

Neurocognition and Schizophrenia

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MBBS DPM

MD PG III

Outline

- Concepts and Development of neurocognition
- Domains of neurocognition in schizophrenia
- Specific emphasis on intelligence pertinent to the case
- Cognitive dysfunctions in schizophrenia and their assessments
- Genetic expression of neurocognitive deficits
- Prevalence of neurocognitive deficits
- Is neurocognitive deficits progressive ??
- Relationship with schizophrenic symptoms
- Clinical importance
- Treatment

Cognitive development

Developmental theories can be divided into

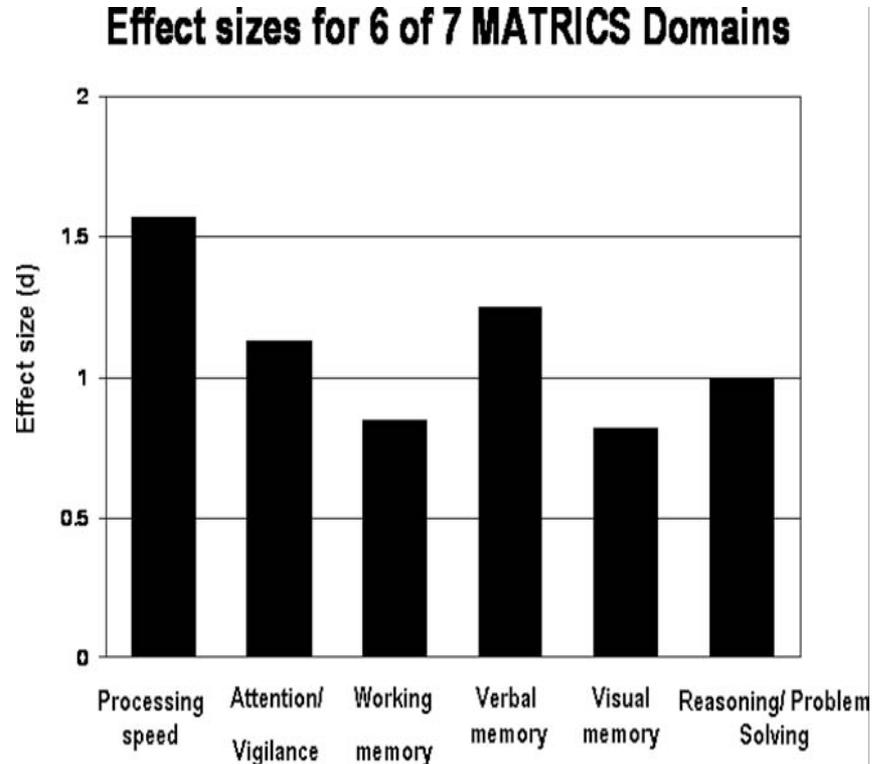
- **Stage theories** (Jean Piaget, neo-Piagetian approaches) described discontinuous periods of development, with periods of stability and consolidation alternating with periods of instability and transition.
- **Non stage theory** - Information-processing models postulate in which the emergence of cognitive capacity is a continuous process



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Domains of Neurocognition

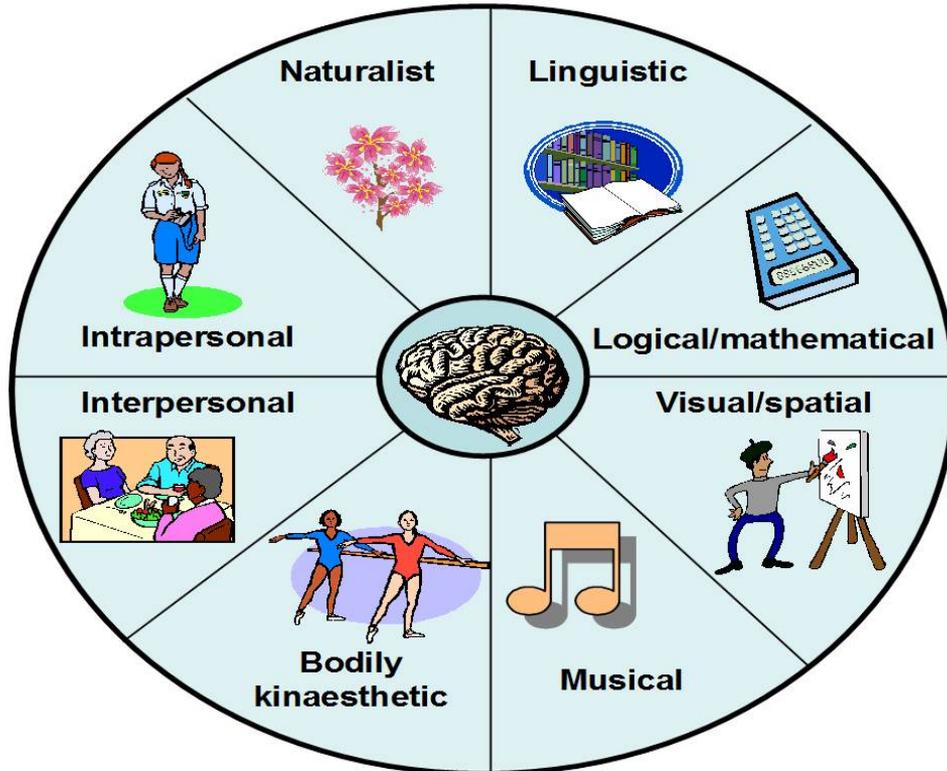
- National Institute of Mental Health in the Measurement and Treatment Research to Improve Cognition in Schizophrenia (MATRICS) Consensus Cognitive Battery (MCCB)
- Six domains are measured
- Seventh domain, Social cognition



What is intelligence and its types

- Ability to think rationally ,act purposefully and deal effectively

Types of intelligence



Theories of Intelligence

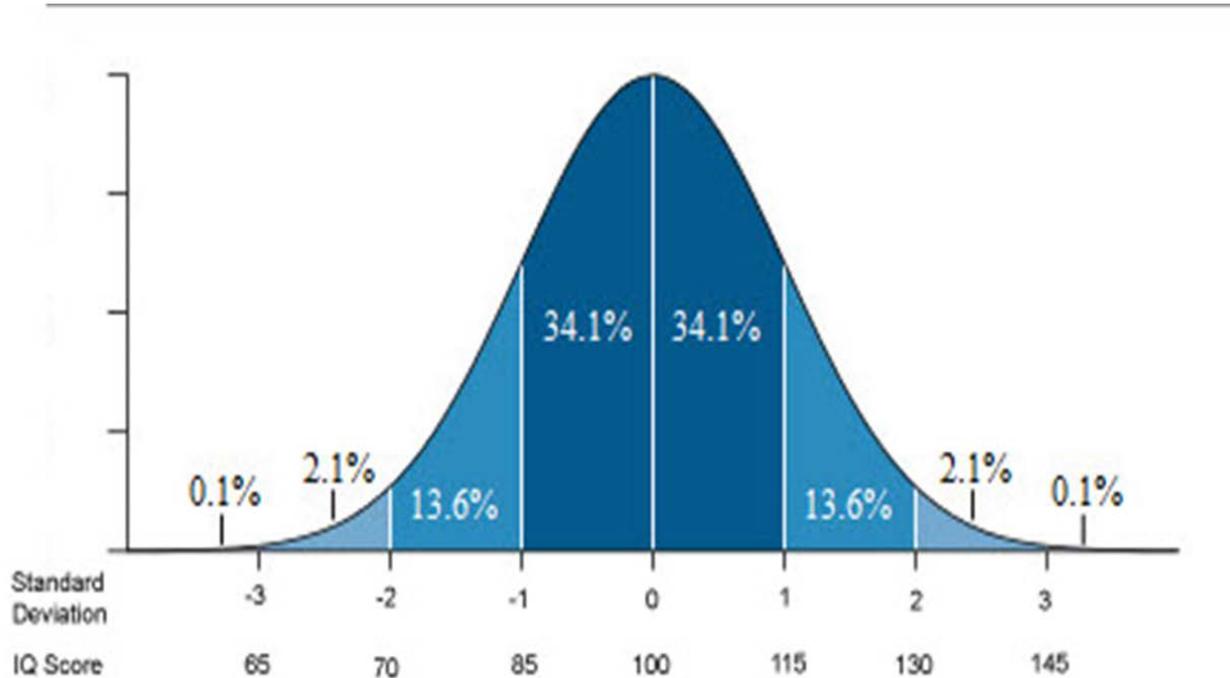
Factor theories

- Based on the assumption that intelligence consist of one or more major factors
- Every intelligence task requires a different ability
- Unitary theory
- Multifactor theory
- Vernon's Hierarchical
- Guilford's theory

Process oriented theories

- Gives importance to the patterns of thinking that people use for problem solving
- Focuses on how the person goes about in solving the problem
- Paige's Theory
- Brunner's theory
- Triarchic theory

Distribution of intelligence : Normal distribution



Age – intelligence increases till 16 to 20 years

Sex – no significant differences

Normal Distribution of IQs

Intelligence Interval

- 40 - 54
- 55 - 69
- 70 - 84
- 85 - 114
- 115 - 129
- 130 - 144
- 145 - 159
- 160 - 175

Cognitive Designation

- Severely challenged
- Challenged
- Borderline
- Average
- Above average
- Gifted
- Genius
- Extraordinary genius

(Weschler,1955; Grossman1977)

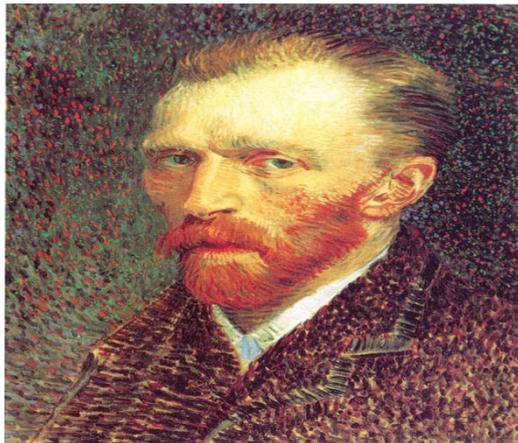
Famous personalities with High IQ who developed schizophrenia



John Nash IQ 150



**Bobby
Fischer
IQ 180**



Vincent Van Gogh IQ 200

Relationship of intelligence with schizophrenia

- Gunnell et al (2002) found that the relationship between intellectual functioning and schizophrenia was **non-linear**.
- Risk was markedly higher in the lowest-performing group
- David et al (1999) reported a nine-fold increase in schizophrenia risk among conscripts scoring in the lowest IQ band compared with those falling within the highest IQ band.
- However exceptional cases where Schizophrenia can occur in extremely clever individuals such as John Nash.

(**PAUL FEARON and ROBIN MURRAY Intellectual function and schizophrenia BRITISH JOURNAL OF PSYCHIATRY(2002) ,181, 276- 277)**

- Excellent school performance among 16-year-old males was associated with four-fold increase in schizophrenia risk; 11% of pre-schizophrenia cases, compared with only 3% of the comparison group, obtained excellent mean school marks.
- In keeping with this finding, the proportion of pre schizophrenia cases falling within the highest IQ category among the Israeli 16- to 17-year-old male conscripts was six times higher than that of the comparison subjects (with no hospital treated psychiatric outcome) **(Davidson et al, 1999)**.

(BRITISH JOURNAL OF PSYCHIATRY(2002) ,181, 276- 277)

Recent Insights

- High IQ could halt the development of in schizophrenia in some people, particularly those who have genetic predisposition.
- This study contradicts previous findings that high IQ can increase the risk of schizophrenia.
- “ If you are really smart , your genes for schizophrenia don’t have much of a chance of acting “- Kenneth Kendler of Virginia CWU

(American journal of psychiatry 2015)

Assessment of Intelligence

Verbal tests

- Stanford Binnet Scale
- Army Alpha Test

Performance/nonverbal tests

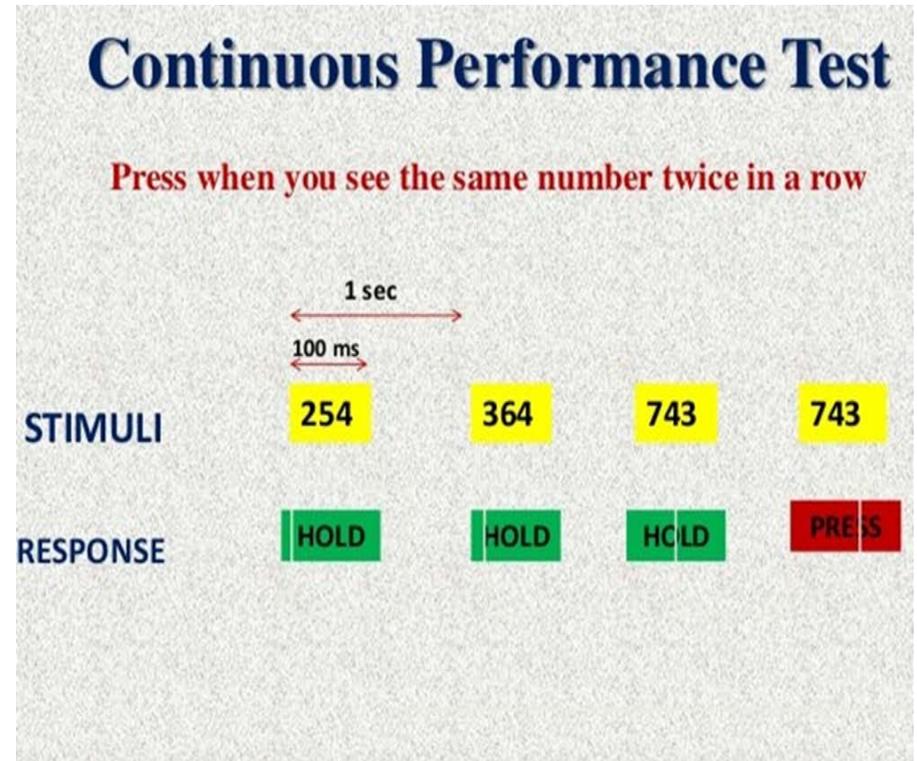
- Alexander's Battery of Performance Tests
- Bhatia Battery of Performance Tests
- Wechsler Bellevue Intelligence Scale
- The Arthur Point Scale

Attention /Vigilance

- Vigilance refers to the ability to maintain attention over time

Impairments in vigilance can result in

- Difficulty following social conversations
- Inability to follow important instructions of treatment, therapy, or work functions
- Reading or watching television become impossible.



(Kaplan&Saddock 9th edition)

Verbal Learning and Memory

Ability to learn and retain new information over time, and recognizing previously presented material.

California Verbal Learning Test

➤ Patient to listen to 12 to 16 words, then immediately recall as many of the words as possible.

First trial

Normal controls - recall about 8 of 16 words

Schizophrenia - recall only about 5.

After Five consecutive trials

Normal controls – recall upto 13 words

Schizophrenia - recall only 9.

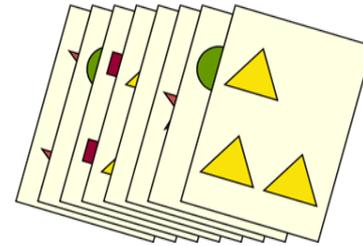
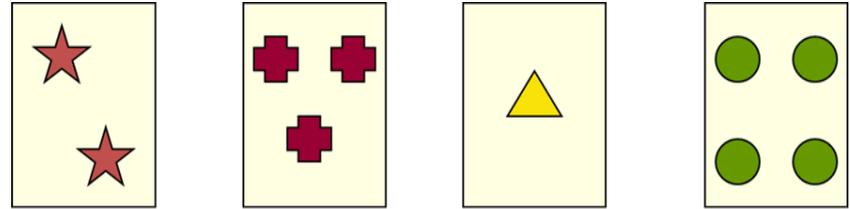
- Patients show larger deficit in learning than in retention

Visual Learning

- Visual information is not as easily expressed as verbal information
- Require subjects to draw figures from memory
- Visual memory impairment is correlated with :
 - Employment status
 - Job tenure
 - Psychosocial rehabilitation success
 - Social functioning , quality of life & functional capacity.

Reasoning and Problem Solving

- Poor performance of patients with schizophrenia on the WCST and the reduced activity of the dorsolateral prefrontal cortex
- Led to hypothesis of frontal hypoactivation in schizophrenia
- Impairment of measures of reasoning and problem-solving lead to difficulty adapting to the rapidly changing world around them.



Wisconsin Card Sorting Test

Speed of Processing

- Latency of response to environmental demands and the time required to execute the tasks that require processing of speed

Wechsler Adult Intelligence Scale Digit Symbol Test.

- Each numeral (1 through 9) is associated with a different simple symbol.
- Subjects are required to copy as many of the symbols associated with the numerals as possible in 90 seconds

Immediate/Working Memory

- Immediate memory - refers to the ability to hold a limited amount of information “online” for a brief period of time (usually a few seconds)

Eg - Repeating a string of digits (digits forward)

- Working memory manipulation of the information being held online.

Eg -Repeating a series of digits in the reverse

Verbal fluency

- Most neurocognitive assessments have included measures of verbal fluency as a separate domain of functioning

Phonological fluency & semantic fluency

Phonological fluency - ability to produce as many words as possible beginning with a particular letter within, for instance, 60 seconds.

Semantic fluency - ability to produce words within a particular meaning based category, such as “animals.”

Schizophrenia patients produce fewer and inappropriate

Genetic expression of neurocognitive deficits

- Neurocognitive impairment has a heritable component
- First-degree relatives of individuals with schizophrenia are impaired
- The COMT gene has an association with schizophrenia

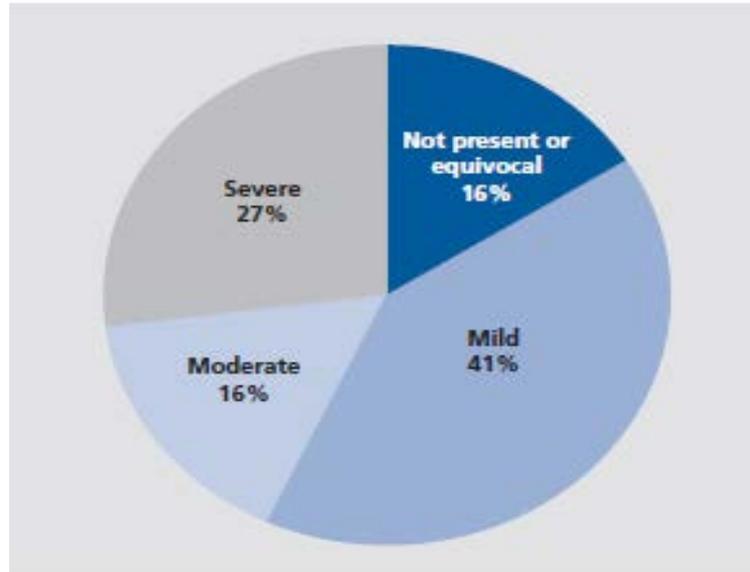
(Dialogues in Clinical Neuroscience - Vol 7No.1.2005)

- Other risk genes are – chitinase-3-like protein , ZNF804A
PACAP are associated with neurocognitive deficits

(Asian journal of psychiatry (2011)S1-S39)

Prevalence of Neurocognitive deficits

- This impairment is often quite severe, typically 1 to 2 standard deviations below normal



- Cognitive deficits are extremely common 75%–85%

Does cognitive impairment predate the illness ??

Premorbid cognitive functioning:

- It is associated with early premorbid cognitive deficits.
- Low educational test scores in verbal, non-verbal, and mathematics/arithmetic were the risk factors.
- Evidence of poor academic performance in average individuals as early as first grade
- In adolescence, premorbid IQ levels in those who go on to develop schizophrenia are roughly 8 points below normal

Peri-onset cognitive course

- can be seen prior to the prodromal period, when patients begin to be socially withdrawn **(Neuropsychol Rev (2009) 19:365–384)**

Post onset cognitive course

- Kraepelin's initial suggested that it is characterized by a course of progressive decline, tend to stabilize and may even partially improve during the initial stabilization phase immediately after first onset

(Heaton et al. 2001; Kurtz 2005; Rund 1998),

Longitudinal studies

- Schizophrenia in the British 1946 birth cohort
- Dunedin multidisciplinary health and development study
- Philadelphia cohort of the national collaborative perinatal project
- Schizophrenia in the 1949 to 1950 Swedish conscript study
- Schizophrenia in the Israeli conscript study

(**Dialogues in Clinical Neuroscience - Vol 7No. 1 .2005**)

Is neurocognitive deficits progressive ??

- Neurocognitive deficits is severe ,in patients who have experienced first episode psychosis even before antipsychotic treatment
- Patients recovering from acute exacerbation do not appear to demonstrate improvement in their neurocognitive impairment
- Course of neurocognitive impairment in elderly patients is uncertain
- Patients with the most chronic courses of illness may manifest a further, albeit gradual, decline in the latest years of life.

(Kaplan&Saddock 9th edition)

Relationship to schizophrenia symptoms

- Neurocognitive deficits were the result of the symptoms of the illness, then the deficits would disappear simultaneously to symptom reduction
- The performance of the patients with schizophrenia does not change when psychotic symptoms are minimised

Positive symptoms	Negative symptoms	Formal thought disorder	Affective symptoms
Absence of relationship	Significant correlation	Impairment of the “semantic network”	Role of depressed mood is important
-	Neurocognitive deficits may cause reduced motivation	-	Direct deleterious effect
-	Unable to engage in dif tasks	-	poorer verbal memory, processing speed performance

(Kaplan&Saddock 9th edition)

Clinical importance of neurocognitive impairment

- Relationship of Neurocognitive Impairment to functioning & quality of life
- Neurocognitive Impairment and Unemployment
- Neurocognitive Impairment and Relapse Prevention
- Neurocognitive Impairment and Medical Comorbidity
- The Costs of Neurocognitive Impairment

(Kaplan&Saddock 9th edition)

Treatment of neurocognitive impairment

- Neurocognitive impairment in patients with schizophrenia has a devastating impact on illness and their lives
 - Patients treated with large doses of , “typical” antipsychotics, which may have had direct adverse neurocognitive effects.
 - Larger doses of conventional antipsychotics cause lethargy, somnolence, and extrapyramidal symptoms, all of which impair neurocognition.
 - Anticholinergic medications used to control side effects cause additional neurocognitive impairment
 - “Atypical” antipsychotic treatments provide greater neurocognitive benefit to schizophrenia
- (Kaplan&Saddock 9th edition)**

Neurocognitive Remediation Programs

- Drill and practice exercises
 - Teaching strategies to compensate for neurocognitive impairments
 - Coping strategies
 - Group discussions
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- Cognitive Behavioural Therapy
 - Physical exercises and yoga
 - Psychosocial rehabilitation programmes

(Kaplan&Saddock 9th edition)

Take Home message

- Schizophrenia is a common psychiatric illness
- Cognitive dysfunction is a important domain in this illness
- It appears even before the active psychopathology is evident
- Hence early identification , treatment and appropriate rehabilitation will reduce the morbidity