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RESEARCH ARTICLE

Screening for Mood Disorders in School-Aged Children and Adolescents (6-18 Years): Development and Validation of the AHEAD-Emotional Health (Mood) Subsection

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Abstract: ***Background***: Mood disorders in school-aged children and adolescents (6-18 years) are a significant public health concern, yet they often go undiagnosed in primary care and school settings. Existing comprehensive assessment tools are frequently too long for routine screening. This study aimed to develop and validate a brief, psychometrically sound screening tool, the AHEAD-Emotional Health (Mood) subsection, for this age group.
Methods: This multi-phase validation study recruited participants (N=750) aged 6-18 years from clinical and community settings. An initial 10-item pool was refined using a pilot study (N=250), which established construct validity through Exploratory (EFA) and Confirmatory Factor Analysis (CFA), reliability via Cronbach's alpha and Intraclass Correlation Coefficients (ICC), and an optimal cut-off score using ROC curve analysis. The diagnostic accuracy of the final module was then assessed in a larger general population sample (N=750), using the Child Behavior Checklist (CBCL) as the reference standard. ***Results***: The final 8-item AHEAD module demonstrated an excellent CFA model fit (CFI = .989, TLI = .978, RMSEA = .046), good internal consistency (Cronbach's α = .796), and excellent test-retest reliability (ICC = 0.983). In the general population validation (N=750), ROC analysis showed an AUC of 0.940 ($p < .001$). Using an optimal cut-off score of ≥ 8, the AHEAD module demonstrated 86.5% sensitivity and 89.6% specificity against the CBCL. The tool achieved a high Negative Predictive Value (NPV) of 97.8% and substantial agreement (Cohen's Kappa = 0.611). ***Conclusion***: The 8-item AHEAD-Emotional Health (Mood) module is a brief, reliable, and valid screening instrument for identifying mood disorders in children and adolescents. Its high sensitivity and excellent NPV make it a highly effective tool for ruling out disorders, supporting its use in primary care and school-based screening programs to facilitate early detection and referral.

Keywords:

INTRODUCTION

Mental and mood disorders among school-aged children and adolescents represent a significant and growing global public health challenge, with estimates suggesting 10-20% of the global pediatric population is affected.[1] This burden is disproportionately high in Low- and Middle-Income Countries (LMICs), where over 80% of cases occur.[2,3] India, which is home to 20% of the world's adolescent population, faces a substantial prevalence of these conditions, with common mental disorders affecting an estimated 17.6% of individuals in South Asia.[4,5] The onset of these disorders during this critical developmental period can lead to poor academic performance, strained social relationships, and a higher risk of severe psychiatric conditions in adulthood.[6,7]

Despite this high prevalence, mood disorders like depression and anxiety in children and adolescents frequently go unrecognized in primary care and educational settings.[8] This detection gap is exacerbated by a lack of screening tools that are rapid, reliable, and easily deployable. While comprehensive, parent-reported diagnostic tools like the Child Behavior Checklist (CBCL) are considered effective for assessment, their length and requirement for specialized interpretation can limit their feasibility for routine, large-scale screening in busy clinics or schools.[9] This highlights a pressing need for an instrument that is validated for this specific age group, culturally appropriate, and practical for use by frontline health or education professionals.

To address this gap, the Assessment of Holistic Emotional and Developmental Growth (AHEAD) tool was developed as a brief, digital-first screening instrument. This article details the specific development and validation of the AHEAD-Emotional Health (Mood) subsection for school-aged children and adolescents (6-18 years). We report its psychometric properties, including the multi-stage construct validation, internal consistency, and test-retest reliability. Finally, we establish its diagnostic accuracy, sensitivity, and specificity by benchmarking it against the CBCL.

Material and Methods

Study Design and Setting: This study was a part of a larger, exploratory sequential validation study conducted from January 2023 to December 2024. Participants were recruited from the paediatric outpatient department of Saveetha Medical College and Hospital, a tertiary care centre in Chennai, India, as well as from local schools and community health programs to ensure a diverse and representative sample.

Study Population: A stratified random sampling approach was employed. This article focuses on the stratum of 750 children and adolescents aged 6 to 18 years. Inclusion criteria were: age between 6 and 18 years, availability of a primary caregiver, and provision of informed consent (and assent for older children). Exclusion criteria included severe neurological disorders (e.g., uncontrolled epilepsy), acute medical illness at the time of screening, or a non-consenting parent/guardian.

Procedure and Validation: The validation process occurred in distinct phases. After an initial item pool was refined through face and content validity (detailed elsewhere), a pilot study was conducted on a subgroup of 250 children (aged 6-18 years) to establish construct validity and reliability.

1. Construct Validity (Pilot Phase): Exploratory Factor Analysis (EFA) was conducted to assess the underlying structure. The Kaiser-Meyer-Olkin (KMO) measure and Bartlett's Test of Sphericity confirmed sample adequacy. Principal Axis Factoring with Direct Oblimin rotation was used. The resulting factor structure was then validated using Confirmatory Factor Analysis (CFA) in AMOS, assessing model fit via indices such as CFI, TLI, and RMSEA.
2. Reliability (Pilot Phase): Internal consistency of the refined module was assessed using Cronbach's alpha. Test-retest reliability was established by re-administering the tool to the same 250 participants after one month, and stability was measured using Intraclass Correlation Coefficients (ICCs).
3. Cut-off Determination (Pilot Phase): Receiver Operating Characteristic (ROC) curve analysis was performed on the pilot data, using the CBCL diagnosis as the state variable, to determine the optimal cut-off score. The cut-off maximizing Youden's Index was selected.
4. General Population Validation: The final 8-item AHEAD-Emotional Health (Mood) module for 6-18 years, with its established cut-off, was then administered to the full general population sample of 750 participants.

Reference Standard: The Child Behavior Checklist (CBCL) for ages 6-18 was used as the "gold standard" reference tool for comparison.[9] The CBCL is a comprehensive, parent-reported questionnaire widely validated for assessing emotional and behavioural problems.

Statistical Analysis: All statistical analyses were conducted using SPSS 29.0 and SPSS AMOS 29. Diagnostic accuracy of the AHEAD module was evaluated against the CBCL by calculating sensitivity, specificity, Positive Predictive Value (PPV), Negative Predictive Value (NPV), and Cohen's Kappa. A binary logistic regression was performed to confirm the tool's predictive ability. A p-value $< .05$ was considered statistically significant.

Ethical Considerations: The study protocol was approved by the Institutional Ethics Committee (IEC-Reference Number: 010/09/2024/IEC/SMCH). Written informed consent was obtained from the primary caregiver of each participant, and assent was obtained from participating adolescents.

Results

Pilot Study: Construct Validity and Reliability (N=250) The pilot study cohort (N=250) for the 6-18 years module had a mean age of 12.60 ± 3.4 years. There was no significant difference in age or sex distribution between those who screened positive or negative on the reference CBCL ($p > .05$).

1. Construct Validity: An initial EFA was conducted on 10 items. Sampling adequacy was confirmed (KMO = .728; Bartlett's Test ($\chi^2(45) = 903.683$, $p < .001$). Four factors were extracted, explaining 74.00% of the total variance. Following EFA, a refined 8-item model was tested using Confirmatory Factor Analysis (CFA). The refined model demonstrated an excellent fit to the data ($\chi^2(18) = 27.676$, $p = .067$; CFI = .989; TLI = .978; RMSEA = .046). The final 8-item module comprised four factors: (1) Deficits in Social Responsiveness and Interpersonal Interaction, (2) Deficits in Emotional Awareness and Environmental Engagement, (3) Deficits in Cognitive Control and Task Engagement, and (4) Deficits in Behavioural Regulation and Attentiveness.
2. Reliability: The final 8-item module showed good internal consistency (Cronbach's $\alpha = .796$). Test-retest reliability was excellent, with an Intraclass Correlation Coefficient (ICC) for the total score of 0.966 (95% CI [0.948, 0.976]) for single measures and 0.983 (95% CI [0.973, 0.988]) for average measures.
3. Cut-off Determination: ROC curve analysis was performed to evaluate the module's ability to predict a CBCL-defined mood disorder. The Area Under the Curve (AUC) was 0.940 (95% CI [0.911, 0.969], $p < .001$), indicating excellent diagnostic accuracy. A cut-off score of ≥ 8 was identified as optimal, maximizing Youden's Index (.802) and yielding a sensitivity of 93.3% and a specificity of 86.8% in the pilot sample (Figure 1).

General Population Validation (N=750) The AHEAD-EH (Mood) module with the cut-off of ≥ 8 was validated in a larger general population sample of 750 participants (mean age 11.9 ± 3.2 years). There were no significant differences in age or sex distribution between AHEAD-positive and CBCL-positive groups ($p > .05$).

1. Diagnostic Accuracy: When compared to the CBCL as the reference standard, the AHEAD module demonstrated high diagnostic accuracy. The sensitivity was 86.5% (95% CI [78.7%, 92.3%]), and the specificity was 89.6% (95% CI [87.1%, 91.8%]). The module achieved a Positive Predictive Value (PPV) of 55.0% (95% CI [47.0%, 62.8%]) and a high Negative Predictive Value (NPV) of 97.8% (95% CI [96.5%, 98.8%]) (Table 1).
2. Agreement and Likelihood Ratios: The Positive Likelihood Ratio (LR+) was 8.33, indicating that a positive AHEAD screen was over 8 times more likely to come from a child with a mood disorder than one without. The Negative Likelihood Ratio (LR-) was 0.15, indicating a strong ability to rule out disorders. Agreement between the AHEAD module and the CBCL was substantial (Cohen's Kappa = 0.611, $p < .001$).
3. Predictive Value: A binary logistic regression confirmed the AHEAD total score as a significant predictor of mood disorder status ($p < .001$). The model was statistically significant (chi-square(1) = 244.98, $p < .001$) and correctly classified 90.8% of cases. The odds ratio (OR) for the total score was 1.73 (95% CI [1.57, 1.90]), indicating a 73% increase in the odds of having a mood disorder for each one-point increase in the AHEAD score.

Discussion

This study successfully developed and validated the AHEAD-Emotional Health (Mood) subsection for screening mood disorders in Indian children and adolescents aged 6-18 years. The final 8-item module demonstrated strong psychometric properties, including a clear factor structure, good internal consistency (Cronbach's $\alpha = .796$), and excellent test-retest reliability (ICC = 0.983). When benchmarked against the widely used CBCL, the AHEAD module showed high diagnostic accuracy, with a sensitivity of 86.5% and a specificity of 89.6% using an optimal cut-off score of ≥ 8.

The performance of the AHEAD module compares favourably with other brief screening tools. For instance, studies validating the Patient Health Questionnaire-9 (PHQ-9) in adolescents reported sensitivities around 89.5% but specificities around 77.5%,[12] suggesting AHEAD might offer a better balance, particularly in reducing false positives in a general population screen. While structured interviews like the K-SADS-PL offer high diagnostic precision,[10] their length and requirement for trained administrators make them unsuitable for primary screening. AHEAD's brevity (8 items) and digital format address the practical limitations often faced with tools like the CBCL,[9] enhancing its feasibility for integration into busy clinical workflows, school health programs, or large-scale community screening initiatives like India's Rashtriya Bal Swasthya Karyakram (RBSK).[13]

A key strength of the AHEAD module is its high negative predictive value (NPV) of 97.8%. This suggests that the tool is particularly effective at ruling out mood disorders, making it a valuable instrument for identifying children who likely do not require further, more intensive assessment, thereby optimizing resource allocation in strained health systems. The substantial agreement with the CBCL (Kappa = 0.611) further supports its criterion validity.

However, certain limitations must be acknowledged. The positive predictive value (PPV) was moderate at 55.0%, indicating that a significant proportion of children screening positive may not meet diagnostic criteria upon further evaluation. This underscores the importance of using AHEAD as a *screening* tool, necessitating follow-up diagnostic assessment for positive cases. The validation was conducted primarily against the CBCL, a parent-report measure, rather than a clinical diagnostic interview for the entire sample, which remains the gold standard. While developed with expert input for cultural relevance, broader linguistic validation across different Indian languages is warranted. Furthermore, the cross-sectional design limits conclusions about predictive validity over time.

Despite these limitations, the AHEAD-EH (Mood) module for 6-18 years represents a significant advancement. It provides a psychometrically sound, brief, and digitally deployable tool tailored for the Indian context, addressing a critical gap in adolescent mental health screening. Its successful validation supports its potential for widespread adoption to facilitate early detection and intervention for mood disorders in this vulnerable population, aligning with national and global mental health priorities.[5],[14]

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Tables:

AHEAD - Emotional Health: Mood Subsection (6 - 18 years)		
Criterion for test positivity	Statistic value	95% CI
Sensitivity	86.50%	78.7% - 92.3%
Specificity	89.60%	87.1% - 91.8%
Positive Predictive Value	55%	47% - 62.8%
Negative Predictive value	97.80%	96.5% - 98.8%
LR+ (Likelyhood ratio positive)	8.33	
LR- (likelyhood ratio negative)	0.15	
Cohen's Kappa	0.611	0.537 - 0.685
PABAK	0.784	

Table 1: Diagnostic accuracy analysis of the AHEAD - Emotional Health Module (6 – 18 years)

Figures:

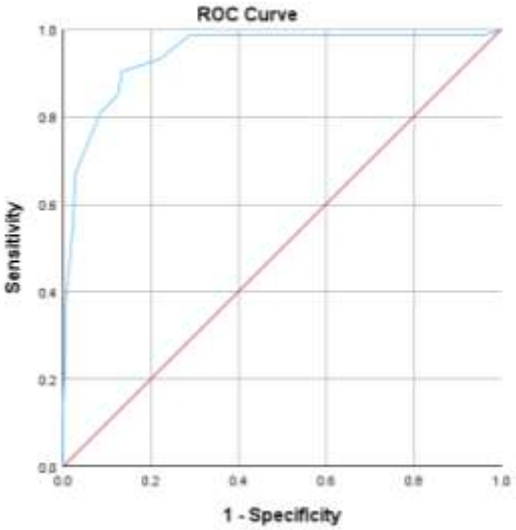

Figure 1: ROC Curve for Evaluating the Diagnostic Accuracy of AHEAD - EM in predicting Mood disorder acc. to CBCL