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CHILDHOOD PEGBOARD TASK PREDICTS ADULT-ONSET PSYCHOSIS-SPECTRUM DISORDER AMONG A GENETIC HIGH-RISK SAMPLE



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Background

- Motor abnormalities have been established as a core aspect of psychosis-spectrum disorders, with numerous studies identifying deficits prior to clinical symptom presentation.¹⁻⁴
- Motor deficits are thought to represent aspects of the underlying psychophysiology of psychosis-spectrum disorders, which may be viable candidates for illness endophenotypes.
- Additional research is needed to pinpoint standardized motor assessments associated with psychosis-spectrum disorders prior to illness onset to enhance prediction and understanding of etiology.⁵
- Pegboard tasks are a viable and understudied measure of motor functioning prior to psychosis onset.⁶⁻¹⁰
- The current investigation aimed to examine performance on the Simultaneous Pegs Test in children at genetic high-risk and matched controls followed for nearly 50 years.
- We hypothesized that childhood deficits in Simultaneous Pegs Test performance would predict later development of a psychosis-spectrum disorder relative to other non-psychotic mental disorders and to no diagnosis.

Methods

- 244 participants aged 10–13 (94 at genetic high-risk for psychosis and 150 controls)
 - Participants were recruited from the Copenhagen Perinatal Cohort, which enrolled participants between 1959 and 1961
- Genetic Risk
 - Participants were categorized into one of three genetic risk categories:
 - 1) children with at least one biological parent with a hospital psychiatric diagnosis of schizophrenia (high risk)
 - 2) children with at least one biological parent with a hospitalization record for a non-psychotic psychiatric diagnosis (other risk)
 - 3) children with neither biological parent having a record of psychiatric hospitalization (low risk)
- Simultaneous Pegs Test
 - Participants simultaneously and bimanually placed a number of small plastic pegs into the holes of a squared plastic plate as rapidly as possible
 - Criterion for failure was set at 16 seconds on all three trials.¹⁴ Time to complete the task was measured even if it exceeded 16 seconds.¹⁵
 - Both pass/fail criterion and time to completion were analyzed in the current study.
- IQ
 - During the same evaluation as the Pegs Test, participants also were evaluated with the Wechsler Intelligence Scale for Children (WISC)
 - The WISC provides a measure of verbal, performance, and full scale intelligence quotients. Subscales included in this assessment were Similarities, Vocabulary, Block Design, and Maze.¹³
- Diagnostic Outcome
 - In 1992, when participants were between the ages of 31 and 33, a psychiatrist administered the SCID and also the psychosis section of the Present State Examination.^{11,12}
 - 33 participants were diagnosed with a psychosis-spectrum disorder (“spectrum”), 78 were identified as having a non-psychotic disorder (“other disorders”; OPD), and 133 were identified as having no mental health diagnosis (“no mental illness”; NMI)

Table 1. Means, standard deviations, and pass/fail score on Simultaneous Pegs Test (SPT) by psychiatric outcome group

	<i>Psychosis-spectrum</i>	<i>Other disorders</i>	<i>No mental illness</i>
Pass/fail SPT			
Pass	27 (81.82%)	74 (94.8%)	124 (93.22)
Fail	6 (18.18%)	4 (5.13%)	9 (6.77%)
Seconds needed to complete SPT			
Mean	13.3	12.68	12.14
SD	3.4	2.24	2.04

Table 2. Coefficients from two multinomial logistic regressions predicting adult diagnostic outcome

<i>Model Predictors</i>	Wald χ^2	df	B	Odds Ratio	95% CI
Model 1					
<i>Other psychopathology group vs. psychosis-spectrum group</i>					
Intercept	0.71	1	1.42	---	---
Pass/fail score on the SPT	6.48*	1	-1.86	0.16	0.04-0.65
IQ	0.29	1	0.007	1.01	0.98-1.04
Parent w/ spectrum vs NMI	5.30*	1	1.65	5.19	1.28-21.12
Parent w/ spectrum vs. OPD	7.93**	1	1.45	4.26	1.55-11.66
<i>No mental illness vs. psychosis-spectrum group</i>					
Intercept	0.58	1	-1.26	---	---
Pass/fail score on the SPT	5.10*	1	-1.43	0.24	0.07-0.83
IQ	5.43*	1	0.03	1.03	1.01-1.06
Parent w/ spectrum vs NMI	11.35**	1	2.29	9.91	2.61-37.65
Parent w/ spectrum vs. OPD	5.89*	1	1.21	3.35	1.26-8.90
Model 2					
<i>Other psychopathology group vs. psychosis-spectrum group</i>					
Intercept	0.85	1	1.87	---	---
Seconds needed to complete SPT	3.21†	1	-0.16	0.85	0.72-1.02
IQ	0.05	1	0.003	1.00	0.98-1.06
Parent w/ spectrum vs NMI	4.92*	1	1.56	4.74	1.20-18.76
Parent w/ spectrum vs. OPD	7.69**	1.40	1.40	4.05	1.51-10.91
<i>No mental illness vs. psychosis-spectrum group</i>					
Intercept	0.13	1	0.74	---	---
Seconds needed to complete SPT	6.85**	1	-0.23	0.80	0.67-0.94
IQ	3.25†	1	0.03	1.03	1.00-1.06
Parent w/ spectrum vs NMI	11.45**	1	2.27	9.71	2.60-36.23
Parent w/ spectrum vs. OPD	6.72*	1	1.28	3.61	1.37-9.53

SPT = Simultaneous Pegs Test, OPD = other psychiatric disorder, NMI = no mental illness.

† $p < .10$

* $p < .05$

** $p < .001$

Figure 1. ROC curve predicting psychosis-spectrum vs. other outcomes

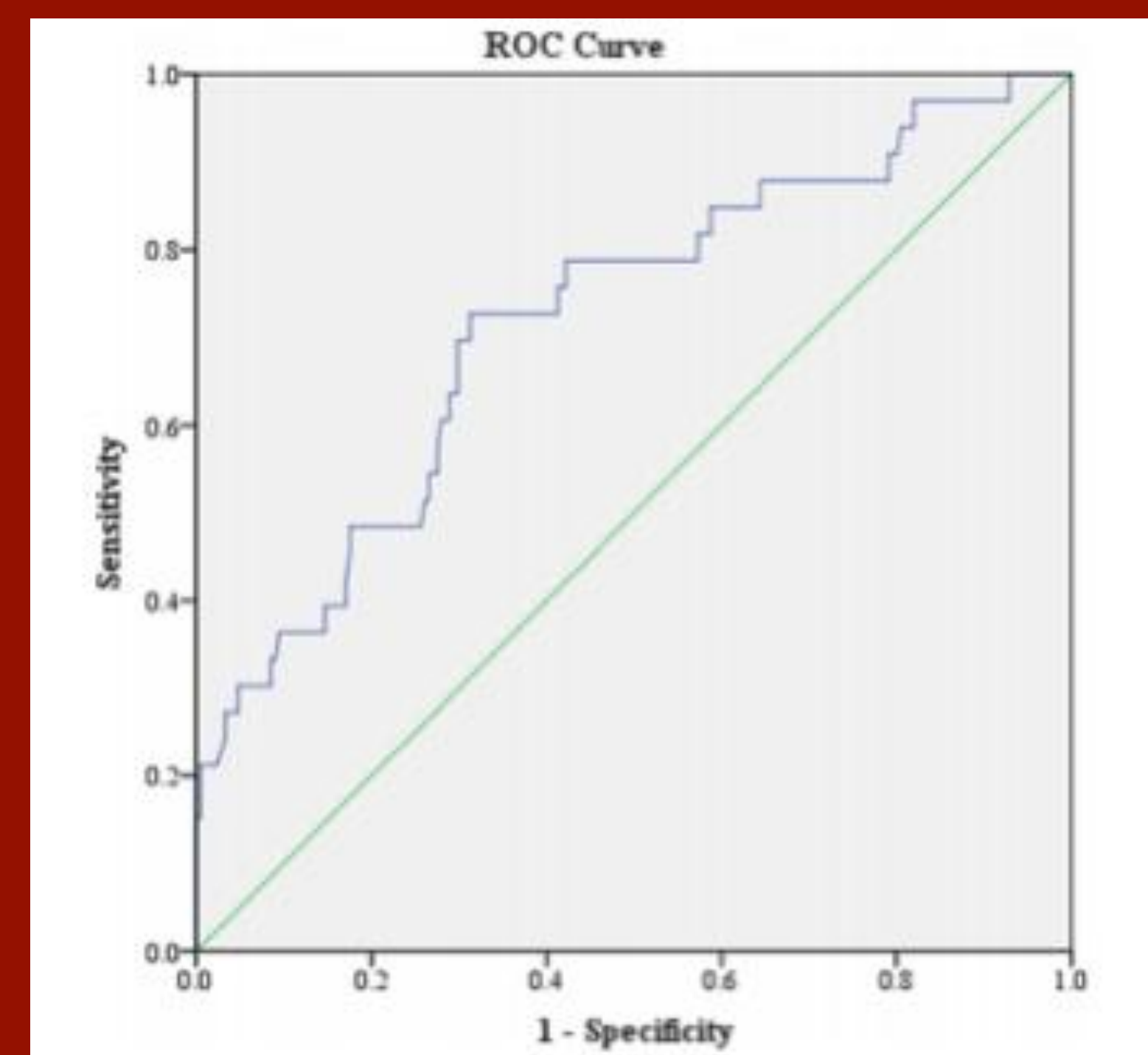


Table 3. ROC analysis classification summary: spectrum vs. all others

<i>Observed</i>	<i>Predicted Group Membership</i>		Σ
	<i>Spectrum</i>	<i>Not Spectrum</i>	
Spectrum	24	9	33 (13.5%)
Not Spectrum	66	145	211 (86.5%)
Σ	90 (36.9%)	154 (63.1%)	244 (100%)

Results

- The model examining the pass/fail criterion on the Simultaneous Pegs Test as a predictor of diagnostic outcome discriminated among the diagnostic outcomes ($\chi^2 [8, N = 244] = 36.01, p < .001$) and yielded a Nagelkerke pseudo R^2 of 0.16.
- The overall model examining completion time for the Simultaneous Pegs Test as a predictor of diagnostic outcome was significant ($\chi^2 [8, N = 244] = 36.13, p < .001$), with a Nagelkerke pseudo R^2 of 0.16.
- A ROC curve was plotted to predict diagnostic outcomes. Using predicted probabilities as the ROC curve predictor variable, the AUC was 0.72 [95% C.I. = 0.62–0.82, $p < 0.01$], in the “fair” range.¹⁷
- The ROC curve produced a sensitivity of 0.73, specificity of 0.69, positive predictive value of 0.27, and negative predictive value of 0.94.
- Overall, the inclusive model was able to correctly classify 69% of participants into spectrum vs. not-spectrum diagnostic groups (see figure 1, table 3).

Discussion

- Results suggest an association between premorbid pegboard performance and adult onset psychosis-spectrum disorders.
- Pass/fail and greater time to complete the Simultaneous Pegs Test in childhood was related to development of a psychosis-spectrum disorder relative to children who later developed other psychiatric disorders or no mental illnesses.
- The current study adds to the scant literature reporting premorbid pegboard task performance deficits in children who later develop a psychosis-spectrum disorder
- Pegboard tasks may be measuring perceptual motor speed deficits, as well as neurological soft signs, both of which are found to be present in individuals at clinical high risk for psychosis.¹⁸⁻²⁰
- Given the ease and low cost of administration as compared to other neuropsychological tests, these findings highlight the potential utility of assessments such as pegboard tasks in measuring motor deficits when assessing for psychosis risk, and might make valuable contributions in clinical high risk assessment.

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