

Supplementary Online Content

Carrión RE, McLaughlin D, Goldberg TE, et al. Prediction of functional outcome in individuals at clinical high risk for psychosis. *JAMA Psychiatry*. Published online September 4, 2013. doi:10.1001/jamapsychiatry.2013.1909.

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This supplementary material has been provided by the authors to give readers additional information about their work.

eAppendix

Supplemental Methods

After deriving logistic equations for the final models, predicted probabilities were developed for each subject and receiver operating characteristic curves were constructed to determine the accuracy of the models. The ROC curve displays the sensitivity (probability that a test will produce a true positive result) and specificity (probability that a test will produce a true negative result) as its discrimination threshold is varied (1). The area under the curve (AUC) with 95% confidence intervals was used as indicator of the probability that a randomly chosen respondent would be correctly distinguished based on their screened baseline variables (2). AUC values can range from 0.5 (indicates that an instrument can discriminate between groups no better than chance) to 1.0 (represents perfect discriminatory performance).

Supplemental Results

Receiver operator characteristic curves were generated to determine the ability of the final models to discriminate between individuals with good and poor outcome. For social outcome, the AUC was 82.4 (95% CI, 73.6-91.3, $P < .001$), indicating that for any randomly drawn pair of participants from these two functioning groups, the probability that a participant with poor social outcome would have poor social functioning, impaired processing speed and total behavioral disorganization ≥ 4 was 82.4% (see Supplemental Figure 1). For role outcome, the AUC was 77.2 (95% CI, 67.8-86.5, $p < 0.001$), indicating an acceptable discriminative ability (see Supplemental Figure 2).

eTable 1

Neurocognitive domains, Individual tests, and Dependent measures

Verbal Memory ($\alpha = .82$, 4 tests)	
California Verbal Learning Test (CVLT) Total for trials 1–5 Long delay free recall	Words recalled in trials 1-5 Recognition errors
Wechsler Memory Scale, Revised (WMS-R) Logical Memory: Immediate and Delayed	Story elements recalled
Working Memory ($\alpha = .78$, 3 tests)	
Wechsler Intelligence Scale for Children-III/Wechsler Adult Intelligence Scale-R (WISC-III/WAIS-R) Digit Span Forward and Backward	Digit sequences recalled
Letter-Number Span	Number of correct trials
Executive Function ($\alpha = .78$, 5 tests)	
Ruff Figural Fluency Test	Number of correctly reproduced figures
Wisconsin Card Sorting Test (WCST), Version 2 Perseverative Errors Categories Completed Conceptual Level Responses	Percentage of perseverative errors; Number of correctly completed categories Number of consecutive correct responses in ≥ 3 runs
Controlled Oral Word Association Test (COWAT)	Words produced in 1 minute
Sustained Attention ($\alpha = .84$, 3 tests)	
Continuous Performance Test-Identical Pairs (CPT-IP) 2-, 3-, and 4-digits	d' (for all stimulus sets)
Processing Speed ($\alpha = .81$, 4 tests)	
Trails Making Test, Part A and B	Time to complete trails
WISC-III/WAIS-R Digit Symbol Coding	Symbols accurately coded in 2 minutes
Symbol cancellation test	Time to complete cancellation
Motor Speed ($\alpha = .75$, 4 tests)	
Finger Tapping Test, Dominant and Nondominant hand scores	Taps in 10 seconds, over 5 blocks
Grooved Pegboard Test, Dominant and Nondominant hand scores	Time to place pegs
Visuo-Spatial Processing ($\alpha = .63$, 2 tests)	
Judgment of Line Orientation WAIS-R/WISC-III Block Design	Lines accurately matched Correctly reconstruct blocks to match patterns on cards
Language ($\alpha = .82$, 3 tests)	
Wide Range Achievement Test-III (WRAT-III) Reading	Total score for words read correctly
Boston Naming Test	Number of correctly named items
WAIS-R/WISC-III Vocabulary	Number of words orally defined

eTable 2. Potential Predictor Domains and Individual Variables for the Multivariable Logistic Regression Models

Domain	Variables	Variables Retained After Univariable Screening Procedure for Social Outcome Model ($P < .15$)	Variables Retained After Univariable Screening Procedure for Role Outcome Model ($P < .15$)
Demographics	Age at baseline Level of education Parental socio-economic status (SES) Gender Handedness Race Ethnicity First-degree relative with Psychosis	Race First-degree relative with Psychosis	Age at baseline Level of education
Intellectual Functioning	Estimated Current IQ	None	None
Neurocognitive Performance	Processing speed Verbal memory Executive function Working memory Visuo-spatial processing Motor speed Sustained attention Language	Processing Speed Verbal Memory Executive Function Working Memory Motor Speed Language	Processing speed Verbal memory Executive function Working memory Sustained attention Language
Positive Symptoms, SOPS	5 Symptoms: 1. Unusual Thought Content 2. Suspiciousness 3. Grandiosity 4. Perceptual Abnormalities 5. Disorganized Communication Absolute number of symptoms greater than 2, level 3, and level	Suspiciousness; Perceptual Abnormalities; Disorganized Communication Total Positive Score Absolute number of symptoms greater than level 4	Suspiciousness; Grandiosity Total Positive Score

	4 Total Positive Score (raw score; cutoff > 15)		
Negative Symptoms, SOPS	4 Symptoms: 1. Social Isolation 2. Avolition 3. Expression of Emotion 4. Experience of Emotion and Self 5. Ideational Richness 6. Occupational Functioning Absolute number of symptoms greater than 2, level 3, and level 4 Total Negative Score (raw score; cutoff > 13)	Isolation ^a Avolition Decreased Expression Decreased Ideational Richness Absolute number of symptoms greater than 2, level 3, and level 4 Total Negative Score	Avolition, Decreased Ideational Richness, Deteriorating Role ^a Absolute number of symptoms greater than level 4
Disorganized Symptoms, SOPS	4 Symptoms: 1. Odd Behavior or Appearance 2. Bizarre Thinking 3. Trouble with Focus and Attention 4. Hygiene Social Attentiveness Absolute number of symptoms greater than 2, level 3, and level 4 Total Disorganized Score (raw score; cutoff > 4)	Odd Behavior; Bizarre Thinking; Hygiene Social Attentiveness Total Disorganized Score (>4) Absolute number of symptoms greater than 2	Odd Behavior; Attention Trouble; Hygiene Social Attentiveness Total Disorganized Score (>4) Absolute number of symptoms greater than 3
	4 Symptoms: 1. Sleep Disturbances 2. Dysphoric Mood 3. Motor Disturbances 4. Impaired Tolerance to	Sleep Disturbances; Motor Disturbances	Sleep Disturbances; Motor Disturbances

	<p>Normal Stress</p> <p>Absolute number of symptoms greater than 2, level 3, and level 4</p> <p>Total General Score (raw score; cutoff > 6)</p>		
Total score, SOPS	<p>Raw score; cutoff > 41</p> <p>Absolute number of symptoms greater than 2, level 3, and level 4</p>	Total score, SOPS	Total score, SOPS
Social and Role Functioning	<p>Baseline GF: Social</p> <p>Baseline GF: Role</p> <p>GF: Social or Role deterioration of 10%</p> <p>GF: Social or Role deterioration of 30%</p> <p>Global Assessment of Functioning (GAF)</p>	Baseline GF: Social	Baseline GF: Role; GAF
Diagnostic Comorbidity: Axis 1	<p>DSM-IV diagnoses:</p> <p>Any mood disorder</p> <p>Any anxiety disorder</p> <p>Any mood or anxiety</p> <p>Any substance abuse disorder</p> <p>Major depressive disorder</p> <p>Generalized anxiety</p> <p>Agoraphobia</p> <p>Obsessive-compulsive disorder</p> <p>Panic</p> <p>Social phobia</p> <p>Cannabis</p> <p>Alcohol</p> <p>Nicotine</p>	Any Mood disorder	Any mood disorder; Attention deficit hyper disorder
Diagnostic Comorbidity: Axis 2	<p>DSM-IV diagnoses:</p> <p>Paranoid</p> <p>Schizoid</p>	None	None

	Schizotypal		
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^aThese variables were subsequently removed from the models due to high collinearity.

eTable 3. Demographic Characteristics of Participants at Baseline

Characteristic	Healthy Control Subjects (n=68)	Clinical High-Risk, Positive Group (n=92)	<i>P</i> value
Age, y, mean (SD)	16.32 (2.62)	15.96 (2.18)	.34
Estimated Current IQ, mean (SD)	109.94 (13.25)	103.41 (16.06)	<.01
Years of education, mean (SD)	10.52 (2.62)	9.72 (2.16)	.08
Gender, No. (%)			
Female	35 (51.5)	34 (37.0)	.08
Handedness, right, No. (%)	60 (88.2)	78 (84.8)	.65
Parental SES ^a Low, No. (%)	7 (10.9)	6 (6.6)	.39
Race, No. (%)			
White	42 (61.8)	74 (80.4)	.01
Ethnic Origin, No. (%)			
Hispanic	3 (4.4)	13 (14.1)	.06

^a Socioeconomic status, Hollingshead index (Hollingshead & Redlich, 1958), where 1–3 “high” and 4–5 “low”.

References

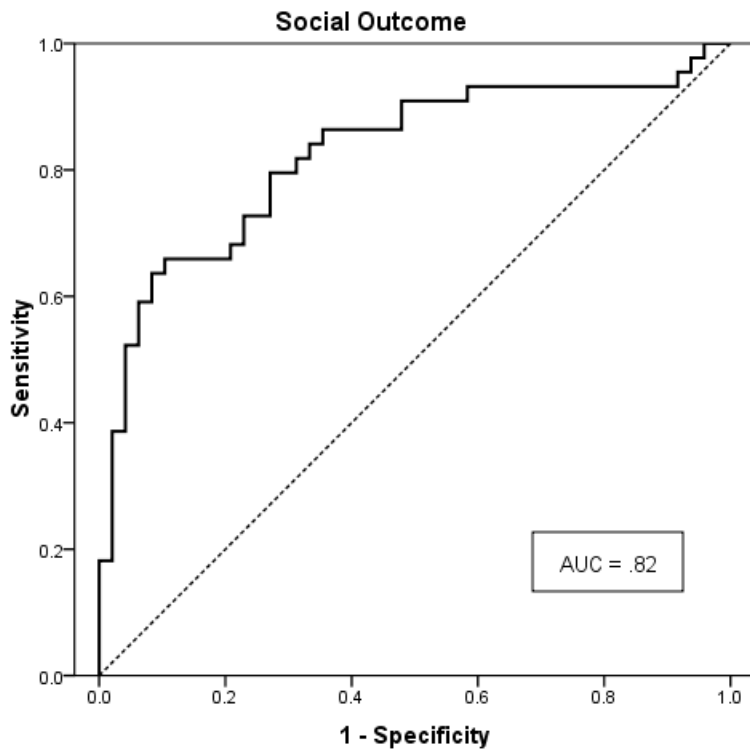
1. Altman DG, Bland JM: Diagnostic tests. 1: Sensitivity and specificity. *Bmj* 1994; 308(6943):1552
2. Hanley JA, McNeil BJ: The meaning and use of the area under a receiver operating characteristic (ROC) curve. *Radiology* 1982; 143(1):29-36

eFigure Captions

eFigure. Panel A. Receiver-operating characteristics (ROC) curve for a logistic regression model predicting social outcome in individuals at clinical high risk of psychosis. The ROC curve plots the true positive rate (sensitivity) against the false-positive rate (1-specificity) for different cut-points. The more closely the curve follows the top and left-hand border of the ROC space, the more accurate the test. The area under the curve (AUC) with 95% confidence intervals was used as indicator of the probability that a randomly chosen respondent would be correctly distinguished based on the prediction model.

eFigure. Panel B. Receiver-operating characteristics (ROC) curve for a logistic regression model predicting role outcome in individuals at CHR of psychosis.

A.



B.

