Analyzing the Efficacy of the NIH Emotion Toolbox when Predicting Depression and Anxiety in Individuals with Down Syndrome (DS)

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BACKGROUND:

People with Down syndrome (DS) have been found to experience higher rates of depression and anxiety compared to the general population. The NIH Toolbox Emotion Battery was developed by the National Institutes of Health to standardize assessments of negative affect and emotional wellbeing. NIH emotion toolbox has not been widely used for those with (IDD), including DS.

AIMS:

This study aimed to determine the efficacy of the NIH toolbox to predict a diagnosis of anxiety and depression with the following research questions.

1. Are the self-report and parent-report NIH Toolbox Emotion Battery subscales reliable for people with DS?
2. Does the NIH Toolbox Emotion Battery predict a diagnosis of depression or anxiety in people with DS?
3. Is there evidence of convergent and discriminant validity among the subscales of the NIH Toolbox in people with DS?

METHODS AND MEASURES:

Methods:

The study included 90 individuals with Down syndrome (ages 12–45; M = 22, IQR 17–29; 57% female) and their parent/caregiver.

Measures;

NIH Toolbox: Participants with DS completed the NIH Toolbox Sadness, Fear, and Positive Affect subscales. Sum scores were converted to T-scores using normative data.

Glasgow Depression and Anxiety Scale: Screening tool that assess symptoms of anxiety and depression, particularly in people with IDD. help clinicians identify emotional difficulties using simple language and observable behaviors.

Psychiatric Assessment Schedule for Adults with Developmental Disabilities: A validated structured diagnostic interview for individuals with intellectual and developmental disabilities, yielding DSM-5 and ICD-10 diagnoses. Participants with DS and their caregiver were interviewed and classified as having an anxiety or depressive disorder if they met criteria under either system.

Data Analysis Plan: Area Under the Curve (AUC) was conducted using the R `pROC` package.

Figure 1. Distribution of the NIH Toolbox Subscale Scores.

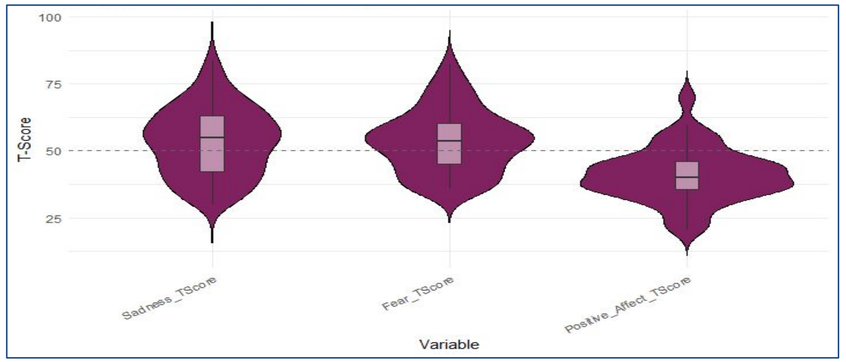


Figure 2. Self-Report NIH Toolbox Sadness Predicting Depression Diagnosis

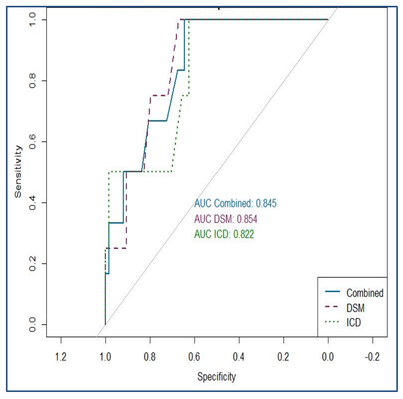


Figure 3. Self-Report NIH Toolbox Fear Predicting Anxiety Diagnosis

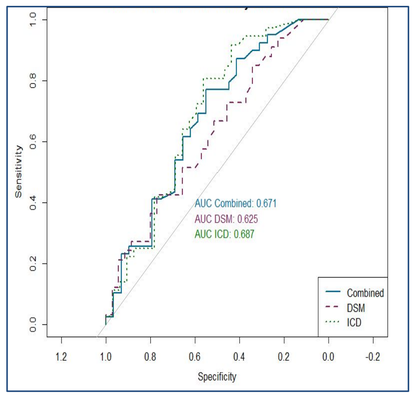
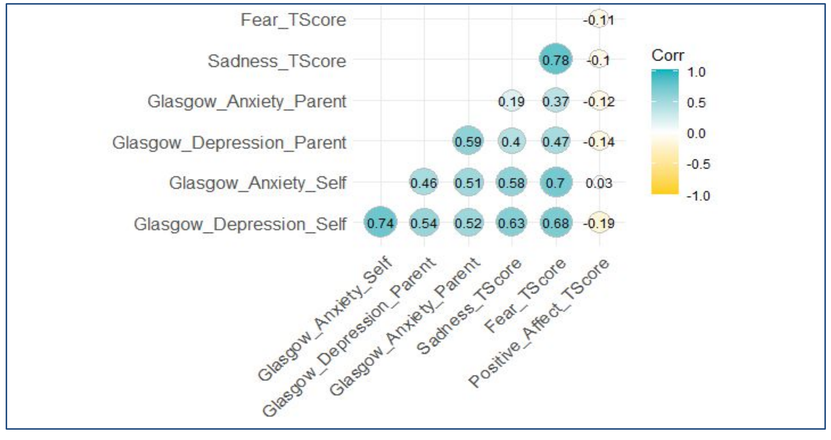


Figure 4. Correlations Between Convergent and Discriminant Measures of Sadness and Fear



RESULTS:

Average T-scores on the NIH Toolbox were Sadness (M = 54; IQR = 43, 63), Anxiety (M = 53; IQR = 45, 61), Positive Affect (M = 41; IQR = 36, 46). See Figure 1.

Reliability

- Sadness subscales demonstrated strong internal consistency reliability (α = .84 - .90).
- Fear subscales demonstrated strong internal consistency reliability (α = .81 - .85).

Diagnostic Accuracy

- NIH Sadness had strong diagnostic accuracy (AUC = 0.845) (85%; Figure 2) for predicting depression. Youden's J statistic suggested that a T-score cutoff of 56.55 optimized sensitivity (1.00) and specificity (0.64), with an overall accuracy of 0.676.
- NIH Fear was less effective for predicting anxiety with an AUC of 0.671 (67%; Figure 3). Youden's J statistic suggested that a T-score cutoff of 49.97 optimized sensitivity (0.76), specificity (0.55), and accuracy (0.676).

Convergent and Discriminant Validity

- See Figure 4 for convergent and discriminant validity. NIH Toolbox Sadness scores were positively correlated with PAS-ADD depression diagnoses (r = 0.36, p = 0.002), and NIH Fear scores were positively correlated with PAS-ADD anxiety diagnoses (r = 0.27, p = 0.02).
- NIH Positive Affect scores showed negative but non significant correlations with depression (r = –0.23, p = 0.055) and anxiety (r = –0.13, p = 0.073) diagnoses.

CONCLUSION:

Internal consistency and correlations were **consistent with expectations**, suggesting reliable participant responses.

The NIH Toolbox Sadness subscale demonstrates **comparable accuracy to other common depression screeners** in predicting depression (Youngstrom, 2014). A T-score **above 56** on the NIH Sadness subscale warrants **further assessment for depression**. This cutoff is close to the standard "at risk" threshold of 60.

The NIH Toolbox Fear subscale was **less effective in predicting anxiety disorders** in individuals with Down Syndrome. Researchers and clinicians should **exercise caution** when interpreting Fear T-scores in this population.

LIMITATIONS:

- The sample is **not representative** of the overall DS (Down Syndrome) population.
- To ensure consistency, adult fear scores (originally two separate scales) were averaged to allow for comparison with children's single fear scores.
- **Medical evaluations were not conducted**, which limited the ability to accurately diagnose depression in participants with DS, as common conditions like hypothyroidism can mimic depression symptoms.