQL *Emotional* and *School* subscales, respectively. Small and non-significant correlations were found between the instruments' *Social* subscales. However, for each comparison, MyHEARTSMAP scores correlated in the expected direction with PedsQL.

Table 5 describes the parent-reported MyHEARTSMAP domains and parent-reported PedsQL subscales and the

Table 2 Distribution of demographic and other characteristics of participant children and families (n = 122)

Variable	n (%) / median (IQR)
Setting	
British Columbia	82 (67%)
Alberta	40 (33%)
A-CAP follow-up	
Post acute (1 Week Post-Injury)	21 (17%)
3 month post-injury	25 (21%)
6 month post-injury	76 (62%)
Injury type, n (%)	
Orthopedic injury	52 (43%)
Concussion	70 (57%)
Child sex, n (%)	
Female	54 (44%)
Male	68 (56%)
Age, mean years (SD)	12.6 (2.2)
Ethnicity, n (%)	
European	74 (61%)
Asian	19 (16%)
Other/multi-racial	28 (23%)
Unknown	1 (1%)
Family income, n (%)	
< \$25,000	4 (3%)
\$25,000—\$64,999	7 (6%)
\$65,000—\$94,999	22 (18%)
\$95,000—\$124,999	23 (19%)
\$125,000—\$154,999	19 (16%)
\$155,000 or more	45 (37%)
Unknown	2 (2%)
MyHEARTSMAP parent	
Psychiatry [0–9]	1 (0, 2)
Function [0–9]	0 (0, 1)
Social [0–9]	1 (0, 1)
Youth Health [0–9]	0 (0, 0)
MyHEARTSMAP child	
Psychiatry [0–9]	1 (0, 2)
Function [0–9]	0 (0, 1)
Social [0–9]	1 (0, 1)
Youth Health [0–9]	0 (0, 0)
PedsQL parent ^a	
Emotional [0–100]	85.0 (75.0, 100.0)
School [0–100]	90.0 (75.0, 100.0)
Social [0–100]	100.0 (85.0, 100.0)
Psychosocial summary [0–100]	90.0 (78.3, 98.3)
PedsQL child ^a	
Emotional [0–100]	80.0 (65.0, 90.0)
School [0–100]	85.0 (70.0, 100.0)
Social [0–100]	92.5 (85.0, 100.0)
Psychosocial summary [0–100]	85.0 (75.0, 93.3)
SDQ score parent	
Emotional [0–10]	1 (0, 2)

Table 2 (continued)

Variable	n (%) / median (IQR)
Conduct [0–10]	1 (0, 2)
Peer [0–10]	1 (0, 2)
Total [0–10]	5 (3, 8)

IQR interquartile range (Q_1 , Q_3), SD standard deviation, A-CAP advancing concussion assessment in paediatrics, PedsQL pediatric health related quality of life, SDQ strengths and difficulties questionnaire

^aPedsQL raw (non-reversed) scores are reported here. These scores are reversed for correlation analysis

combined *Psychosocial Summary*. Results replicate those found for parent-reported scores.

Convergence Between MyHEARTSMAP and SDQ

Table 6 reports correlation coefficients for parent-reported MyHEARTSMAP domains and parent/guardian-reported SDQ subscales and their combined total scores. Strong and significant correlations were found between the MyHEARTSMAP *Psychiatry* domain and the SDQ *Emotional Problems* and *Total Difficulties* scores. The MyHEARTSMAP *Social* domain did not correlate with the combined SDQ *Conduct* and *Peer* scale.

Severity Associations Between MyHEARTSMAP, PedsQL, and SDQ

Table 7 presents the level of agreement between MyHEARTSMAP's severity classifications and PedsQL or SDQ's severity classifications. Mutual information agreement was statistically associated between the tools in four out of six evaluated comparisons, while MyHEARTSMAP *Social* domain associations with SDQ *Conduct* and *Peer* were inconclusive.

Discussion

This study demonstrated strong correlations between the *Psychiatry* and *Function* domains of the MyHEARTSMAP and the *Emotional* and *School* subscales of the PedsQL, as well as the PedsQL *Psychosocial Summary* score, based on both child and parent reports. Larger correlations were observed between the MyHEARTSMAP *Psychiatry* domain and the SDQ *Emotional Problems* subscale. Further, there was severity association agreement between MyHEARTSMAP *Psychiatry* and *Function* domains with their corresponding subscales in PedsQL and SDQ. All this suggests convergent validity and association agreement

Table 3 Overall prevalence of child psychosocial concerns identified by parent/guardian-proxy or child-self reports

MyHEARTS-MAP	Domain or subscale severity, <i>n</i> (%)			
	No issues (0)	Mild (1–3)	Moderate (4–6)	Severe (7–9) ^a
Psychiatry	30 (25%)	78 (64%)	11 (9%)	3 (2%)
Function	72 (59%)	46 (38%)	3 (3%)	1 (1%)
Social	32 (26%)	87 (71%)	3 (3%)	0 (0%)
PedsQL ^b	At-risk			
Emotional	28 (23%)			
School	23 (19%)			
Social	10 (8%)			
SDQ ^c	High			
Emotional	4 (3%)			
Conduct	7 (6%)			
Peer	6 (5%)			

^aAny component section equaling 3 is also classified as severe^bScores greater than one standard deviation below the population mean are considered at-risk for impaired health-related quality of life. Cut-off scores are defined here [32]^cScore severity classifications are defined on the SDQ website [39]

Table 4 Correlation coefficients (95% CI) of parent MyHEARTSMAP with parent PedsQL scores

MyHEARTSMAP parent-reported domain	PedsQL parent/guardian-reported measure			
	Emotional	School	Social	Psychosocial summary
Psychiatry	0.51* (0.36, 0.63)	–	–	0.50* (0.36, 0.63)
Function	–	0.46* (0.30, 0.59)	–	0.50* (0.35, 0.62)
Social	–	–	0.16 (– 0.02, 0.33)	0.26* (0.09, 0.42)
Youth health	–	–	–	0.44* (0.28, 0.57)

* $p < 0.05$ **Table 5** Correlation coefficients (95% CI) of child MyHEARTSMAP with child PedsQL scores

MyHEARTSMAP child-reported domain	PedsQL child-reported measure			
	Emotional	School	Social	Psychosocial summary
Psychiatry	0.44* (0.28, 0.57)	–	–	0.54* (0.40, 0.66)
Function	–	0.58* (0.44, 0.69)	–	0.58* (0.45, 0.69)
Social	–	–	0.25* (0.07, 0.41)	0.39* (0.23, 0.53)
Youth health	–	–	–	0.48* (0.32, 0.60)

* $p < 0.05$ **Table 6** Correlation coefficients (95% CI) of parent MyHEARTSMAP with parent SDQ scores

MyHEARTSMAP parent-reported domain	SDQ parent/guardian measure		
	Emotional	Conduct and peer	Total
Psychiatry	0.60* (0.47, 0.70)	–	0.52* (0.38, 0.64)
Function	–	–	0.43* (0.28, 0.57)
Social	–	0.07 (– 0.11, 0.24)	0.09 (– 0.09, 0.27)
Youth health	–	–	0.31* (0.14, 0.47)

* $p < 0.05$

of MyHEARTSMAP to these tools. Interestingly, the MyHEARTSMAP *Social* domain had low convergent validity and inconclusive agreement with comparable subscales from the PedsQL and SDQ. The reason for the low convergence and inconclusive agreement is likely that MyHEARTSMAP *Social* domain assesses abuse and substance use, which are not included in the PedsQL or the SDQ. We also found that the prevalence of moderate to severe psychosocial issues detected by the three tools was similar; however, MyHEARTSMAP characterized a higher proportion of participants as having mild mental health

concerns, compared to “not at-risk” and “close to average” classification on the PedsQL and SDQ. This may indicate that MyHEARTSMAP may be more sensitive to emerging psychosocial issues than the PedsQL or SDQ, as it includes areas not covered by the other two: home life, alcohol and drugs, abuse, suicidality, homicidality, and sexual health. We found severity classification agreement between all domain-subscale comparisons, except for the MyHEARTSMAP *Social* domain with the combined SDQ *Conduct* and *Peer* scales.

Findings from this study help remedy a general lack of psychometric evidence supporting pediatric mental health screening instruments. This problem has existed for more than a decade and was reiterated in three recent systematic reviews evaluating a total of 41 distinct instruments [15, 17, 23]. The reviews found that, in general, evidence of structural, construct, and criterion validity, as well as internal consistency, was limited [23]. In this context, our study provides evidence of convergent validity of MyHEARTSMAP in relation to two commonly used screening instruments: the PedsQL and the SDQ. Convergent validity is essential to yield accurate detection of mental health concerns and to measure change or improvement in research and clinical settings [17, 23]. Furthermore, this study provides evidence that MyHEARTSMAP classifies severity of psychosocial issues in a way akin to the PedsQL and SDQ. These findings indicate that

Table 7 Association between tools' severity classifications using measures of mutual information

First instrument	Second instrument	Mutual information Agreement, $I_{agreement}$	Mutual information Disagreement, $I_{disagreement}$	Mutual information, $I_{agreement} + I_{disagreement}$	Degrees of Freedom, ν	Chi-square Distribution, $\chi^2(\nu)$	Association outcome ^a
MyHEARTSMAP psychiatry	PedsQL emotional	0.148	– 0.043	0.105	3	17.62**	Agreement
	SDQ emotional	0.137	– 0.025	0.112	9	19.00*	Agreement
MyHEARTSMAP function	PedsQL school	0.180	– 0.023	0.157	3	26.58**	Agreement
MyHEARTSMAP social	PedsQL social	0.058	– 0.012	0.046	3	7.77 [†]	Agreement
	SDQ conduct	0.018	– 0.002	0.016	9	2.78	Inconclusive
	SDQ peer	0.014	0.008	0.022	9	3.70	Inconclusive

^aIf $I_{agreement} > I_{disagreement}$ and $p < 0.1$ then there is significant agreement [36]

[†] $p < 0.1$, * $p < 0.05$, ** $p < 0.001$

MyHEARTSMAP is a viable brief and general youth psychosocial assessment tool. Its comprehensive coverage of adolescent-specific psychosocial issues (e.g. home life, alcohol and drugs, abuse, and sexual health) provides an advantage over other screening tools. Additionally, our results indicate that the three instruments agree in the way they assess severity of mental health issues, which indicates that MyHEARTSMAP, the PedsQL, and the SDQ also classify mental health similarly.

Findings from this study should be interpreted considering three limitations. First, families with high socioeconomic status were overrepresented in the sample and, therefore, results do not necessarily generalize to the entire population. Second, participants were recruited from a sample of children and youth with a concussion or minor OI returning for study follow up assessments at one week, three months, and six months post injury. Continued participation in longitudinal studies comparing a concussion with OI is associated with higher socioeconomic status [42] and, in turn, better quality of life outcomes [43]. Therefore, our sample could have lower prevalence of psychosocial issues compared with the general population. However, this seems unlikely because MyHEARTSMAP prevalence rates and severity distribution among the current sample are comparable to those found in a previous study including 795 child-parent dyads presenting to the emergency department with non-mental health complaints [24]. Third, this study examined convergent validity in a convenience sample of concussion and OI patients. Accordingly, research evaluating other psychometric properties (i.e., divergent, discriminant, and structural validity) and in different populations is needed.

In conclusion, MyHEARTSMAP, the PedsQL, and the SDQ assess similar psychological constructs, and they also establish similar severity classifications. Further,

MyHEARTSMAP covers many aspects of a child's psychosocial life, including areas not covered by PedsQL or SDQ, without resulting in diverging assessments relative to these tools. Consequently, MyHEARTSMAP is a comprehensive alternative for routine general mental health assessment in emergency departments and schools.

Summary

Mental health concerns among youth is a prevalent public health issue and unfortunately many concerns are missed by parents, educators, and primary care professionals. Undetected and untreated mental health issues lead to decreased quality of life and increased risk of mental health issues in adulthood. A variety of mental health screening tools are available; however, they are often issue-specific or lack adolescent-specific psychosocial measures. MyHEARTSMAP is an online youth psychosocial screening tool that covers a broad range of mental health measures, including youth-specific measures such as alcohol/substance use and sexual health. Participants enrolled in a larger concussion study were recruited for MyHEARTSMAP comparison to two established general youth screening tools, PedsQL and SDQ, in terms of convergent validity and severity classification agreement. The findings indicate that MyHEARTSMAP assesses similar psychosocial constructs and severity classifications to these tools, while evaluating youth-specific measures not found in either tool. Therefore, this work shows that MyHEARTSMAP is a strong alternative for general youth psychosocial assessment in schools and primary care. Future work should expand on the evaluation of MyHEARTSMAP's psychometric properties in different populations.

Supplementary Information The online version contains supplementary material available at <https://doi.org/10.1007/s10578-021-01221-7>.

Funding This study was supported by funding for the Advancing Concussion Assessment in Pediatrics (A-CAP) study from the Canada Institutes of Health Research (CIHR).

Declarations

Conflict of interest Brian Brooks receives royalties for the sales of the Pediatric Forensic Neuropsychology textbook (2012, Oxford University Press) and three pediatric neuropsychological tests [Child and Adolescent Memory Profile (ChAMP, Sherman and Brooks, 2015, PAR Inc.), Memory Validity Profile (MVP, Sherman and Brooks, 2015, PAR Inc.), and Multidimensional Everyday Memory Ratings for Youth (MEMRY, Sherman and Brooks, 2017, PAR Inc.)]. He has previously received in-kind support (free test credits) from the publisher of the computerized cognitive test (CNS Vital Signs, Chapel Hill, North Carolina). He holds a salary award from CIHR for research in concussion outcomes. Roger Zemek holds competitively-funded research grants from Canadian Institutes of Health Research (CIHR), Ontario Neurotrauma Foundation (ONF), Physician Services Incorporated (PSI) Foundation, CHEO Foundation, Ontario Brain Institute (OBI), and Ontario SPOR Support Unit (OSSU), National Football League (NFL) Scientific Advisory Board, and Clinical Research Chair in Pediatric Concussion from University of Ottawa. He has no commercial conflicts of interest to disclose. Keith Yeates holds research grants from CIHR. He receives book royalties from Guilford Press and Cambridge University Press. He is supported by the Ronald and Irene Ward Chair in Pediatric Brain Injury from the Alberta Children's Hospital Foundation. He has no commercial conflicts of interest to disclose. Miriam Beauchamp holds research grants from CIHR and NSERC. She receives book royalties from Guilford Press. She is supported by a Canada Research Chair. She has no commercial conflicts of interest to disclose.

Ethical Approval Obtained from both recruiting institutions: University of British Columbia Children's and Women's Research Ethics Board and the Conjoint Health Research Ethics Board at the University of Calgary. All procedures performed in this study were in accordance with the ethical standards from the institutional ethics committees and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent All participants provided written informed consent or assent prior to study participation.

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