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Cognitive development 'growth charts' may help diagnose and treat psychosis-risk kids

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Penn Medicine researchers have developed a better way to assess and diagnose psychosis in young children. By "growth charting" cognitive development alongside the presentation of psychotic symptoms, they have demonstrated that the most significant lags in cognitive development correlate with the most severe cases of psychosis. Their findings are published online this month in *JAMA Psychiatry*.

"We know that disorders such as schizophrenia come with a functional decline as well as a concurrent cognitive decline," says Ruben Gur, PhD, director of the Brain Behavior Laboratory and professor of Neuropsychology at the Perelman School of Medicine of the University of Pennsylvania. "Most physicians have a clinical basis from which to assess psychosis, but less idea as to how to best assess and measure a decline in cognitive function. To make this easier and to aid in early diagnosis and treatment, we created 'growth charts' of cognitive development to integrate brain behavior into the diagnostic process."

Psychosis is a severe mental illness, characterized by hallucinations, delusions, social withdrawal and a loss of contact with reality. Genetics and environment, including emotional or physical trauma, can both play a role in its development.

The Penn researchers assessed the brain behavior of a cohort of about 10,000 patients between the ages of eight and 21 at Children's Hospital of Philadelphia from November 2009 to November 2011, including 2,321 who reported psychotic symptoms. Of those, 1,423 reported

significant psychotic symptoms, 898 had limited psychotic symptoms, and 1,963 were typically developing children with no psychotic, mental or any medical disorders.

Researchers administered a structured psychiatric evaluation, looking for symptoms of psychosis, anxiety, mood, attention-deficit, disruptive behavior and eating disorders; for the younger children, independent interviews with their caregivers were also conducted. The team also administered 12 computerized neurocognitive tests to evaluate each child's brain development across five domains: executive function, testing abstraction and mental flexibility, attention and working memory; episodic memory, testing knowledge of words, faces and shapes; complex cognition, evaluating verbal and nonverbal reasoning and spatial processing; social cognition, looking at emotion identification, intensity differentiation and age estimation; and sensorimotor speed, to understand the workings of their motor and sensorimotor skills.

The results were analyzed to predict chronological age for each child.

They showed that those with the most extreme psychotic symptoms had a lower chronological than predicted age, compared with the typically-developing group and the group with other psychiatric symptoms. They also had a greater developmental lag than the psychosis-limited group, with the lags most pronounced for complex cognition and social cognition and smallest for sensorimotor speed.

"Broken down further, we found that boys on the psychosis spectrum showed an early decline in memory, complex and social understanding, compared with typically developing children, while girls showed minimal lag in memory across all ages groups, with a lag in complex cognition appearing later in development," explains Gur. This seems to follow the differences in how disorders such as schizophrenia manifest themselves across the sexes.

Further, the team used the results to conclude that delays associated with psychotic symptoms appear to be between six and 18 months, and students are almost a year behind already by age eight. After age 16, the lag widens across all domains, which echoes literature showing cognitive deficits in school-age children eventually diagnosed as having psychosis.

"We now have a tool for parents, educators and clinicians to assess children's clinical symptoms, combined with brain function, to aid in early detection and targeted interventions to make a difference for affected kids before their disease is allowed to progress," says Gur.

Additional Penn Medicine researchers include Monica E. Calkins, PhD; Theodore D. Satterthwaite, MD, MA; Kosh Ruparel, MSE; Warren Bilker, PhD; Tyler M. Moore, PhD; Racquel Gur, MD, PhD, from the department of Psychiatry; and Hakon Hakonarson, MD, PhD, with Children's Hospital of Philadelphia.

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