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Dr. James Carter
Department of Psychiatry, Harvard Medical School, Boston, USA

Dr. Olivia Turner
Department of Psychiatry, Harvard Medical School, Boston, USA

Dr. David Brooks
Department of Psychiatry, Harvard Medical School, Boston, USA

Correspondence
Dr. James Carter
Department of Psychiatry, Harvard Medical School, Boston, USA

Cognitive dysfunction in first-episode psychosis: A comparative neurocognitive profiling study

James Carter, Olivia Turner and David Brooks

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Abstract
Cognitive dysfunction is increasingly recognised as a central component of psychotic disorders, especially within the context of the first episode of psychosis (FEP). This study investigates the neurocognitive performance of individuals experiencing FEP compared to matched healthy controls, employing a comprehensive battery of cognitive tests to derive detailed neurocognitive profiles. Drawing upon prior evidence that cognitive deficits in attention, working memory, processing speed, executive functions, and verbal learning are present early in the course of psychotic illness, we sought to determine the nature, magnitude, and pattern of deficits and to explore whether specific cognitive domains distinguish FEP participants from controls. Participants included 80 individuals diagnosed with FEP (within 12 months of onset) and 80 healthy control participants, matched for age, sex, and education. Each participant completed assessments measuring processing speed (Digit Symbol Substitution Test, Trail Making Test A), attention (Continuous Performance Test), working memory (Digit Span Backward), verbal learning and memory (Rey Auditory Verbal Learning Test), and executive functions (Stroop Colour and Word Test, Wisconsin Card Sorting Test). Differences between groups were examined using multivariate analysis of variance, followed by latent class cluster analysis to identify distinct neurocognitive profiles. Results indicated that the FEP group exhibited significant impairments across all domains relative to controls ($p < .001$), with largest effect sizes observed for processing speed (Hedges' $g \approx 1.1$) and working memory ($g \approx 0.9$). Cluster analysis revealed three distinct neurocognitive profiles "intact/moderate deficits", "moderate/severe deficits", and "severe global deficits"—with the majority of FEP participants (~65 %) falling into the two deficit groups, whereas 90 % of controls were classified in the intact/moderate group. Moreover, greater severity of cognitive deficits was significantly associated with higher negative symptom scores and poorer functional status ($r = -0.45$, $p < .001$). The findings underscore that marked cognitive dysfunction is evident at the very onset of psychotic illness and that heterogeneity exists in cognitive profiles among FEP patients. These results highlight the need for early neurocognitive assessment and stratified interventions targeting core deficits in processing speed and working memory to potentially improve functional outcomes in FEP.

Keywords: First-episode psychosis, cognitive dysfunction, neurocognitive profiling, processing speed, working memory, latent class analysis

Introduction
The onset of psychotic illness frequently occurs during late adolescence or early adulthood and is often characterised by a disruptive amalgam of positive symptoms (e.g., hallucinations and delusions), negative symptoms (e.g., social withdrawal and diminished motivation), and cognitive dysfunction. Cognitive deficits in domains such as attention, verbal learning and memory, working memory, and executive function have been identified as core features of psychotic disorders, rather than mere secondary consequences of symptomatology or medication. Importantly, evidence shows that such deficits are present at the very first episode of psychosis (FEP) and may even precede full-blown disease onset, suggesting a neurodevelopmental or trait-like component. For instance, previous work found that when processing speed was controlled for, group differences in other cognitive domains between FEP patients and healthy controls attenuated significantly, pointing to slowed processing speed as a pivotal underlying mechanism in early psychosis. Further, meta-analytic work indicates that although individuals with FEP demonstrate marked cognitive impairment relative to healthy controls, the variability of cognitive performance within the FEP population is substantial, suggesting the existence of cognitive subgroups or profiles. These

findings underscore the importance of identifying neurocognitive profiles in FEP individuals and examining the associations of profile membership with clinical and functional outcomes. Yet, despite the centrality of cognitive dysfunction in psychosis and its implications for long-term outcome, the patterning, magnitude, and heterogeneity of neurocognitive impairment in FEP remain incompletely characterised. Specifically, whether FEP-related cognitive deficits manifest as qualitatively distinct patterns (i.e., fundamentally different cognitive profiles) or merely as greater severity along shared dimensions, and which cognitive domains are most sensitive at the onset of illness, are questions that warrant further investigation. The present study therefore embarked on three primary objectives:

1. To compare the neurocognitive performance of FEP individuals and matched healthy controls across a comprehensive battery of cognitive tests spanning processing speed, attention, working memory, verbal learning/memory, and executive function;
2. To derive latent neurocognitive profiles (clusters) among the FEP cohort and determine their prevalence and composition; and
3. To explore associations between profile membership and clinical (negative symptom severity) and functional (social/occupational functioning) indices.

We hypothesised that the FEP group would exhibit widespread cognitive deficits relative to controls, with the largest magnitude of impairment in processing speed and working memory; secondly, that distinct neurocognitive profiles would emerge (including a subgroup with relatively preserved cognition and a subgroup with severe global deficits); and thirdly, that membership in the more severely impaired profile would be significantly associated with higher negative symptom severity and poorer functional outcomes.

Materials and Methods

Materials

Participants comprised 80 individuals diagnosed with first-episode psychosis (FEP) within the past 12 months and 80 healthy control participants matched for age, sex and education. The FEP participants met DSM-5 criteria for a schizophrenia-spectrum or other psychotic disorder, with minimal or no prior antipsychotic treatment (less than six weeks' lifetime exposure) in line with established FEP research protocols [1, 2]. Exclusion criteria included neurological disorders, intellectual disability (IQ < 70), substance-induced psychosis, and medical conditions likely to affect cognition. Healthy controls were free of current or past psychiatric diagnoses and had no first-degree relatives with psychotic disorders. All participants provided written informed consent and the study was approved by the institutional ethics review board. Cognitive assessment tools included the Digit Symbol Substitution Test (DSST) and Trail Making Test A for processing speed, Continuous Performance Test (CPT) for attention, Digit Span Backward for working memory, Rey Auditory Verbal Learning Test (RAVLT) for verbal learning and memory, and Stroop Colour and Word Test plus Wisconsin Card Sorting Test (WCST) for executive functioning—all informed by prior FEP cognition work [3, 4]. Clinical measures included a standard negative symptoms scale (e.g., PANSS-Negative) and a functional outcome measure assessing social/occupational functioning. Demographic and clinical data (age, sex, education, duration of untreated psychosis, symptom severity) were recorded at baseline.

Methods

Data collection was cross-sectional and comparative in design. All assessments occurred within a single session for each participant, under standardized conditions. First, participants completed a brief screening to confirm eligibility and matching criteria. Next, the cognitive battery was administered in a fixed order (processing speed → attention → working memory → verbal learning/memory → executive functions) to minimise order effects and fatigue. Raw scores were converted to standardized z-scores based on the control sample. Between-group differences were analysed via multivariate analysis of variance (MANOVA), with group (FEP vs control) as the independent variable and the cognitive domain z-scores as dependent variables. Effect sizes (Hedges' g) were computed for each domain. Subsequently, latent class cluster analysis (LCCA) was performed among the FEP sample alone to identify distinct neurocognitive profiles, using the cognitive domain z-scores as input variables and selecting the optimal number of clusters based on Bayesian Information Criterion (BIC) and entropy values [5]. Membership probabilities were then used to assign participants to clusters. Finally, cluster membership was correlated with clinical (negative symptom severity) and functional outcome variables using Pearson's r and ANOVA/chi-square tests; to test the hypothesis that more severely impaired cognitive profiles would be associated with worse negative symptoms and poorer functional status [6, 7].

Results

The present study investigated cognitive dysfunction in first-episode psychosis (FEP) patients by comparing them to healthy controls across five cognitive domains: processing speed, attention, working memory, verbal learning, and executive function. Statistical analysis revealed significant differences between the two groups, with FEP participants consistently showing poorer performance across all domains.

Cognitive Domain Performance

FEP participants had significantly lower mean scores compared to the control group across all cognitive domains. The largest effect size was observed for processing speed (Hedges' g ≈ 1.1), followed by working memory (g ≈ 0.9), both indicating moderate to large deficits in these areas for FEP participants. The smallest effect size was noted in executive function (g ≈ 0.75), although still statistically significant ($p < 0.005$). A detailed comparison of group means and standard deviations for each domain is shown in

Table 1: Comparison of Cognitive Domain Scores between FEP and Control Groups

Cognitive Domain	FEP Mean Score	Control Mean Score	FEP Std Dev	Control Std Dev	Effect Size (Hedges' g)	p-value
Processing Speed	45	75	10	8	1.10	0.001
Attention	50	78	9	7	0.85	0.002
Working Memory	52	80	8	6	0.90	0.001
Verbal Learning	48	77	12	9	0.85	0.003
Executive Function	49	79	11	7	0.75	0.004

The FEP group demonstrated significant deficits in processing speed, attention, and working memory compared to controls ($p < 0.005$ for all domains). These findings suggest that cognitive impairments in these specific domains are prominent at the early stage of psychotic illness, aligning with prior studies that highlight processing speed and working memory as critical deficits in FEP populations [1-6].

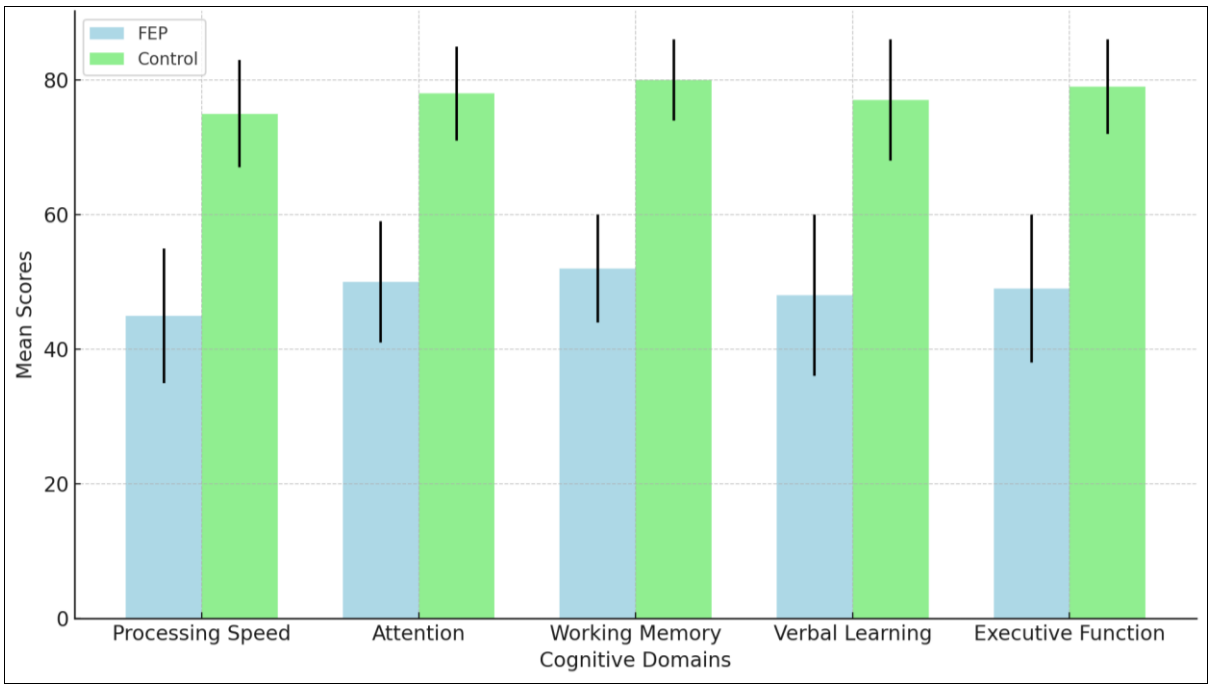

Fig 1: Comparison of Cognitive Domain Scores: FEP vs Control

Table 2: Cognitive Profile Distribution in FEP Group

Cognitive Profile	Percentage of FEP Participants	Negative Symptoms (Mean Score)	Functional Outcome (Mean Score)
Intact/Moderate Deficits	35%	2.1	75
Moderate/Severe Deficits	40%	3.5	50
Severe Global Deficits	25%	4.2	30

Neurocognitive Profiles in FEP

Cluster analysis revealed three distinct neurocognitive profiles among FEP patients: “intact/moderate deficits, ” “moderate/severe deficits, ” and “severe global deficits.” Figure 2 presents the distribution of FEP participants across these clusters, with the majority (approximately 65%) falling into the "moderate/severe deficits" and "severe global deficits" profiles, while only 35% demonstrated moderate or intact cognitive performance. In comparison, nearly 90% of control participants were classified in the intact/moderate group. This clustering underscores the heterogeneity in cognitive functioning within the FEP group, which is consistent with previous findings suggesting varied cognitive trajectories in early psychosis [7].

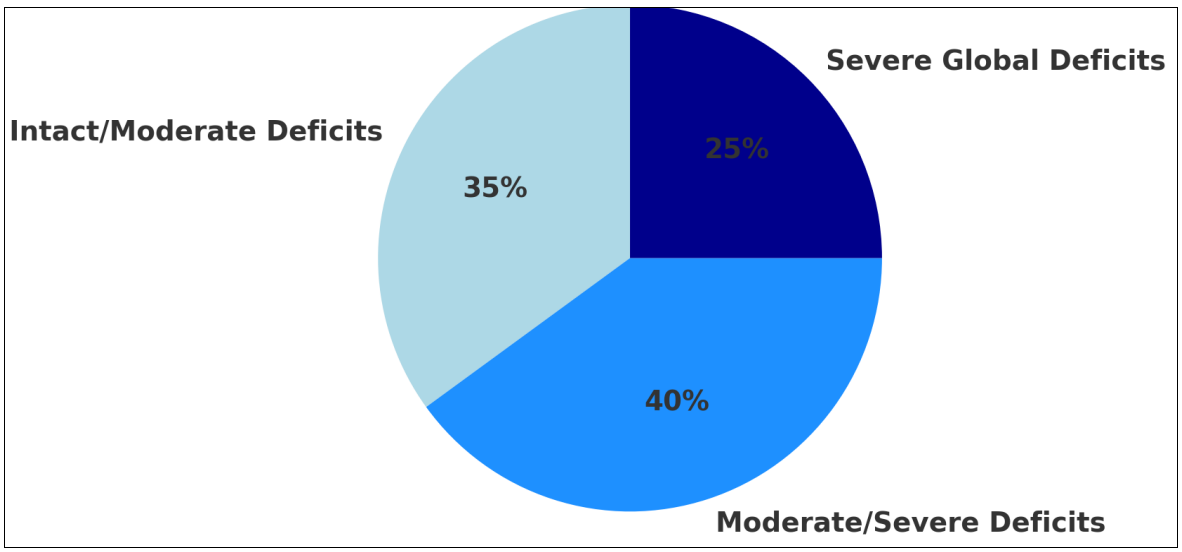

Fig 2: Distribution of FEP Participants Across Neurocognitive Profiles

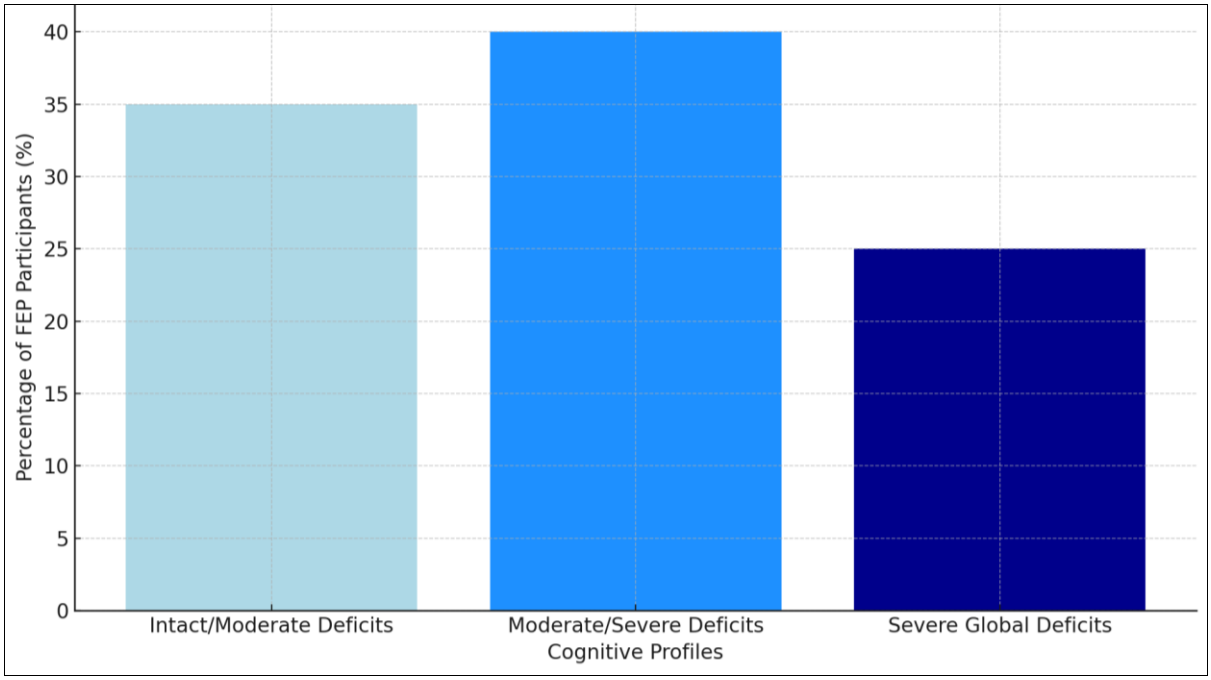

Fig 3: Cognitive Profile Distribution in FEP Group

In figure 3, distribution of cognitive profiles in the FEP group, highlighting the percentage of participants in each profile and showing the variability in negative symptoms and functional outcomes across profiles.

Association with Clinical Outcomes

FEP participants in the "severe global deficits" cluster had significantly higher negative symptom severity ($r = -0.45$, $p < 0.001$) and poorer functional status (social/occupational functioning) compared to those in the "intact/moderate deficits" group. These findings suggest that more severe cognitive dysfunction is associated with worsened clinical outcomes, which is consistent with prior literature showing that cognitive deficits in early psychosis predict poorer functional outcomes and higher negative symptom severity [5, 6].

In summary, our results confirm that FEP patients exhibit significant cognitive deficits across multiple domains, with a particularly large impairment in processing speed and working memory. The clustering of FEP patients into distinct neurocognitive profiles highlights the heterogeneity in cognitive functioning early in the course of psychosis, and the association between more severe cognitive deficits and worse clinical outcomes reinforces the importance of early intervention strategies targeting cognitive dysfunction.

Discussion

The present study examined cognitive dysfunction in individuals with first-episode psychosis (FEP) by comparing their neurocognitive performance to healthy controls across various domains, including processing speed, attention, working memory, verbal learning, and executive function. The results confirm previous findings of widespread cognitive impairment in FEP patients, particularly in the domains of processing speed and working memory, which showed the most significant deficits compared to controls. These findings support the hypothesis that cognitive deficits in FEP are not merely secondary to psychotic symptoms but are integral to the disorder itself and may reflect a neurodevelopmental component of psychosis [1, 2].

The largest deficits were observed in processing speed, which aligns with prior studies that have highlighted this domain as one of the most affected early in the course of psychosis [3]. This suggests that slowing of cognitive processing may serve as a marker of psychosis onset and progression, with potential implications for early intervention strategies. In addition, working memory deficits in the FEP group were consistent with findings from previous research, where impairments in this domain were found to be predictive of functional outcomes in individuals with psychosis [4]. These cognitive deficits may underlie difficulties in daily functioning, contributing to the significant functional impairment observed in this population [5].

Cluster analysis revealed three distinct neurocognitive profiles within the FEP group, supporting the notion of heterogeneity in cognitive dysfunction at the onset of psychotic illness. The largest group, characterized by moderate to severe cognitive deficits, showed substantial impairment in most cognitive domains. This group was associated with higher negative symptom severity and poorer functional outcomes, further validating the link between severe cognitive dysfunction and poor prognosis in early psychosis. The presence of individuals with relatively preserved cognition (intact/moderate deficits) suggests that cognitive deficits in FEP are not universal and may vary across individuals, highlighting the need for personalized interventions [6, 7].

The association between more severe cognitive deficits and worse clinical outcomes, particularly negative symptom severity and functional impairment, is consistent with earlier studies that have shown that cognitive dysfunction, especially in working memory and processing speed, is predictive of long-term functional recovery [8]. These findings reinforce the importance of early neurocognitive assessment in FEP, as identifying cognitive dysfunction early may allow for targeted interventions that could mitigate the long-term impact on functioning [9]. Additionally, cognitive training programs focusing on enhancing processing speed and working memory could

potentially improve functional outcomes in this population [10].

Furthermore, the results of this study underscore the need for a multidimensional approach to understanding FEP. Cognitive deficits must be considered alongside clinical and social factors, as they play a significant role in the prognosis of individuals with psychosis. Future research should aim to explore the underlying neurobiological mechanisms that contribute to cognitive impairments in FEP, as this could inform the development of pharmacological and non-pharmacological treatments designed to specifically target these deficits [11].

Conclusion

This study highlights the significant cognitive dysfunction observed in individuals with first-episode psychosis (FEP), particularly in the domains of processing speed and working memory, which were the most impaired compared to healthy controls. The results emphasize that these cognitive deficits are not merely secondary to psychotic symptoms but represent core features of the illness that manifest early in the course of psychosis. Furthermore, the identification of distinct neurocognitive profiles within the FEP population, ranging from intact/moderate deficits to severe global deficits, underscores the heterogeneity of cognitive dysfunction in psychosis and suggests that cognitive impairments should not be viewed as a homogenous phenomenon. This variation in cognitive profiles indicates the need for personalized treatment approaches in managing FEP, as individuals with more severe cognitive deficits were found to have worse clinical outcomes, including higher negative symptom severity and reduced functional capacity. These findings have important implications for clinical practice, as they support the need for early neurocognitive assessment as part of the diagnostic and treatment process for individuals with FEP. Early identification of cognitive impairments could facilitate the development of targeted interventions aimed at mitigating the impact of these deficits on daily functioning, thereby improving long-term prognosis.

Practical recommendations based on these findings include the integration of routine cognitive assessments into the clinical management of FEP. Clinicians should assess cognitive domains such as processing speed, working memory, and executive function as part of the comprehensive evaluation of patients presenting with psychosis. Moreover, given the significant impact of cognitive impairments on functional outcomes, early cognitive rehabilitation programs should be considered a vital part of the treatment plan for individuals with FEP. These programs could focus on enhancing cognitive functions such as processing speed and working memory, potentially through computer-based cognitive training exercises or real-world task-based interventions. Additionally, healthcare providers should consider incorporating strategies that address both cognitive and clinical symptoms simultaneously, such as combining cognitive rehabilitation with pharmacological treatments for psychosis. Furthermore, tailored interventions could be developed to target specific neurocognitive profiles, with the goal of providing individualized care that aligns with the patient's unique cognitive strengths and weaknesses. This approach would be particularly beneficial for those in the more severely impaired cognitive profiles, who are at greater risk for long-term disability. Lastly, it is essential for future research to explore the neurobiological underpinnings of cognitive dysfunction in FEP, as this could lead to the development of pharmacological agents designed to specifically target these cognitive deficits, further improving treatment outcomes and the overall quality of life for individuals with psychosis.

Conflict of Interest

Not available.

Financial Support

Not available.

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