Short Research Article: Heads Up Checkup (HCU): A Digital Prototype for Brief Assessment of Mental Health Risk among Adolescents

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Abstract

This study provides evidence-based support for Heads Up Checkup (HCU), a brief and secure new generation on-line mental health risk screening system for adolescents. HCU features a priority index (HPI) that classifies level of risk, enhancing its clinical relevance and feasibility for the delivery of preventive and therapeutic services. Predictive validity estimates are presented for a community sample (N=2244) of middle and high school students from Orange County, California. Findings regarding the prevalence rate of MDD symptoms among female and male adolescents suggest that HCU can generate results consistent with statewide and national survey estimates.

Keywords: Heads Up Checkup (HCU), HCU Priority Index (HPI), major depressive disorder (MDD), adolescence, brief mental health risk screen.

Three Key Practitioner Points

What is currently known? Validated evidence-based brief digital mental health and behavioral risk screens for children and adolescents are urgently needed.
What has been shown? Heads Up Checkup (HCU) is a brief adaptive on-line screening system which can detect levels of risk across various psychiatric disorders. Validation and consistency data based on a community sample of adolescents with significant representation of Hispanics show HCU to have good psychometric properties for major depressive disorder (MDD).
What is the significance of this for clinical practice? HCU provides the clinician with a comprehensive, self-scoring and self-reporting mental health screening tool that can be completed in English or Spanish in about 10 minutes from any WiFi connected device. Screenings can easily be administered as part of intake prior to appointment. HCU clinical report shows comorbid symptoms, risk of suicide and substance use, and ACEs, which can be used to assist the clinician in the diagnostic process.

INTRODUCTION

The U.S. Surgeon General's Advisory (2021) on protecting youth mental health emphasized the urgent need for an integrated, real-time data collection infrastructure for understanding the needs of at-risk children and adolescents. According to the National Center for Health Statistics (Garnett et al., 2022), the suicide rate among girls ages 10-14 more than tripled from 2000 – 2020, and for those ages 15-24 the rate increased by 87% from 2007-2020. Among males, the suicide rate also increased for the 10-14 and 15-24 year-old groups during the same timeframe. Moreover, a 2021 Centers for Disease Control and Prevention (2022) mental health survey estimated that 44% of adolescents experienced prolonged symptoms of depression in 2020-2021; the rate was 57% among girls and 76% among LGB youth. In response, the U.S. Preventive Services Task Force, an independent group of national experts in prevention and evidence-based medicine, issued recommendations to primary care physicians and mental health providers to screen regularly for anxiety among youth as early as 8 years of age (2022) and for depression starting at 12 years (Siu, 2016). The actionable directive to utilize technology in the assessment of mental health risk among youth has never been so attainable (Lazar et al.,2017).

In keeping with the goals of this public mental health initiative, Heads Up Checkup is an adaptive computerized screening system designed to identify a constellation of child and adolescent mental health risks. To identify probable risk cases, HCU's algorithm simultaneously analyzes twenty psychiatric diagnostic considerations, including depression, social anxiety, generalized anxiety, panic, phobia, PTSD, substance abuse, sleep issues, eating disturbances, thought disorders, conduct problems, ADHD, ASD/Asperger's, and learning challenges. In addition, HCU evaluates the presence of suicidal and homicidal ideation as well as adverse childhood experiences. An advantage of HCU is its ability to provide the respondent and the designated adult recipient (e.g., parent or guardian, school counselor, physician, etc.) with immediate confidential feedback. Its efficiency stems from an adaptive algorithm that utilizes conditional logic to customize the risk screen for users. For example, if respondents were to endorse the requisite number of critical symptoms for depression, then additional questions would be presented. If not, the algorithm would skip the remaining depression questions and continue to the next diagnostic consideration. Consequently, HCU typically takes under 10 minutes to complete. It is accessible in English or Spanish from any WiFi connected device and can be administered individually or delivered at population level in schools. Over the past three years, the HCU has been offered to middle and high school students. When presented as a school-wide voluntary opportunity, student response rate has consistently ranged between 70% and 85%.

Using a decision-tree algorithm, the HCU assigns a "priority" risk level based on the percent criteria met for one or more psychiatric categories, the severity of symptoms, and the presence of key risk factors. Referred to as the HCU Priority Index (HPI), this risk designation conveys the scope and urgency of diagnostic concerns. Because the HPI risk designation is not determined by a single category, a respondent can simultaneously meet 70-99% of the diagnostic criteria for more than one category. In addition, the same respondent can meet 100% criteria for more than one diagnosis. In this example, although the respondent would receive feedback containing information about all the endorsed diagnostic considerations, only one HPI risk level would be determined by any categories that met the 100% criteria threshold. HPI risk levels can range from "1" or less than 50% criteria met for one or more diagnoses to "7" acute suicidal ideation, child abuse, or threat to others.

Purpose of the Present Study

Preliminary data support the reliability and predictive validity of HPI risk levels for major depressive disorder (MDD) (Genero et al., 2021). Using a significance test of independence and proportional differences, the purpose of this study is to demonstrate how the HPI works in relation to MDD symptom levels.

Method

Sample

HCU's community sample for this study comprises (N=2244) adolescents, including n=1150 females and n=1094 males, with a total of (n=1688) 7^{th}-8^{th} graders and (n=556) 9^{th}-12^{th} grade students who were screened in 2020 and/or 2021. At the time of screening, all respondents were enrolled in one of four public schools in Orange County, California. The student enrollment in two participating middle schools is at least 35% low-income which meets criteria for Title I federal subsidies. Most students completed HCU while in grades 7-8 (75.2%), and the majority (92.3%) completed the screening in English (n=2071). Race/ethnicity data were not available. All duplicate cases or incomplete screenings were excluded from the sample.

Procedure

A voluntary Informed Consent form was presented to students 12-17 years of age in compliance with the State of California laws regarding minor consent and confidentiality. Individual screening accounts used a Student ID and temporary password as login credentials. Students were then directed to a URL unique to each school and completed the screening during a non-academic period. All data were analyzed and reported in aggregate form with no identifying personal student information

Measures

Eleven binary scale (Yes, No) items and severity measures of duration and impact were used to screen for depression. For convergent validity purposes, the MDD items align with criteria published by the World Health Organization for ICD-10 Code F32.9 Major depressive disorder, single episode, unspecified (2022) and the Patient Health Questionnaire-9 (APA, 2022) (Appendix 1).

Results

The MDD frequency distribution for the total number of symptoms indicates that over half the sample (Median= 52%) endorsed one or fewer symptoms. This distribution resulted in two symptom groups: (Low MDD, n=1165) and (High MDD, n=1079). For the HPI distribution, cases at or below the 50-69% criteria for at least one diagnostic category, or HPI Levels 1-2, accounted for 49.5% of the total sample, resulting in two risk groups: (Low HPI, n= 1110) and (High HPI, n= 1134).

Based on a 2X2 contingency tabulation for the MDD and HPI subgroups, probabilities for different psychometric properties and odds ratios are summarized as follows:

Table 1

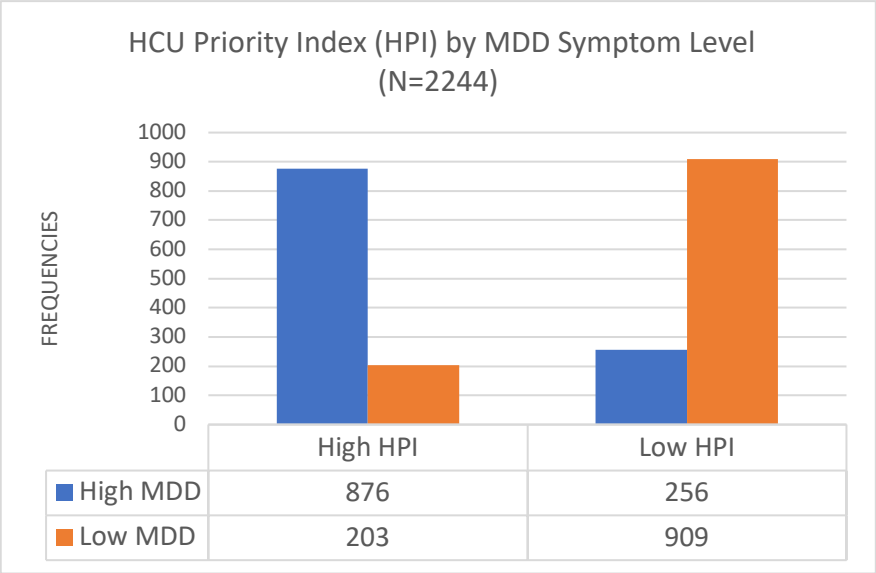
MDD Psychometric Properties (N=2244)

Reliability	Prevalence of High MDD	Sensitivity	Positive Predictive Value (PPV)	Specificity	Negative Predictive Value (NPV)	Positive Likelihood Ratio	Negative Likelihood Ratio
α =.77	48%	77%	81%	82%	78%	4.2	.27

A prevalence rate of 48% is consistent with the UCLA Center for Health Research rate for psychological distress among youth in California (Wright et al., 2021). Consistent with published data (Nolen-Hoeksema, 2001), we found females to have a markedly greater prevalence of high depressive symptoms than males (59% vs 37%, respectively). The positive and negative likelihood odds ratios show good discrimination; cases classified as “true positive” (high HPI, high MDD) are approximately 4.2 (95% CI 3.646, 4.698) times as likely to be in the high HPI risk group, compared to “true negative” cases (low HPI, low MDD). Whereas “true negative” (low HPI, low MDD symptoms) cases are approximately .27 (95% CI .239, 299) or one-fourth as likely to be in the high HPI risk group. Moreover, MDD severity data (i.e., duration of symptoms and impact on daily living), were found to be consistently higher among “true positive” cases.

Furthermore, a CHI SQ Test of Independence between the two categorical variables, HPI risk level (low vs high) and MDD Symptoms (low vs high), evaluated the strength of their association. A significant association suggests that the proportion of “low vs high” observed MDD cases varies by the predicted “low vs high” HPI designation. The predicted association was significant (CHI Sq (1) = 786, p <.001) with a strong effect size (φ = 0.59). As for clinical relevance, the odds ratio indicated that cases classified as high HPI are 15.3 times (95% CI 12.5, 18.8) more likely to be in the high MDD group. With respect to gender differences, females with a high HPI designation are 17 times (95% CI 12.8,23.6) more likely to be classified as high MDD, whereas males are 11.5 times (95% CI 8.6, 15.4) as likely. Expected differences in proportions show high MDD cases (n=876) are in the “predicted” high HPI category, and low MDD cases (n=909) are in the low HPI group (Figure 1).

Figure 1



Discussion

A brief digital assessment of mental health risks among adolescents is critical to the delivery of timely support services to adolescents. Although HCU does not replace more time-intensive validated instruments used by clinicians to support diagnostic decision-making, Heads Up Checkup can quickly differentiate risk priority levels according to the number of self-reported MDD symptoms. Analyses of the relationships among other HCU diagnostic scales are needed to expand the predictive and construct validation of the HPI. Moreover, understanding how HPI risk status differs by factors, including negative early childhood experiences, alcohol and/or drug abuse, low social support, sexual orientation, gender identity, and acculturative stress (Cervantes et al., 2019) will inform intervention planning and the provision of support resources. The inclusion of demographic data will provide information about ways in which age, gender, race, ethnic origin, and socioeconomic status interact with risk. Triangulating HCU findings with clinical outcomes as well as independent data from parents and schools regarding academic and behavioral functioning will also reinforce the psychometric properties of HCU. Further analyses of screenings collected at multiple timepoints would also confirm HCU's ability to detect changes in risk status and symptom prevalence rates over time.

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Appendix 1: Comparison of MDD Items: Convergent Validation

World Health Organization	Heads Up Checkup (HCU)	Patient Health Questionnaire-9 (PHQ-9)
Depressed, sad, empty, or hopeless	I often feel sad, depressed, or hopeless	Feeling down, depressed, or hopeless
Fatigue or no energy	I don't seem to have enough energy to do anything	Feeling tired or having little energy
Very little interest or pleasure in normal activities	I've lost interest in doing things I used to enjoy	Little interest or pleasure in doing things
Difficulty thinking or concentrating	I have trouble concentrating	Trouble concentrating on things, such as reading the newspaper of watching television
Feeling worthless	I feel guilty or unworthy	Feeling bad about yourself- or that you are a failure or have let yourself or your family down
Guilt or unworthiness		
Pessimism		
Thinking about death, self-harm	Within the past few weeks, I have had thoughts of killing myself	Thoughts that you would be better off dead or of hurting yourself in some way
Sleeping too much or not enough	I sleep too much	Trouble falling or staying asleep or sleeping too much
	I don't get enough sleep	
Decrease or increase in appetite	I don't eat enough	Poor appetite or overeating
	I don't feel hungry most of the time	
	Sometimes I eat way too much or eat when I'm not even hungry	
Severity: Functioning Impact	Severity: Functioning Impact	Severity: Functioning Impact
Duration of Symptoms	Duration of Symptoms	Duration of Symptoms