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Review Article

Psychiatry/Mental Health Section

# Cognition and Functional Recovery in Severe Mental Disorders- A Narrative Review

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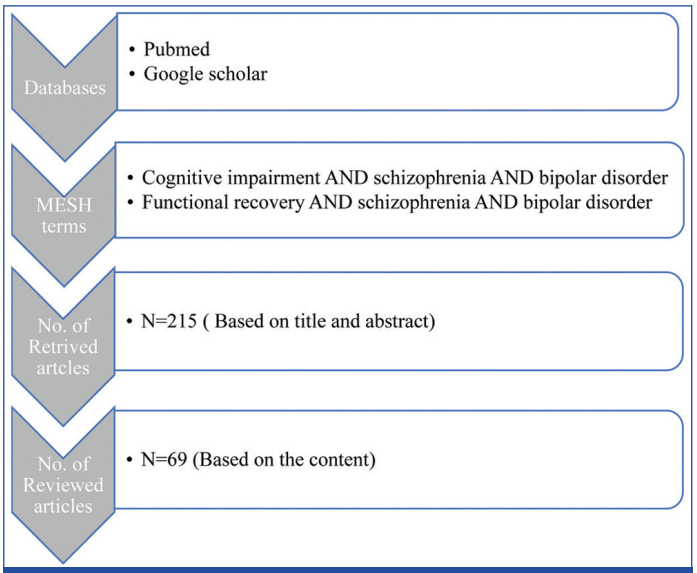
Severe Mental Illness (SMI) like schizophrenia and mood disorders has a prolonged and strenuous course which takes a major toll on the lives of the patients. In an effort to understand the consequence of these illness functional recovery has been studied in detail in the past. Cognitive impairment has been identified as an important contributor to the functional recovery. Cognitive impairment is an important component, independent of the symptoms, of SMI. Various cognitive deficits are found to occur in patients with SMI. Patients with lesser cognitive deficits were found to have better outcomes. This narrative review explains about cognitive impairment and functional outcome in people with SMI and the existing evidence for the relationship between both. Authors had performed manual search strategy of PubMed, Google Scholar engines for relevant research publications and reviewed them along with cross references from the retrieved articles. A broad review on the research shows, cognitive impairment has been recognised in both patients with schizophrenia and bipolar disorder even during periods of symptomatic remission and that people with symptomatic recovery continued to have functional deficits. This review also showed that patient with lesser cognitive deficits had better outcomes. Keeping this in mind, cognitive rehabilitation should be made a part of the management of SMI to achieve complete functional recovery.

**Keywords:** Neurocognition, Psychiatric disorders, Remission

## INTRODUCTION

The Severe Mental Illness (SMI) in psychiatry involves a range of mental illnesses, of which psychotic disorders and mood disorders form a major part [1]. People with SMI experience many obstacles on their path to recovery leading to lifelong disability and functional impairment [2]. Recovery in SMI is a dynamic concept, which contributes significantly to societal and economic burden, when disrupted. Recovery is no longer seen as clinical improvement alone, but as a holistic approach, where the aim is to help individuals with SMI live independently and reintegrate into the society. Un-remitting symptoms, treatment failure, co-existing medical illness, cognitive deficits, lack of insight, lack of psychosocial support are some of the factors contributing to the disability [3]. The role of cognition in recovery has made it a key area of focus in psychiatric conditions. Impairment in cognition has been found to occur in SMI like schizophrenia and mood disorders. While looking at cognition in SMI, a number of factors relating to the symptoms, prognosis and management have come to light. A review of previous literature on the role of cognition in SMI, concept of functional recovery in SMI and the relationship between cognitive impairment and functional recovery has been presented in this article.

**Literature search:** Manual search was performed in PubMed, Google Scholar and other relevant publications were reviewed by the authors. The search terms used in PubMed were cognitive impairment AND schizophrenia OR Bipolar disorder, Functional recovery AND schizophrenia OR Bipolar disorder. Obtained articles were filtered based on the title and abstract by searching the electronic databases. Around 200 articles were retrieved based on clinical relevance and cross reference from the articles. A total of 69 articles were reviewed by both the authors [Table/Fig-1].




**[Table/Fig-1]:** Flow diagram for article selection.

### What is Cognition?

Cognition in essence refers to acquiring, understanding, and processing of information [4]. It entails many conscious (as well as unconscious) mental activities like attention, working memory, execution, learning, problem solving, judgement, insight, etc., [5]. Many of the cognitive functions are unique to the human species [6]. The neural correlation of cognition is attributed to the sustained firing of neurons in the Dorsolateral Prefrontal Cortex (DLPFC) [7]. Functional imaging studies have made it possible to understand how certain cognitive functions are related to specific regions of the cerebral cortex [6]. Cognition is a highly complex ensemble of activities which interacts with affective domain as well. The state of cognition influences emotional well-being and similarly affective changes do influence the cognitive status [6,8].

**Assessment of cognition:** Evaluation of cognitive functions is essential to identify the domains affected and the cortical regions involved in the disorder causing cognitive disturbances. Many tools have been introduced over the years to screen for cognitive impairment [9].

*Mini Mental State Examination (MMSE):* MMSE is a widely used tool for cognitive assessment by clinicians. It can be administered in <10 minutes and it is scored out of 30. It tests attention, orientation, verbal fluency, memory, abstraction. Lesser weightage is given testing visuospatial skills [10].

*Montreal Cognitive Assessment (MoCA):* MoCA is scored out of 30, and it tests visuospatial skills, executive function, memory, verbal

fluency, attention, abstraction. MoCA has a higher sensitivity in detecting MCI [11].

*Adden brooke's Cognitive Examination (ACE) III:* ACE-III covers a wide range of cognitive domains including attention, calculation, executive functions, verbal fluency, language, memory. It is scored out of 100 and a score of 88 is the cut-off. It takes about 20-30 minutes more than other screening tools [12].

Various neuropsychological tests are used to assess individual domains of cognition [Table/Fig-2] [13-23].

| Neurocognitive domains | Neuropsychological tests |
|---|---|
| Language | Boston Naming Test [13], Controlled oral word association [14] |
| Executive functions | Trail making tests A and B [15], Iowa Gambling Test [16], Wisconsin card sorting test [17] |
| Verbal learning memory | Paired associate learning [18], Rey Auditory Verbal Learning Test (RAVLT) [19], Free and cued selective reminding test [20] |
| Attention/concentration | Digit span forward and backward [21], Oddball tasks [22] |
| Visuospatial skills | Copy tasks (wire cube, interlocking pentagons, clock face, Rey complex figure, Visual Object Space Perception (VOSP) [13] |
| Social cognition | The Awareness of Social Inference Test (TASIT) [23] |

**[Table/Fig-2]:** The table shows the various neuropsychological tests used to assess cognitive domains [13-23].

## Cognition in Severe Mental Illness (SMI)

Cognitive impairment is a term used to describe abnormalities in any of the multiple domains of cognition [5]. Some areas of cognitive impairment present in SMI range from inattention, difficulty in concentrating, working memory deficits, visuospatial deficits etc., [6]. Cognitive deficits have been identified in schizophrenia, even before the onset of psychotic symptoms [24]. Moderate to severe impairments have been found to co-occur during the first episode of psychosis [24]. Impairment in attention, verbal learning and memory, verbal fluency, executive function has been identified in schizophrenia [5]. Over the years, researchers have determined that cognitive deficits persisted in individuals with schizophrenia who were in remission [25]. Research has confirmed that after statistical adjustment for Positive and Negative Symptoms Scale (PANSS) and IQ scores, patients with schizophrenia continued to have cognitive deficits [26]. Recent studies have also shown cognitive impairment in patients with bipolar disorder, particularly in the areas of attention, executive function, and verbal memory during remission [5,27]. The severity of cognitive impairment correlates with number and severity of the episodes [27].

While looking at why cognitive deficits in SMI are important, authors come to understand that cognitive impairment plays an important role in determining the functional outcome of SMI making it an important component of treatment.

## The Road to Recovery

What functional recovery means has been a sector of active research over many years. According to various researchers, psychosocial well-being has been explained as independence and living a meaningful life [28]. Independence in terms of taking charge of their personal needs of daily living, medications, and their finance [28]. Additionally, being able to find a job or return to work and receive remuneration for their work is also a part of psychosocial well-being. A person who has recovered from a psychiatric illness should be in a position to effectively communicate with others, live as a part of a family, integrate into community and fulfill their age appropriate role in the society with the least impact of the illness on the patient, the family and the community [26,29].

Investigations into the details of what hampers functional recovery in patients with SMI, a multifold of elements have come into light [30]. Environmental agents, history of substance use, familial support have been found to have a role in predicting functional recovery [31,32]. However, neurocognition, negative symptoms and personalised stigma towards the illness have stood out among the determinants [33].

## Functional Recovery in Severe Mental Illness (SMI)

***My whole mental power has disappeared, I have sunk intellectually below the level of a beast" (a patient with schizophrenia, quoted by Kraepelin, 1919, p. 25)*** [34].

Schizophrenia is a complex and SMI which is chronic, heterogeneous, and incapacitating. The remission in Schizophrenia Working Group defined symptomatic remission in schizophrenia as *"the state in which the patient shows improvement in signs and symptoms, to such an extent that they do not interfere significantly in their behavior, and they are below the diagnostic threshold"* [35]. Advances in therapeutic approaches have made it possible today to help patients with schizophrenia achieve symptomatic remission [36]. Nevertheless, schizophrenia remains to be one of the top 10 causes of disability and causes a high degree of global burden, making functional recovery an important area to be addressed in the future [29].

Functional recovery in schizophrenia is a multi-dimensional theory which entails personal, social, interpersonal, occupational domains [36]. Studies have found that the patients with schizophrenia have difficulty in acquiring and maintaining jobs, establishing social relationships, and living independently [24,37,38]. Bipolar disorder was initially thought to be an episodic illness with inter-episodic premorbid level functioning. However, recent studies have shown that patients with bipolar disorder do not achieve their premorbid psychosocial functioning even during remission [39-41]. Bipolar disorder patients continue have deficits in various domains of functional recovery.

## Assessment of Functional Impairment

Several tools are used worldwide to assess functional impairment. The commonly used tools are:

**WHO Disability Assessment Scale (WHODAS) 2.0 [42]:** WHO Disability Assessment Scale 2.0 is a reliable instrument developed by World Health Organisation (WHO) that can be used across cultures to assess disability. There are 2 versions, a self-administered 36 item score and a shorter 12 item version that can be administered in 5 minutes. It covers six domains, and each domain is scored between 0 and 4 [42].

**Indian Disability Evaluation and Assessment Scale (IDEAS) [43]:** The Indian Disability Evaluation and Assessment Scale (IDEAS) were introduced by Indian Psychiatric Society in 2001. Self-care, interpersonal activities, communication, and work are the 4 areas assessed in IDEAS. Each area is scored between 0 and 4 [43].

**Global Assessment of Functioning (GAF) [44]:** GAF scale was developed to rate Axis 5 of DSM 4. It is a 100-point scale that is rated by clinicians. Significant weightage is given to symptoms in GAF, which can lead to biases in scoring. Individuals with persistent symptoms might score lesser despite good functioning [44].

**WHO Quality of Life (WHOQOL) [45]:** WHO has developed WHOQOL to assess the quality of life. This instrument helps to capture many subjective aspects of quality of life among patients. 2 versions WHOQOL 100 and WHOQOL BREF are available. WHOQOL 100 gives scores of individual facets (positive feelings, support etc.,) while WHODAS BREF gives scores of the domains (psychological, social, and physical) [45,46].

**Social and Occupational Functioning Scale (SOFAS) [47]:** SOFAS was designed to rate Axis 5 of DSM 4. It is scored between 0-100, lower scores denote lower level of functioning. It differs from GAF by focusing on functioning rather than individual symptoms [47,48].

## Relationship between Cognitive Deficits and Functional Outcome

Multiple studies have proved that patients with schizophrenia had deficits in cognitive domains that have translated to disabilities in

life activities and participation [49,50]. Association between verbal memory and living either independently or in a community has been found [51]. Deficits in language, visuospatial ability, verbal memory has been associated with performing activities of daily living [51]. Associations between attention and performing life skills and work performance have been identified [51]. Similarly, patients with bipolar affective disorders during their euthymic states continued to live with occupational and social impairment [52]. The neurocognitive domains affected in patients with bipolar disorders during euthymic phase includes impairments in executive functions, attention deficits, working memory [52,53]. Research has shown associations between psychosocial functioning and verbal memory, attention deficits as well [38]. The [Table/Fig-3] below summarises the findings of different studies involving cognitive deficits and functional outcome in schizophrenia and bipolar patients in the last two decades [54-67].

| References | Study type and subjects | Objectives | Assessment | Cognitive domains | Other domains |
|---|---|---|---|---|---|
| Huang YC et al., [54] | Cross-sectional study | Schizophrenia, MDD, BD Cognitive profile, Daily skill functioning. | BACS-Cognitive assessment, UPSA B- Functional profile | **Verbal memory** score-SCZ<MDD=BD<Controls<br>**Working memory** scores-SCZ <BD<MDD <controls<br>**Motor speed**-SCZ<BD<MDD <controls<br>**Verbal fluency**-SCZ <BD=MDD<controls<br>**Attention and processing speed**-SCZ<BD<MDD <controls<br>**Executive function**-SCZ<MDD<BD <controls | **Financial skills**-SCZ<MDD=BD=controls<br>**Communication skill-**SCZ<BD<MDD<controls<br>**Negative symptoms and cognitive function**<br>- Negative correlation<br>**Negative symptoms and financial skills**<br>Negative correlation |
| Valencia M et al., [55] | Descriptive, observational cross-sectional study | Schizophrenia, rates of symptomatic remission, Psychosocial remission, Functioning. | PANSS-Psychopathology<br>CGI-Symptoms severity<br>PSRS-Psychosocial remission<br>GAF-Functional remission | - | Association was found between PANSS dimensions and PSRS dimensions.<br>Association was found between PSRS dimensions and GAF scores. |
| Jain M et al., [56] | Cross-sectional study | Assess cognition in schizophrenia Relationship between cognition and disability | BACS-Cognitive assessment<br>WHODAS 2.0-Disability assessment | **Mean BACS score**<br>Verbal memory scores<br>Digit sequencing<br>Token motor task<br>Semantic memory task<br>Symbol coding<br>Tower of London<br>- Schizophrenia<controls | **BACS and Mobility, social relations, Life activities and participation**<br>- Negative correlation<br>**WHODAS 2.0 score and PANSS**<br>- Positive correlation<br>**BACS and PANSS**<br>- Negative correlation |
| Santosh S et al., [57] | Cross-sectional study | Schizophrenia, Cognitive function, social function | SCARF-SFI-Social functioning<br>PANSS-Psychopathology<br>Cognitive Function Battery-Cognitive assessment | **Attention, Working memory, Verbal fluency test scores and SFI**<br>- Positive correlation<br>**Psychomotor speed, visual scanning and SFI scores**<br>- Negative correlation<br>**Severity of symptoms and Cognitive deficits**<br>- Significant correlation | **PANSS and SFI score**<br>- Negative correlation |
| krishnadas R et al., [58] | Cross-sectional study | Schizophrenia, Symptomatology, Cognitive profile, and functional outcome | The PGI memory scale, Trail making tests A and B, Rey-Osterrieth complex figure test, Frontal assessment battery-Cognitive assessment<br>IDEAS-Daily functioning | **Attention, vigilance, immediate memory, working memory, delayed memory, executive function scores**<br>- Schizophrenia<controls.<br>**Digit span backward, Immediate recall and IDEAS score**<br>- Negative correlation<br>**Other cognitive test scores and IDEAS score**<br>- No correlation | **Symptoms score and IDEAS score**<br>- No correlation |
| Jiménez-López E et al., [59] | Longitudinal study-5 year follow-up | Bipolar disorder with psychosis and without psychosis, Schizophrenia Neurocognition, Functional impairment. | PANSS, HAM-D, YMRS-Symptom severity<br>FAST-Functioning<br>GAF-F-Functioning<br>Trail making part A, WAIS-III Category Fluency Test (animal naming), WAIS-III-digit span backward subtest, letter-number sequencing subtest of the WMS-III, DS-CPT, CVLT, ROCFT, WCST, Stroop Test interference, Trail Making Test-Part B (TMT-B), FAS test.<br>- Neurocognitive assessment | **Neurocognitive assessment scores**<br>- Schizophrenia<BD<br>Psychosis=BD-NP | **Psychosocial functioning impairment**<br>Controls=BD- NP<BD<br>Psychosis<Schizophrenia |
| Norlin Bagge E et al., [60] | An exploratory study 64 patients filled the criteria and 19 accepted participations: 14 males, 5 females, median age 56 years | | Barrow Neurological Institute Screen for Higher Cerebral Functions (BNIS)<br>The Frontal Systems Behaviour Scale (FrSBe)<br>Functional Independence Measure V.3.0<br>Assessment of activities of daily living (ADL) function was made with the FIM | | |

| | | | | | |
|---|---|---|---|---|---|
| Joseph J et al., [61] | Cross-sectional analytical study | Schizophrenia-spectrum disorders, functional decline. | SAPS, SANS, HAMD-Symptom severity<br>UPSA 2, ALFA<br>- Functional capacity<br>MATRICS<br>- Cognitive assessment | **Associations were found between:**<br>- Working memory and current paid employment<br>- Slower number sequencing and current close friendships<br>- Visual learning and recreational engagement<br>- Planning performance and employment.<br>- Motor speed and Independent living<br>- Attention and Romantic relationships<br>- Verbal learning and recreation. | Association was found between severity of depression symptoms and functioning |
| Leifker FR et al., [62] | Cross-sectional study | Symptoms severity, Neuropsychological test, Activities of daily living, social functioning, predictors of everyday outcome. | UCSD, USPA, SSPA, SLOF<br>- functional capacity<br>PANSS-psychopathology<br>WCST, TMT-A&B, WAIS -III, Digit span, digit symbol, letter number sequencing subsets, MMSE and WRAT 3 for screening, RAVLT-Cognitive assessment | NP performance and everyday functioning outcomes<br>**- Strong association**<br>NP performance, and social outcome<br>**- Weak association** | **Other predictors of real-world outcomes:**<br>Passive- apathetic social withdrawal, blunted affect, and lack of spontaneity and ability to perform everyday skills. |
| Zhu Y et al., [63] | Cross-sectional study<br>85- SCZ, 89- BPAD, 90 MDD and 243 Healthy controls | Schizophrenia, MDD, BPAD, Cognitive function, Symptom dimensions | BPRS 18- symptom dimensions<br>MATRICS, Wisconsin card sorting test- cognitive assessment | **Cognitive dysfunction**<br>- SCZ> BPAD> MDD<br>Association was present between Negative/ disorganised symptom and cognitive dysfunction in all patients<br>**Negative/ disorganised symptoms and TMT- A, category fluency, spatial span in MDD**<br>- Weak association | - |
| Altshuler LL et al., [64] | Cross-sectional study | Euthymic BPAD subjects, NC function, role functioning | YMRS, HAM-D-symptom severity<br>GAF-functional outcome<br>California verbal learning test (CVLT)-verbal declarative memory<br>Wisconsin card sort test (WCST)-executive function | Verbal declarative and Executive function and poor role functioning<br>**- Strong association** | - |
| Goswami U et al., [65] | Cross-sectional study | Euthymic BPAD patients, Neurocognitive function, social disability | HAM- D<br>Bech's modification and Beigel's Manic state rating scale<br>- Symptoms severity<br>Schedule for assessment of psychiatric disability<br>- Social disability<br>Kolakowska battery, AIMS<br>- NC soft signs<br>Letter cancellation test, symbol digit modalities test, trail making tests Part A and B, Porteus maze, Five-point test, Categories test, reverse digit span, forward digit span, RAVLT<br>- NC assessment | **Impairment executive function test**<br>BPAD> controls<br>**Verbal memory (short term memory, immediate) impairment**<br>BPAD>controls<br>**Attention and psychomotor speed**<br>BPAD=controls<br>Frontal lobe dysfunction and executive function<br>**Weak association** | **54%-**mild to moderate disability<br>**8%**-marked disability<br>**27%-**no impairment<br>Frontal lobe dysfunction correlates with social disability. |
| Deng M et al., [66] | Cross-sectional study | Schizophrenia, BPAD, Resilience, Cognitive function. | The Connor Davidson Resilience Scale (CD- RISC, Chinese version<br>- Resilience<br>Information subscale of Wechsler Adult Intelligence Scale-Chinese Revised (WAIS-CR), Tests of Verbal Fluency (VF), the N-back task (N-back).<br>- Cognitive assessment | **Cognitive performance**<br>- Schizophrenia <BPAD <controls<br>**Verbal comprehension, executive functioning, working memory score**<br>- Schizophrenia<BPAD<controls | **Resilience**<br>Schizophrenia <BPAD <controls |
| Belvederi Murri M et al., [67] | Cross-sectional study | Late life BPAD, cognitive impairment, risk factors, clinical outcomes | Clinical dementia rating scale<br>Montreal cognitive assessment<br>Cumulative illness rating scale-symptoms severity | Cognitive impairments in late life BPAD were associated with type 1 BD | Cognitive impairment was associated disability, recent aggressive behaviour, fewer years of education, higher severity of physical diseases but not suicidal ideation. |

**[Table/Fig-3]:** Studies and their findings on cognitive impairment and functional recovery in schizophrenia and bipolar disorder [54-67].

With this in mind, cognitive remediation therapy has become a focus of patient rehabilitation. Cognitive remediation therapy has been defined as "a behavioral training-based intervention that aims to improve cognitive processes (attention, memory, executive function, social cognition, or metacognition) with the goal of durability and generalisation" [68]. It uses simple tasks and exercises that were found to have a huge effect in improving cognitive functions in people with mental illness [69].

## CONCLUSION(S)

A high proportion of patients with SMI have persisting disability and poor quality of life. This is a matter of concern, as it adds significantly to the global burden. From review of research, it can be understood that people with SMI continue to have cognitive deficits inspite of symptomatic recovery. And the significant role of cognitive impairment in the functional recovery of patients with SMI like schizophrenia and bipolar disorder has been identified. Consequently, it can be concluded that targeting cognitive enhancement will go a long way in the rehabilitation and reintegration of patients with schizophrenia and bipolar disorders into the society.

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