Brief cognitive screening in youth at risk for psychosis

David R. Roalf[1], Kosha Ruparel[1], Tyler M. Moore[1], Monica E. Calkins[1], Raquel E. Gur[1], Ruben C. Gur[1]

[1]Department of Psychiatry, Development and Psychosis Section; University of Pennsylvania

Email:
roalf@pennmedicine.upenn.edu
Website: www.davidroalf.com

Abstract

Introduction: Cognitive dysfunction is associated with psychosis. Those with, or developing, psychosis are not typically evaluated for cognitive dysfunction. Unfortunately, most current cognitive testing procedures are lengthy or have not been validated in youth with psychosis symptoms.

Methods: Here, we measured cognitive performance using a cognitive screening inventory, the MMSE, and a comprehensive computerized cognitive battery, the Penn Computerized Neurocognitive Battery (CNB). Cognitive performance was measured in 334 typically developing (TD; mean age = 17.23 +/- 3.58) youth and 208 youth at risk for developing psychosis (PS; mean age = 17.57 +/- 3.16).

Results: MMSE [F(1,534)=34.98, p< 5.9x10-9] and CNB [F(1,502)=28.78, p< 1.2x10-7] performance were lower in PS as compared to TD. Scores on the MMSE were positively correlated with CNB accuracy [r(505)=0.46, p<2.2x10-16] and with Executive [r(505)=0.46, p<2.2x10-16], Social [r(505)=0.27, p<1.9x10-9] and Memory [r(505)=0.34, p<2.6x10-15] CNB factor scores. MMSE [r(535)=-0.30, p<1.57x10-12] and CNB [r(502)=-0.22, p<4.72x10-7] performance was negatively correlated with clinical symptoms. In addition, MMSE [r(485)=0.32, p<6.08x10-13] and CNB [r(455)=0.29, p<1.5x10-10] performance were similarly correlated with measures of global functioning. ROC analyses of MMSE and CNB accuracy performance indicated similar sensitivity and specificity for identifying PS from TD individuals. Finally, longitudinal clinical follow-up indicates that baseline MMSE performance is lower in PS who with stable or worsening symptoms.

Conclusions: In sum, the MMSE is a clinically relevant cognitive screen in PS youth and MMSE performance is associated with comprehensive computerized cognitive testing. Given that cognitive dysfunction is linked to global function, the failure to identify and monitor cognitive dysfunction likely has significant influence on quality of life and the course of treatment. As such, the availability of well-validated and efficient cognitive screening should be considered part of routine mental health clinical visits.

Psychosis Spectrum and Typically Developing Youth Sample Characteristics

Baseline	TD	PS
N	334	208
Age	17.24 (3.58)	17.58 (3.16)
Sex (F/M)	183/151	102/106
Race (AA/C/O)	133/168/33	134/51/23
Education	8.28 (3.28)	7.89 (2.87)
SIPS	5.87 (5.51)	23.82 (9.82)
GAF	83.85 (9.33)	59.37 (10.26)
CNB		
Accuracy	0.23 (0.86)	-0.22 (1.08)
Speed	0.31 (0.80)	0.03 (0.96)
Efficiency	0.37 (0.80)	-0.14 (0.98)
MMSE score	27.74 (2.15)	26.59 (2.90)
Age-adjusted MMSE score	0.18 (0.84)	-0.29 (1.15)

Age:
F(1,540)=1.23, p=0.27

Sex distribution:

$X^2(1)=1.48$,p=0.22

Race distribution:
$X^2(2)=37.01$, p=9.21x10^{-9}

Education:
F(1,511)=1.94, p=0.16

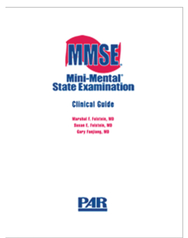
SIPS
PS>TD F(1,535)=733.80, p<2.0x10^{-16}

GAF
PS<TD
F(1,471)=724.80, p<2.0x10^{-16}

TD=Typically Developing; PS=Psychosis Risk; F=female; M=male;AA=African American;C=Caucasian; O=Other Race; SIPS=Structured Interview for Prodromal Symptoms;GAF=Global Assessment of Function; CNB=Penn Computerized Battery; MMSE=MiniMental Status Examination

MMSE and CNB

MMSE: A brief, quantitative assessment of cognition

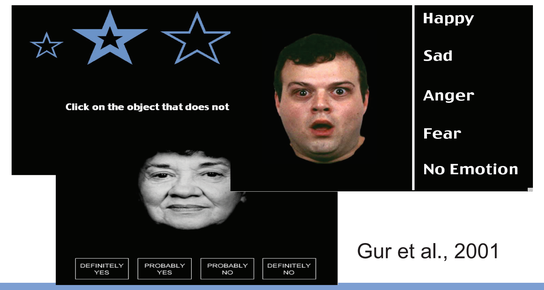


Folstein et al., 1975

MMSE domains:
-Orientation
-Registration
-Attention & Calculation
-Recall
-Language
-Repetition
-Complex commands

Test time:
10-15 Minutes

CNB: A comprehensive, quantitative assessment of cognition

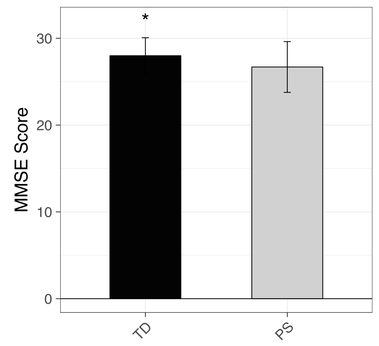


Gur et al., 2001

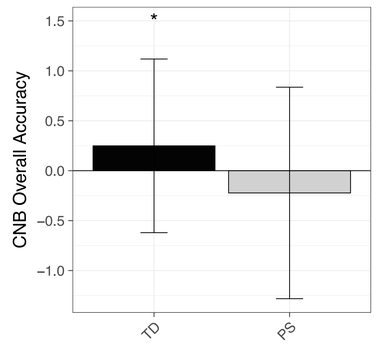
CNB domains:
-Complex Cognition
-Episodic Memory
-Executive Function
-Social Cognition

Test time:
~60 Minutes

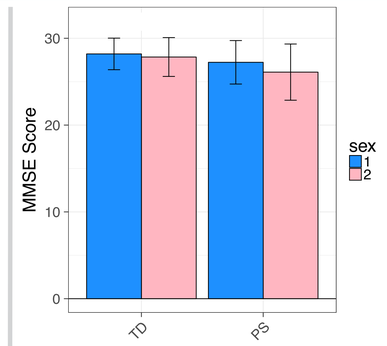
TD outperform PS on both the MMSE and CNB



MMSE scores were significantly lower in PS as compared to TD. (F(1,489)=19.49, p=1.24x10^{-5}

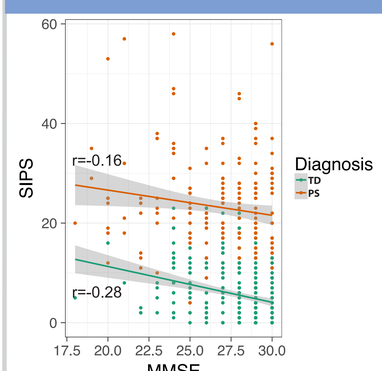


CNB accuracy (age-adjusted) factors scores were significantly lower in PS as compared to TD. (F(1, 344)=10.53, p=0.001

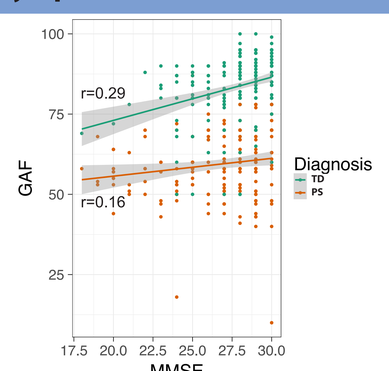


Diagnosis x Sex: MMSE scores were similar between male TD and male PS, but PS females had significantly lower MMSE as compared to TD females. (F(1,489)=4.30, p=0.03

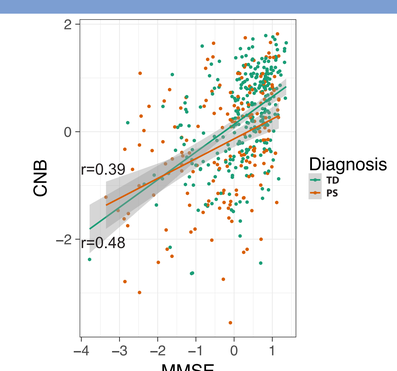
MMSE performance is dimensionally associated with psychosis risk symptoms and levels of function



Higher MMSE scores were associated with lower scores on the Structured Interview for Prodromal Symptoms (SIPS) in PS and TD. As expected SIPS scores were significantly lower in TD as compared to PS.



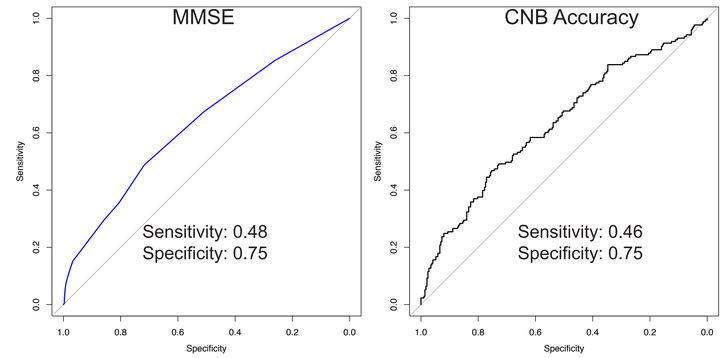
Higher MMSE scores were associated with higher scores on the Global Assessment of Functioning scale in PS and TD. As expected SIPS scores were significantly lower in TD as compared to PS.



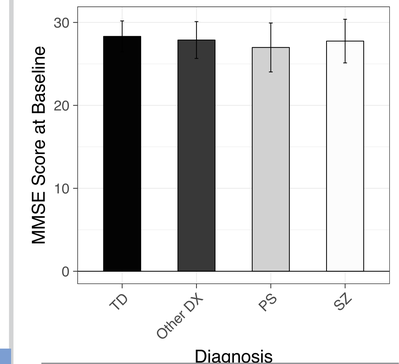
Higher MMSE scores (age-adjusted) were associated with higher accuracy scores on the CNB in PS and TD.

Receiver Operator Characteristics of MMSE and CNB

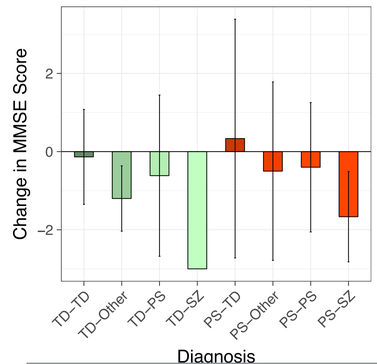
Sensitivity and Specificity of the MMSE and CNB are comparable



Baseline and change in MMSE score is related to longitudinal clinical outcome



Longitudinal Follow-up: Baseline MMSE scores in TD (n=167) and PS (n=131) individuals after longitudinal clinical follow-up. F(3,283)=7.73, p=5.61x10^{-5}



Change in MMSE score: Delta MMSE scores in TD and PS individuals after longitudinal clinical follow-up.

Discussion

The MMSE, a brief assessment of cognition, appears useful in detecting slight cognitive impairment associated with psychosis risk. Profiles of performance were similar to a comprehensive neurocognitive battery.

Higher MMSE scores were associated with better functioning and fewer prodromal psychotic symptoms.

The emergence of greater symptoms of psychopathology was associated with lower baseline MMSE scores.

Change in MMSE score was most prominent in individuals transitioning to schizophrenia.

When a comprehensive cognitive battery cannot be performed the MMSE may serve as useful measure of cognition.

References/Funding

References

Folstein MF, Folstein SE, McHugh PR. "Mini-mental state". A practical method for grading the cognitive state of patients for the clinician. J Psychiatr Res.1975 Nov;12(3):189-98. doi: 10.1016/0022-3956(75)90026-6. PMID: 1202204.

Gur RC, Ragland JD, Moberg PJ, Turner TH, Bilker WB, Kohler C, Siegel SJ, Gur RE. Computerized neurocognitive scanning: I. Methodology and validation in healthy people. Neuropsychopharmacology. 2001 Nov;25(5):766-76. doi:10.1016/S0893-133X(01)00278-0. PMID: 11682260.

Funding:
R01 MH119185 (Roalf)
R01RC2 MH089983 (Gur)
RC2 MH089924 (Hakonarson)