DISSERTATION

on

A STUDY OF COGNITIVE FUNCTIONING IN AGING

Submitted in partial fulfillment of

MD DEGREE EXAMINATION

BRANCH-XVI GERIATRIC MEDICINE

THE TAMIL NADU DR. M.G.R. MEDICAL UNIVERSITY
CHENNAI

MADRAS MEDICAL COLLEGE
CHENNAI – 600003

APRIL 2013

CERTIFICATE

This is to certify that the dissertation titled **"A STUDY OF COGNITIVE FUNCTIONING IN AGING"** a bonafide work done by **Dr. ARYA CHANDRAN S**, Post Graduate Student, Department of Geriatric Medicine, Madras Medical College, Chennai – 600003, in partial fulfillment of the university rules and regulations for the award of MD DEGREE in GERIATRIC MEDICINE BRANCH-XVI, under our guidance and supervision, during the academic period from April 2010 to April 2013.

Prof. B. KRISHNASWAMY, MD,
Professor and Head,
Department of Geriatric Medicine,
MMC and RGGGH,
Chennai – 600003.

Prof. V. KANAGASABAI, MD,
Dean,
MMC and RGGGH,
Chennai – 600003.

DECLARATION

I solemnly declare that the dissertation titled **"A STUDY OF COGNITIVE FUNCTIONING IN AGING"** was done by me at Madras Medical College, Chennai - 03 during the period December 2011 to November 2012 under the guidance of **Prof. B. KRISHNASWAMY, MD,** to be submitted to The Tamil Nadu Dr.M.G.R. Medical University towards the partial fulfillment of requirements for the award of MD DEGREE in GERIATRIC MEDICINE BRANCH-XVI.

Place : Chennai

Date :

Dr.ARYA CHANDRAN S,
MD GERIATRIC MEDICINE,
Post Graduate Student,
Department of Geriatric Medicine,
Madras Medical College,
Chennai – 600003.

ACKNOWLEDGEMENT

I thank **Prof. V. KANAGASABAI, MD**, Dean, Madras Medical College, for having permitted me to conduct the study and use the hospital resources in the study.

I express my heartfelt gratitude to **Prof. B.KRISHNASWAMY, MD**, Professor and Head, Department of Geriatric medicine, for his inspiration, advice and guidance in making this work complete.

I am extremely thankful to **Prof. S.SIVAKUMAR, MD,** Associate professor, Department of Geriatric medicine for guiding me during the period of study.

I am extremely thankful to **Dr.G.USHA, MD**, Assistant Professor, **Dr. S.DEEPA, MD,** Assistant professor, **Dr. K.UMA KALYANI, MD,** Assistant professor, and **Dr. M SENTHIL KUMAR, MD**, Assistant Professor, Department of Geriatric medicine, for guiding me academically and professionally during the period of study.

I also thank all the postgraduate students and paramedical staff for their cooperation which enormously helped me in the study. I am also indebted to thank all the patients and their caring relatives. Without their humble cooperation, this study would not have been possible.

TABLE OF CONTENTS

1.	**INTRODUCTION**	**1**
2.	**AIM OF THE STUDY**	**3**
3.	**MATERIALS AND METHODS**	**4**
4.	**REVIEW OF LITERATURE**	**13**
5.	**OBSERVATIONS AND RESULTS**	**54**
6.	**DISCUSSION**	**73**
7.	**CONCLUSION**	**77**
8.	**BIBLIOGRAPHY**	
9.	**ANNEXURES**	
	PROFORMA	
	INFORMATION SHEET	
	CONSENT FORM	
	ETHICAL COMMITTEE APPROVAL FORM	
	TURNITIN DIGITAL RECEIPT	
	ANTI-PLAGIARISM REPORT	
	MASTER CHART	

INTRODUCTION

Cognitive functioning in individuals changes with aging. The extent and pattern of decline varies among various cognitive domains and also among individuals .Certain cognitive domains tend to decline as a person ages in comparison to his younger counterpart .Some elderly individuals may not show a decline in cognitive functioning. High intelligence, well organized work habits and sound judgment compensate for many of the progressive shortcomings of old age.

Cognitive decline is thought to start after the age of 30 years. Little that is new and original is learned after the age of forty.

Attention, language, and memory are the basic processes that serve as building blocks for the development of higher intellectual functions. The higher cognitive functions include manipulation of well learned material, abstract thinking, problem solving, judgment, arithmetic computations. These complex functions are predicated on the integrity and interaction of more basic processes. Because they represent the most advanced stages of intellectual development, the higher cognitive functions are more susceptible to neurological diseases. The evaluation of these higher functions may demonstrate the early effects

of cortical damage before the more basic processes of attention, language and memory are affected.

Neuropsychological testing is an effective way of identifying very early cognitive impairment and distinguishing them from normal aging, minimal cognitive impairment and various types of dementias using relatively brief battery of tests. Hence it is important to know the cognitive domains that show a decline as a part of normal aging process. A case control study which compares younger and older individuals of the same educational status and socioeconomic background is useful in identifying the cognitive domains affected as a part of normal aging without the influence of compounding factors. The theory that aging brings inevitable decline in cognitive functions is being questioned by studies of the rapidly expanding oldest segment of our society. Although some aspects of cognition are affected by aging, many changes in cognition previously considered the unavoidable consequence of brain senescence may instead result from incremental insults on brain function due to old age related medical conditions. To identify such changes, which may stabilize or even reverse on giving appropriate treatment, and their differentiation from the cognitive changes related to neurodegenerative disease or other neurological disorders is a critical job.

AIM OF STUDY

- To study the pattern of decline of various cognitive functioning with aging.
- To compare with healthy controls in the community.
- To identify the differences in cognitive status based on the educational level and IQ of the patient.

MATERIALS AND METHODS

STUDY CENTRE:

Department of Geriatric Medicine, Madras Medical College & Rajiv Gandhi General Hospital Chennai-600003

STUDY DESIGN:

Case control study

SAMPLE SIZE:

One hundred and twenty six: seventy six cases above the age of 65 and 50 controls from 20-30 age group.

STUDY DURATION:

December 2011 –November 2012

SELECTION OF PARTICIPANTS:

INCLUSION CRITERIA:

- Patients above 65 yrs of age attending the geriatric outpatient department.
- Healthy controls between 20 and 30 years of age from the community.

EXCLUSION CRITERIA:

- Acutely toxic patients
- Patients with diabetes, hypertension, stroke and primary neurologic disease like alzhemier's.

METHODOLOGY:

The study enrolled 76 patients above 65 years of age who attended the geriatric outpatient department for minor ailments who were otherwise healthy and a healthy control group from the community aged 20-30 years. History and physical examination is done in all patients to exclude primary neurological disease and comorbidities like diabetes and hypertension which are known to cause cognitive decline.

Relevant lab investigations will be done in patients to rule out comorbid illness. Cognition assessment is done using Mini mental status examination, test of Attention, memory, language, intelligence, conceptualisation and mental flexibility, visuospatial ability and psychomotor functions.

Comparison is done on the basis of educational status and IQ level.

Minimental status examination as suggested by Folstein et al with minor modifications to suit the educational and socioeconomic status of our population was administered to the elderly and the control group included in the study.

Elderly patients and control group included in the study were matched according to sex, educational status and socioeconomic status and the results were analysed.

Mini Mental State Examination

Orientation:		**Points**	**Score**
Time			
	Year?	1	
	Season?	1	
	Date?	1	
	Day?	1	
	Month?	1	
Place	Country?	1	
	State?	1	
	Town or city?	1	
	Hospital?	1	
	Floor?	1	

Registration

Name three unrelated objects,

then ask the patient to tell

all the three after you have said them. 3

Repeat the words till the patient

learns them.

Attention and calculation

Serial fives (count backwards from 5

100 by fives).

Recall

Ask for names of three objects 3

learned earlier

Language

Naming : Show familiar objects 2

and ask the patient name them .

Repetition: Ask the patient to repeat a sentence	1
Three stage command: Take the paper in your right hand, fold the paper into two and throw it on the floor."	3
Read and obey: "CLOSE YOUR EYES."	1
Write : Have the patient write a sentence	1
Copying: Ask the patient to copy an interlocking pentagon	1
Total score	30

Scoring: Cutoff of 23 or 24 for people with ninth standard or higher education.(93% sensitivity and 100%specificity).

Cutoff of 17 or 18 in low educational group(sensitivity 81% and specificity of 100%)

Test of attention: Sustained attention is assessed by serial subtraction of fives.

Test of Memory:

- Immediate memory: tested by digit span (7 +/-2 digits) forward span as well as backward span.

  Scoring:patient with average intelligence can accurately repeat five to seven without difficulty.

- Recent memory: assessed by three item recall of MMSE.

  Scoring:normal patient below age of 60 should recall 3 words after a 10 minute delay.

- Remote memory:assessed by recall of name of school studied .

- Episodic memory:assessed by recall of an event of last week.

- Semantic memory:recall names of month or days of week.

Test of language

- Naming, Comprehension, Reading, Writing and Repetition as in MMSE.

- Verbal fluency:assessed by Animal naming test.Patient is asked to name as many animals as possible.Patient's performance is timed for 60 seconds.

Scoring:normal:18 to 22 animal names +/- 5 to 7.

Score of less than 13 in normal patients under 70's and less than 10 under 80's.In 85 yr old score of 10 may be lower limit of normal.

Test of Conceptualisation and mental flexibility(executive function)

- Similarities subtest of Weschler's adult intelligence scale:Patient must explain the basic similarity between two overtly different objects or situations.

  Scoring:2 points is given to any abstract similarity or general classification that is highly pertinent for both items in the pair.Total is 10 points.Normal:5 or 6 points.Score of less than 4 suggests reduced general intelligence or impaired abstract thinking ability.

Test of Visuospatial ability

- Copying Interlocking pentagons

- Clock drawing test: the participant draws the circle as well as writes numbers and shows time. A commonly used time setting is "10 after 11" (or "10 past 11").

Test of psychomotor function

- The Stroop test has three steps.

Each step assesses accuracy, reaction time and its associated variance.

Step1

Participants are shown a word in colored letters, with the stipulation tat the word does not name a color.After sometime, participants are presented with a pair of colored squares, one on the left and another on the right. They are instructed to choose asap which of the two squares is the same color as the letters of the word presented immediately before.

Step 2

Participants are presented with a word that names a color in non-colored letters .Participants are then presented with a pair of colored squares and must choose asap which square is the color named by the color word presented immediately prior.

Step 3

Participants are presented with a word that names a color in letters of a color other than that named by the word. As in Step1, participants must choose as quickly as possible which of two squares is the same color as the letters of the word presented immediately prior. The conflicting information provided by the meaning of the word and the color of its letters lead to a reduction in performance relative to the other phases where there is no conflict.

Test of Intelligence

- Digit span-digit forward/digit backward
- Similarities subtest of WAIS.

REVIEW OF LITERATURE

Cognition is defined as various thinking processes through which knowledge is gained, stored, manipulated and expressed.

Cognitive functions include

- Attention
- Memory
- Language
- General intelligence
- Conceptualisation and mental flexibility
- Visuospatial ability and
- Psychomotor functions

Age does not affect all areas of cognition in all adults in the same way. There is inter individual difference in the performance of cognitive functions among the elderly .The factors influencing cognitive changes in the elderly are

- Age associated structural and functional changes in the brain
- Demographic characters
- Educational status
- Socioeconomic status
- Comorbid medical illness
- Associated psychiatric illness and Polypharmacy

	PRESERVED COGNITIVE FUNCTIONS	**COGNITIVE FUNCTIONS SHOWING DECLINE**
General intellectual functioning	Crystallized, verbal intelligence	Fluid intelligence, speed of processing
Attention	Sustained attention, primary attention span	Divided attention (possibly)
Executive function	"Real world" executive functions	Novel executive tasks
Memory	Remote memory, procedural memory, semantic recall	Learning and recall of new information
Language	Comprehension, vocabulary, syntactic abilities	Spontaneous word finding, verbal fluency
Visuospatial skill	skill Construction, simple copy	copy Mental rotation, complex copy, mental assembly
Psychomotor functions		Reaction time

MMSE

MMSE by Folstein [1] gives an overall idea of the basic cognitive functions.Studies done by Adunsky[2] et al show that MMSE scores show modest relations with measures of functional capacity (e.g., driving, cooking, caring for finances, consent to participate in studies), functional outcome after stroke, and time to nursing home care and death Poor performance on the copy polygons task is associated with an increase in motor vehicle crashes. The greatest risk is for those with moderate to severe cognitive impairment, although mild impairment (MMSE scores 18–23) is also associated with increased risk. A decline of at least four points over two years is also predictive of an increased risk of mortalityan association between white matter lesions, noted on MRI, and impaired cognitive function as measured by the MMSE. Clinical-pathological study of patients with AD reveal that the best predictors of MMSE scores are the total counts of neurofibrillary tangles (NFT) in the entorhinal cortex and area 9 as well as degree of neuronal loss in the CA1 field of the hippocampus. The MMSE summary score is sensitive to the presence of dementia, particularly in those with moderate to severe forms of cognitive impairment. Different profiles were seen on the MMSE in patients with AD and patients with Huntington's disease. The differences between the groups rested on

different scores on the memory and attention/concentration items. Patients with AD did worse on the memory items, whereas patients with Huntington's disease did worse on the attention/concentration items.Patients with AD scored lower than patients with ischemic vascular dementia (VaD) or Parkinson's disease (PD) on temporal orientation and recall tasks, while those with VaD obtained lower scores than patients with AD on motor/constructional tasks (copying, writing) and an index comprising items requiring working memory (spelling "world" backward, carrying out three-step commands). The VaD and PD groups also made more errors in writing a sentence and copying intersecting polygons.

The MMSE may also be useful in predicting who will develop AD or VaD scores on the MMSE in nondemented persons were associated with an increased risk of AD or VaD after a three-year follow-up period. Delayed memory was the best predictor in both preclinical VaD and preclinical AD. Analyses of individual items reveal that errors rarely occur onquestions related to orientation to place and language for both normal and demented individuals, most errors occur for the recall of three words, serial 7s/"world," pentagon, and orientation to time. These latter items are the most sensitive to normal aging and a

variety of diseases (e.g., diabetes, cardiovascular disease) including dementing processes .

Attention:

Attention is the patient's ability to concentrate on a specific stimulus without being distracted by any internal or external stimuli.

The concept of attention has two aspects namely,

- Sustained attention
- Selective attention or ability to extract relevant from irrelevant information.

Attention related functions include

- Working memory
- Verbal fluency
- Concentration span
- Scanning and retrieval of stored information
- Mental flexibility

This is assessed by

- Digit span
- Recitation of months in reverse order
- Serial sevens backwards
- Go-No-Go task
- No of words starting with a, f

The basic anatomical structures responsible for maintaining an alert state are the brainstem reticular activating system and the diffuse thalamic projection system, the limbic system is also an integral part of the attention network. Attention results from an interplay among brainstem ,limbic, and cortical activity that allows the person to focus on a specific task to the exclusion of irrelevant stimuli. Attentional deficits disrupt the orderly registration and retrieval of new information and lead to secondary memory deficit, problems with calculation and verbal abstraction .Attentional deficits are the hallmark of acute confusional state or delirium.

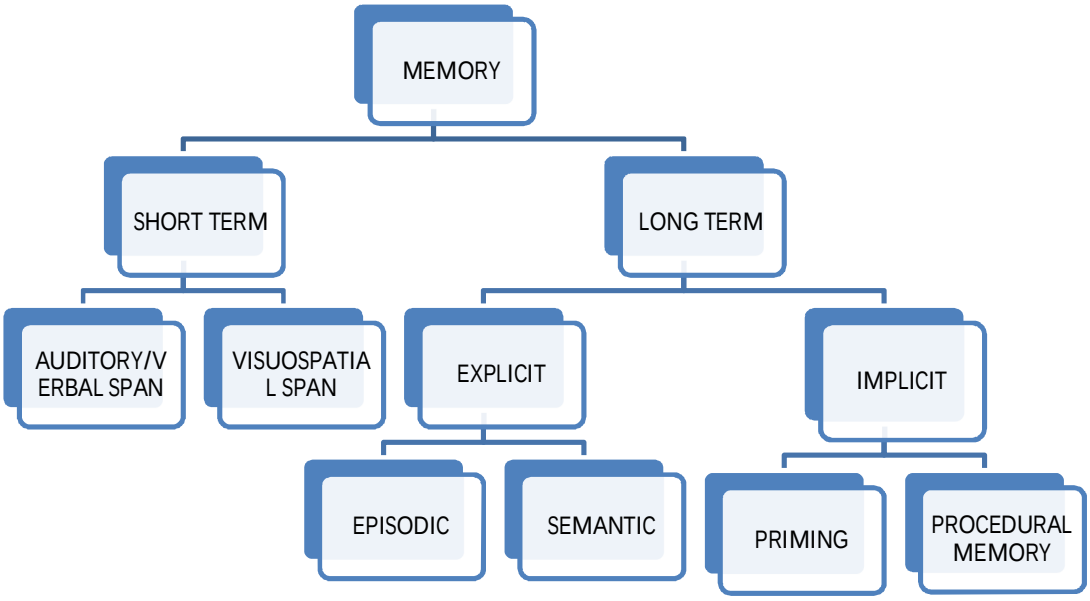
Memory

Memory is a series of specific but interactive stores[3]. It refers to the complex processes by which the individual encodes, stores, and retrieves information. Encoding refers to the processing of information to be stored, whereas consolidation refers to the strengthening of the representations while they are stored. For a memory to be useful, however, one must be able to retrieve it.

Memory is a general term for a mental process that allows an individual to store information for later recall. The time span for recall can be as short as a few seconds, or as long as many years.

WORKING MEMORY

Working memory is conceived of as a limited-capacity store for retaining information over the short term (seconds to 1–2 minutes) and for performing mental operations on the contents of this store. The contents of working memory may originate from sensory inputs but also may be retrieved from long-term memory. Studies done by researchers; Kyllonen & Christal, 1990) [4] stress that working memory capacity is an important moderating variable of learning.



.

LONG-TERM MEMORY

Long-term memory is typically split into two major divisions:

Explicit (conscious or declarative) memory and implicit (unconscious or non declarative or procedural memory). Explicit memory refers to conscious recollection of previous experiences. In explicit memory test, patients are shown a series of words, pictures, or some set of material to be remembered and later given a recall or recognition task that requires them to think back to the study episode in order to produce or select a correct response.

Implicit memory refers to a heterogeneous collection of abilities (priming, habit formation, skill learning or procedural memory) that are manifested across a wide range of situations. Priming acts within the perceptual system with words and objects. Learning to ride a bike is an example of procedural memory. Implicit memory involves a facilitation or change in test performance that can be attributed to information or skills learned previously, even if the individual is not required to or unable to recollect when it was learned.

EPISODIC MEMORY [5]

Explicit memory can be further divided into two : episodic and semantic memory.

Episodic memory refers to the system that enables conscious recollection of specific personal events (episodes) as well as the contexts (time and place) in which they occurred. Examples of episodic memory include events in one's personal history, such as the birth of a child or a dissertation defense. Clinical measures of learning and memory are most commonly measures of episodic memory and typically involve free recall, cued recall, and recognition of lists of items (e.g., words, pictures, faces). They require the person to consciously recollect the content of past experiences as well as their spatial temporal

context. It is important to distinguish recollection, which is closer to what is meant by episodic memory, from another type of explicit memory, namely familiarity with a past event. Familiarity refers to recognition that a particular event has occurred in the past without knowing the specific context. This type of memory shares attributes with episodic memory in that it is memory for a particular bit of information linked to an episode, but it lacks a defining spatial-temporal context.

Historically, hemispheric differences in episodic memory processing have been suggested, with verbal memory processed by left temporal lobe structures and nonverbal memory handled by right hemisphere structures. As a consequence, the collection of episodic memory tests may be further subdivided according to the type of task (i.e., verbal or nonverbal).

SEMANTIC MEMORY

Semantic memory refers to an individual's knowledge Of the world, like facts, concepts, and vocabulary. Semantic memory reflects knowing what chairs

are , that animals and vegetables are fundamentally different, who is the president of the India, and other similar facts and concepts. In contrast to episodic memory, semantic memory is context independent. That is, the knowledge is remembered in the absence of any recollection of the specific circumstances surrounding the learning. Semantic memory can also refer to knowledge one has about oneself (personal semantics), such as where one went to school, whom one married, where one lived, and who one's friends were.

Memory acquisition refers to the sensory uptake of information, its initial encoding, and further consolidation (the creation of a stronger representation over time). Sensory uptake engages the appropriate sensory receptors (e.g., hair cells in the cochlea, rods and cones in the retina), reaching the cortical level (via various subcortical routes and way stations, such as the thalamus), where the information undergoes additional sensory analysis and is maintained over the short term in cortical association areas, particularly prefrontal and posterior neocortex, such as the parietal and inferior temporal cortex.

The limbic system is viewed as engaged in the transfer of episodes and facts for long-term storage in cortical networks.

With regard to semantic memory, there is evidence for neuroanatomic segregation of semantic domains (e.g., knowledge of animate and inanimate objects may require different cortical regions. Retrieval is seen as engaging a combination of frontal-temporal-polar regions, with the left hemisphere dominating retrieval of factual information and the right hemisphere (particularly prefrontal, medial temporal, and parietal areas) dominating retrieval of episodic information. The traditional view about memory consolidation is that the medial temporal lobes, particularly the hippocampus and possibly the diencephalon, are temporary memory structures, needed only for memory retention and retrieval until memories are consolidated in neocortex and other structures, where they are permanently stored and from which they can be retrieved directly. In this view, memory storage initially requires hippocampal linking of dispersed neocortical storage sites, but, over time, this need dissipates and the hippocampal component is rendered unnecessary. This change in function over time is held to account for the retrograde amnesia gradients (deficits in memory stretching back to some point before the onset of the amnesia) that are often seen in patients with hippocampal damage.

IMPLICIT MEMORY (Procedural memory) is involved in learning and retaining a skill. Abilities stored in procedural memory are automatic and do not require conscious implementation. The structures identified as crucial for procedural memory (e.g., learning rules, motor sequences, conditioned responses) include the basal ganglia and cerebellum .

Language

Linguistic ability has four components.

- Phonological
- Lexical
- Syntactic
- Semantic

Phonology:

Phonological knowledge refers to use of the sounds of language and the rules of their combination. This is well preserved in aging.[6]

Lexicon:

There is a difference between lexical representation of a word i.e. the name of an item and its semantic representation i.e. meaning of the word.

These aspects are intact in healthy old individuals.

Syntax:

Syntactic knowledge refers to the ability to combine words meaningfully. This aspect is also well preserved as age advances.

Semantic:

Older individuals have difficulty with semantic aspects of word retrieval. Instead of correctly naming an item they produce semantically related associates, circumlocutions and nominalization. Verbal fluency assesses semantic ability. There is a decline in verbal fluency as age advances. Thus semantic linguistic ability appears to change with advancing age whereas other aspects of linguistic ability are well preserved.

Language functions are subserved by the perisylvian network of the left hemisphere. This consists of Wernicke's area which is the

posterior third of the superior temporal gyrus and a surrounding rim of the inferior parietal lobule and the Broca's area which is the posterior part if the inferior frontal gyrus and the surrounding rim of prefrontal cortex. These areas are interconnected with each other and with temporal, prefrontal and posterior parietal areas. The clinical examination of language includes

- Spontaneous speech
- Comprehension
- Naming
- Repetition
- Writing and
- Reading
- Verbal fluency

Verbal fluency

Phonemic Fluency:

The examinee must produce orally as many words as possible starting with a particular letter during a fixed period of time, usually 60 seconds. F, A, and S are the most commonly used letters for this test.

The choice of letter affects the results to a certain extent because of differences in letter difficulty and word frequency for each letter.

Semantic Fluency

The most common category is “animals” and the individual is asked to say as many animal names as possible within a period of 60 seconds. Food names and “things in the kitchen,” “things in a supermarket,” “things to wear,” “things that get you from one place to another,” “first names,” etc., have also been used.

Studies done by Brickman et al [7] shows that aging is more strongly related to the number of words generated on semantic fluency than phonemic fluency tasks, with poorer performance associated with increasing age.

Educational level exerts a significant impact on both phonemic and semantic fluency tests. Individuals with Higher level of education perform better..For phonemic fluency, education accounted for more variance than age , while for semantic naming, the opposite relationship existed. Age proved the best predictor of performance on both phonemic and semantic fluency tasks but it accounted for a greater share of the variance in semantic than in phonemic fluency . IQ shows a

stronger relationship to phonemic fluency than does education. Further, the association becomes stronger as IQ increases.

INTELLIGENCE

Weschler's adult intelligence scale [8] is the gold standard in assessing intelligence of an individual.

IQ	Factor-Based Index	Subtest
Verbal IQ	**Verbal Comprehension**	***Vocabulary***

Description: Examinee gives oral definition for words

Similarities

Description: Examinee must state in what way two objects or concepts are alike.

Information

Description: Examinee responds orally to questions about factual information.

Working Memory ***Arithmetic***

Description :Examinee must mentally solve arithmetic word problems presented orally within a time limit.

Digit Span: DF/DB

Description :examinee repeats number sequence in same order as presented examinee repeats the number sequence in reverse order.

Letter-Number Sequencing

Description :Examinee is read a combination of numbers and letters and is asked to recall the numbers first in ascending order and then the letters in alphabetic order.

Comprehension

Description : Examinee responds to questions that require understanding of concepts and social practices.

Performance IQ **Perceptual Organization** ***Picture Completion***

Description: Examinee views a picture and points to or names the important part that is missing.

Block Design

Description :Examinee is asked to replicate models or pictures of two-color designs with blocks.

Matrix Reasoning

Description :Examinee looks at a matrix with a section missing and identifies by pointing or by number one of five response options.

Processing speed ***Digitsymbolcoding***

Description ***:***examinee copies symbols paired with numbers in a 120-sec. limit.

Incidental Learning: Pairing—examinee is given

numbers and must recall associated symbols.

Free Recall—examinee writes down as many symbols as

can recall.

Symbol Search: Examinee must determine whether either of two target

symbols match any of the symbols in a search group.

Examinee responds to as many items as possible in a 120-sec. time limit.

Picture Arrangement: Examinee arranges mixed-up cards to create a

logical story.

Object Assembly: Examinee is presented with puzzle pieces that must be put together to depict a common object.

The scale, tests various cognitive abilities:

Semantic Memory (Vocabulary, Information), Verbal Reasoning (Similarities, Arithmetic, Comprehension), Constructional Praxis (Picture Completion, Block Design), Visual Reasoning (Matrix Reasoning, Picture Arrangement), Working Memory (Arithmetic, Digit Span, Letter-Number Sequencing), and Processing Speed (Coding, Symbol Search).

General intelligence consists of

- Fluid intelligence
- Crystallised intelligence

Fluid intelligence

Fluid intelligence measures the capacity to solve new problems which requires time pressure, attention, concentration and working memory. Since some of these components decline with age, fluid intelligence also declines with age.[9]

Crystallised intelligence

Crystallised intelligence measures accumulated knowledge and experience and the ability to access this material. This is preserved even in old age.

Practical intelligence

Most of the intelligence tests predict how a person would function in an academic environment. They do not provide complete assessment of cognitive impairment. Practical intelligence involves the person's ability to solve real world problems. As individuals age, their practical knowledge increases. Hence, they find an effective strategy to complete practical tasks.

Crystallised intelligence is the ability to use all the individual's past experience to behave in novel situations. It is one of the aspects of cognitive functions which does not decline with age ,but is found to be better in older individuals. As we age our life experience increases and hence the level of crystallized intelligence.

Fluid intelligence is the capacity to improve and assimilate information and bring out a new theory. Fluid intelligence decreases with age whereas crystallized intelligence is preserved or increases with age.

Fluid intelligence has the following components:

- Abstract thinking
- Reasoning

- Concept formation and identification of differences between two objects.

- Capacity to acquire new information

- Capacity to adapt to new situations.

Everything put together, intelligence is found to steadily increase till the age of 20,and from then remains stable throughout life.

CONCEPTUALISATION AND MENTAL FLEXIBILITY

Conceptualisation, abstraction capabilities, mental flexibility, reasoning, foresight, judgement and on-line holding of information are essential factors of executive functions. Executive functions are a multistep process. The first step is to develop a plan. The next step is to organize the actions required to carry out the plan .The final step is the execution of the plan. These functions are sub served by the prefrontal cortex.

Executive functions are intrinsic to the ability to respond in an adaptive manner to new situations and has four components:

(1) volition; (2) planning; (3) purposive action; and

(4) effective performance .

Executive functions are metacognitive capacities that allow an individual to perceive stimuli from the environment, respond adaptively, flexibly change direction, anticipate future goals, consider consequences, and respond in an integrated or common-sense way, using all these capacities to serve a common purposive goal. Executive functions are a collection of processes that are responsible for guiding, directing, and managing cognitive, emotional, and behavioural functions, particularly during active, new problem solving.

Executive processes are part of a system that acts in a supervisory capacity in the overall hierarchy of brain processing and encompasses skills necessary for purposeful, goal-directed behavior .

Thus, executive dysfunctions may manifest in a constellation of problems in everyday life. They may include inappropriate social behavior; problems with decision making and showing good judgement; difficulties with devicing, following, and shifting plans; problems with organization; distractibility; and difficulties in situations involving various aspects of memory (e.g., remembering to carry out intended actions at a future time.

Executive dysfunction may be reflected in test performances by poor initiation, poor planning and organization, poor inhibition,

difficulty shifting, poor working memory, inflexibility, perseveration, difficulties generating and implementing strategies, difficulty correcting errors or using feedback, and carelessness.

Concept formation is assessed by a battery of tests such as

- Proverb interpretation test
- Similarities subset of WAIS
- Category test of Halsted-Reitan Battery

Mental flexibility is assessed by

- Set shifting test
- Winconsin card sorting test
- Visual verbal test
- Trail making test

Abstraction capabilities are assessed by

- Tests of discourse comprehension
- Similarities subtest of WAIS
- Proverb interpretation test.

Trail making test:

The TMT is a measure of attention, speed, and mental flexibility. The subject is asked to connect, by making pencil lines, 25 encircled numbers randomly arranged on a page in proper order (Part A) and 25 encircled numbers and letters in alternating order (Part B).

Performance on Trails A and B is affected by age, with performance declining with advancing age. Studies by Clarke et al[10] show that lower levels of educational achievement and lower IQ are associated with poorer test scores. IQ shows a moderate relationship with test performance, with associations becoming stronger, as IQ increases. The effect of IQ appears slightly more pronounced on Part B.

SIMILARITIES TEST

In the verbal similarities test the person is asked to explain the basic similarity between two different objects or situations. It is a test of verbal abstract ability and it needs analysis of relationships, formation of verbal concepts, and logical thinking.

Performance in this test should be compatible with the individual's performance on the fund of information test and proverb interpretation test. If the individual shows equal impairment on both

similarities test as well as fund of information test, it suggests retardation or educational deprivation rather than a specific defect in abstract thinking.

Verbal reasoning and abstraction are primarily dominant hemisphere functions having very close relationship with language. Hence dominant hemisphere lesions frequently interfere with high level verbal manipulations.

VISUOSPATIAL ABILITY

Visuospatial ability is revealed in the recognition and production of figures. This function is sub served by the parieto-frontal network. The parietal lobes are the principal cortical areas associated with visuomotor integration. The visual receptive areas of the occipital lobes and the motor areas of the frontal lobes are necessary for the completion of all of the tests, but it is the association cortex of the parietal lobes that is responsible for most of the complex integration. Drawings to command also require input from the occipital system. The premotor frontal association cortex would theoretically seem to be important in these high skilled motor tasks ,but in fact only a small percentage of patients with lesions restricted to the frontal lobes have constructional impairment. The parietal lobes are involved in learning and

programming skilled movements; while the frontal motor areas are involved in the pure executive nature of the task. There is significant decline in this aspect as age advances.

A high level ,nonverbal cognitive function ,constructional ability is a very complex perceptual motor ability involving the integration of occipital, parietal and frontal lobe functions. Because extensive cortical area is necessary to perform constructional tasks, early or subtle brain damage frequently disturbs performance.

As with any skilled motor activity, both exposure and practice affect the ability to reproduce pencil and paper designs or to complete block constructions. Social deprivation and lack of academic experience hence has a detrimental effect on constructional performance. Deficits in either motor or sensory channels can hinder performance, but such impairment does not reflect the disruption in the intergrative higher cortical function that these tests are designed to assess.

Deficits in drawings from memory may be due to memory problems, constructional problems, or a combination of the two.

This is assessed by

- Constructional tasks such as assembling blocks
- Drawing tasks that involve copying Interlocking pentagon
- Matching tasks that require the subject to identify pictures with similar elements
- Clock drawing.

Clock Drawing Test (CDT)

The Clock Drawing Test screens for dementia as well as for visuospatial, constructional, and executive difficulties. Clock drawing relies on visuospatial, constructional, and higher-order cognitive abilities, including executive functions.

Some researchers prefer to use the predrawn circle because it focuses the clock drawing performance on number and hand placement, thereby bypassing some difficulties inherent in procedures in which the participant draws the circle as well. A commonly used time setting is “10 after 11” (or “10 past 11”); this time setting may help in identifying the “pull” of executive dysfunction, because the 11 is right beside the 10, pulling the minute hand toward the 11, and because it requires

recoding of 10 minutes into a 2-hour segment (i.e., setting the minute hand at 2 o'clock. It also involves both visual fields. The identification of hemilateral neglect or hemianopia is facilitated if the two hands of the clock are in different halves of the clock face.

Age affects clock drawing in adults with performance declining particularly after age 70 years .

Education has an impact on performance in CDT.

Clock drawing shows moderate/high correlations with measures of intellectual status

Clock drawing shows moderate correlations with measures of temporal orientation, visual-spatial/visual-constructional skill and with measures of executive functioning. Semantic memory is also implicated in clock drawing.

Clock drawing also provides an indication of general cognitive functioning, correlating moderately/highly with global measures such as the MMSE, as well as subtests of the WAIS-R (information, similarities, digit span, and block design subtests. Therefore, as a preliminary screen, clock drawing appears to provide a reasonable measure of cognitive functioning.

The CDT comprises two conditions: free drawing followed by a copy condition. The copy condition was able to discriminate between patients with gross constructional impairment (as measured with the MMSE pentagon task) and patients without such impairment.

When the performance of patients with AD was compared with that of patients with subcortical deficits, such as Huntington's disease (HD) and vascular dementia, only the former group displayed marked improvement in the copy condition. A main source of difficulty in the command condition for the AD group reflected deficient knowledge required to bring to mind an accurate representation of a clock.

The test is useful in distinguishing normal elderly from patients with dementia due to AD , Parkinson's disease, and Huntington's disease, as well as from those with mild cognitive impairment. The CDT also appears useful in documenting severity of cognitive impairment and of predicting subsequent cognitive decline and rate of decline. Inclusion of a copy condition (in addition to drawing to command) may improve diagnostic accuracy.

Studies by Freedman et al [11] showed that clock drawings improved from the command to the copy condition in patients with AD, whereas no such improvement occurred among patients with vascular

dementia. Patients with vascular dementia made more graphomotor errors (distortions in size or shape of the circle) in the drawing-on-command condition, and more executive control errors (e.g., turning the page while writing numbers, writing numbers counterclockwise, perseverations) in the copy condition than did AD patients.

It is suggested that findings reflected greater deficits in semantic memory systems in patients with AD and greater deficits in frontal systems among the vascular dementia patients.

The most dramatic examples of constructional impairment are seen in patients with bilateral cortical disease ,especially cerebral atrophy, It is seen in early stages of Alzheimer's disease and multi infarct dementia.

PSYCHOMOTOR FUNCTIONS

Psychomotor functions require precise motor responses, attention and cognitive problem solving abilities. As age advances the speed with which motor functions are done decreases. Hence there is a decline in psychomotor functions as age advances. Reaction time can be tested with Stroop interference test. Studies by Kane et al[12] show that the test depends on attention and working memory to a great extent.

Not all cognitive changes are negative. The positive cognitive changes include greater experience-based knowledge, increased accuracy, better judgment concerning their abilities, and generally an improved ability to handle familiar tasks as compared to their younger counterparts. Aging presents psychological and cognitive challenges requiring mental vitality to adapt. An older person who ages "successfully" has been able to use their accumulated knowledge and wisdom to accomplish most day-to-day living activities well.

Memory Training

The idea of cognitive training as a method of improving, retaining, or regaining skills is attractive to those worried about memory loss and to relatives who hope that developing problems might be minimized. Recent evidence suggesting that education and continued intellectual activity may reduce the risk of developing AD has further increased interest in this area. Experience of formal training programs designed to improve the cognitive skills of healthy elderly subjects and those with cognitive deficits is limited . Those most likely to gain appear to be well-motivated, healthy individuals wishing to conserve their mental faculties as a prophylactic measure. There is little evidence of sustained benefit or generalizability in those with established dementia

and regular tests and “exercises” for the memory can easily become counterproductive. Positive benefits to patients may even be at the cost of increased distress to care givers.

Specific approaches have included relaxation techniques, organization of material (e.g. with the use of categorization, associative cues, and mnemonics), regular and repeated practice sessions, using spaced retrieval to rehearse information, techniques for improving visual imagery (e.g. pegword methods, face-name association etc.), and verbal strategies (rhymes, first letter cueing, alphabet searching etc.). Computer-aided cognitive training is also being developed.

Reactivating therapy, including manual and creative activities, self-management skills and orientation tasks, has been claimed to improve cognitive performance and psychosocial functioning of people with mild dementia. Training in groups with other people with memory impairment or with family members and carers may provide opportunities to harness a wider range of training resources and facilitate expression of mutual support. Another approach is to involve family members in providing the cognitive training at home.

MINIMAL COGNITIVE IMPAIRMENT

The term MCI was coined to describe individuals impairment in cognitive functions but are not demented.

At present it is known as senescent forgetfulness or age associated memory impairment. They present with complaints of decline in memory, which is proved by tests of cognitive function.

Studies by Visser et al[13] showed that the current prevalence of AAMI is around 2 to 30 % in the community and around 6 to 85% in the hospital setting.

Individuals with AAMI should be identified as they have an increased chance of developing dementia, especially the Alzheimer's type.

Diagnostic criteria for AAMI:

- Age of 50 or older
- Subjective sense of decline in memory
- Impaired performance on standard tests of cognitive function, memory function atleast one standard deviation below the mean
- Absence of other signs of dementia.

AAMI can be divided depending on the presenting complaints:

1. With cognitive complaints only
2. With mild functional impairment alone
3. Impairments on cognitive tests alone
4. Combination of complaints and impairment in cognitive tests
5. Combination of mild functional impairment and poor performance in cognition tasks

AAMI can be further classified according to the cognitive domains involved:

- Impairment only in atleast memory
- Only in memory
- In any domain
- In a combination of domains

Amnestic MCI [14] is almost always used in par with the term MCI. For the diagnoses of amnestic MCI the individual has to present with a memory complaint, decline in performance of a test on memory functions, other cognitive domains are preserved, ADL normal and absence of dementia.

Causes of MCI

Most common cause of MCI currently is Alzheimers disease. Other medical which affect the normal functioning of the brain can also cause mild cognitive impairment.

OUTCOME OF MCI

AAMI[15] is not a stable condition .It can progress or revert back depending upon the cause. Studies by Bruscoli &Lovestone[16] ,2004 documented that a short to immediate followup of individuals with MCI showed that around 10% of individuals with MCI developed dementia at each year of followup.

Study by Visser et al[17] 2000 showed that the progression of MCI to dementia was seen more in the hospital setting than in the community. The study also documented that around 90%of individuals

with MCI who had progressed to dementia had the alzheimer's type of dementia.

Studies by Morris et al [18]2001,Peterson et at[19] 2001 showed that when they did a five year follow up for individuals with MCI, it was found that the individuals continued to develop dementia at longer follow up periods.

PREDICTORS OF DEMENTIA IN AAMI (Decarli [20]2003)

- Age
- Score in MMSE
- Functional decline
- Memory impairment
- Medial temporal lobe atrophy
- Presence of apo E allele.

Out of these predictors the strength of association was found to be more with functional decline and memory impairment.

It is important to identify individuals with AAMI as they can progress to dementia, to start early treatment, which might in someway help in slowing the progression to dementia.

ALZHEIMER'S DISEASE

Alzheimer's disease is characterized by a decline in cognitive functions more of which is a decline in memory function, with or without associated aphasia, apraxia or agnosia.

The clinical presentation of Alzheimer's disease differs from patient to patient and the clinical presentation depends on the age of onset of the disease, duration of decline of cognitive functions and other behavioural disturbances.

In AD, the main cognitive domain involved is memory, and memory impairment is a prerequisite for the diagnosis, and it is almost always the presenting complaint.

Most patients present in a progressed disease state, as the early changes go unnoticed or is attributed to old age.

Most individuals present after some medical illness or accident, when the relatives would have noticed a decline in the functioning.

Some patients present with fullblown disease with behavioural disturbances.

Major studies show that there is a considerable time interval (average of 3 years) between the first symptom to the establishment of the diagnosis of dementia in patients.

The memory problem seen in alzheimer's disease is a decline in recent memory, whereas remote memory is preserved. As the disease progresses, there is a decline in remote memory as well as other cognitive domains. There is also an impairment in judgement, abstract thinking and reasoning with also behavioural disturbances.

Therefore all patients with dementia develop a functional impairment and a decline in activities of daily living, making them fully dependent on the caregivers. This is a very bad state of affairs which can be slowed down if not prevented by early identification and treatment.

A Summary of the effects of aging on cognition

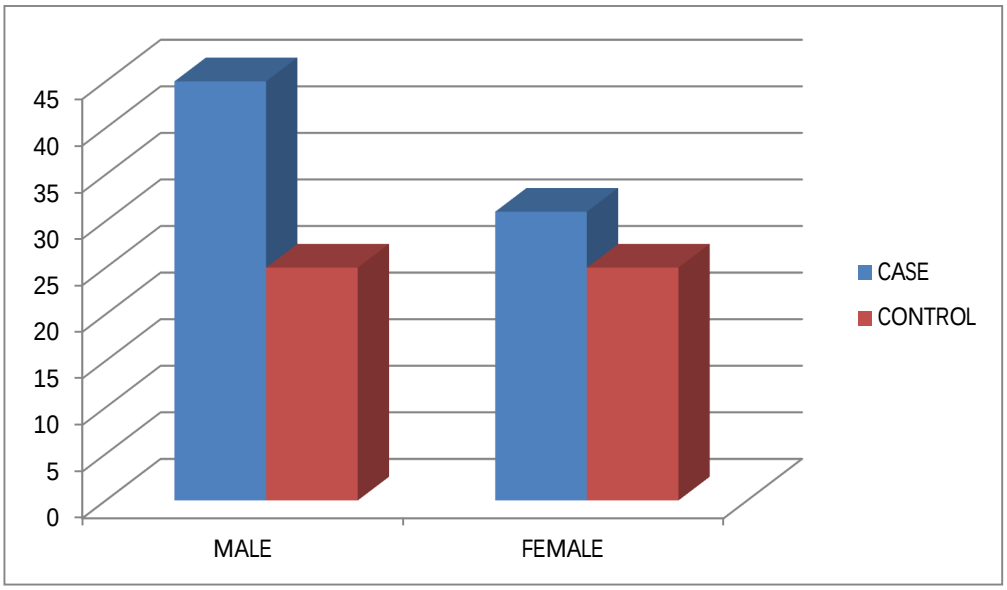
Attention	minimal impairment
Working/Immediate memory	declines
Recent memory	declines
Remote memory	intact
Episodic memory	declines
Semantic memory	intact
Procedural memory	intact
Reading /Vocabulary	intact
Verbal Fluency	declines
Fluid intelligence	declines
Crystallised intelligence	intact
Visuomotor skills	declines
Psychomotor ability	declines

OBSERVATION AND RESULTS

Among 76 elderly individuals selected in the study,45 were males and 31 were females. Among the 50 in the control group,25 were females and 25 were males.

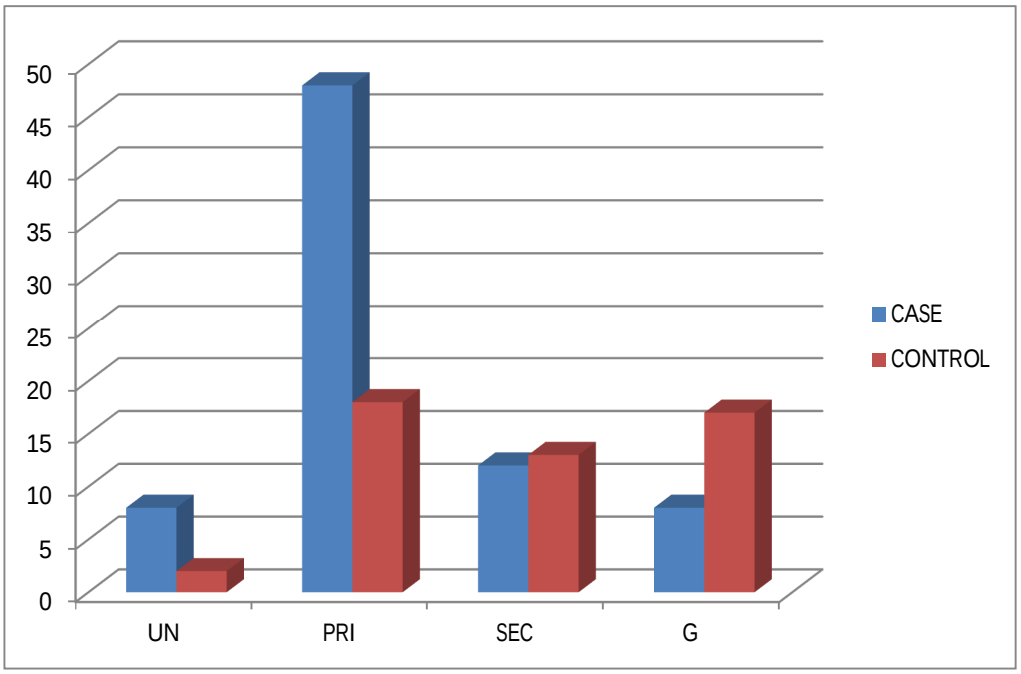
SEX DISTRIBUTION

	MALE	FEMALE
CASE	**45**	**31**
CONTROL	**25**	**25**



EDUCATION WISE DISTRIBUTION

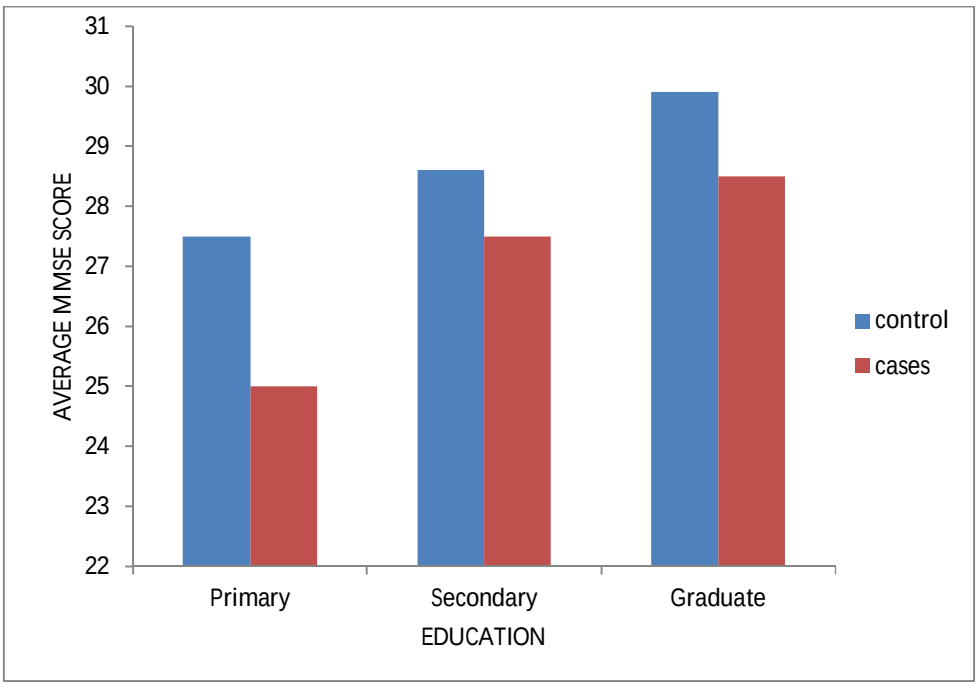
	UN	PRIMARY	SECONDARY	GRADUATE
CASE	**8**	**48**	**12**	**8**
CONTROL	**2**	**18**	**13**	**17**



MMSE CHANGES WITH AGING AND EDUCATION

Education	Average		p value
	Controls	Cases	
Primary education	27.5±2.22	25.0±3.21	0.0006
Secondary	28.6±2.3	27.5±1.97	0.216
Graduate	29.9±0.33	28.5±1.06	0.046

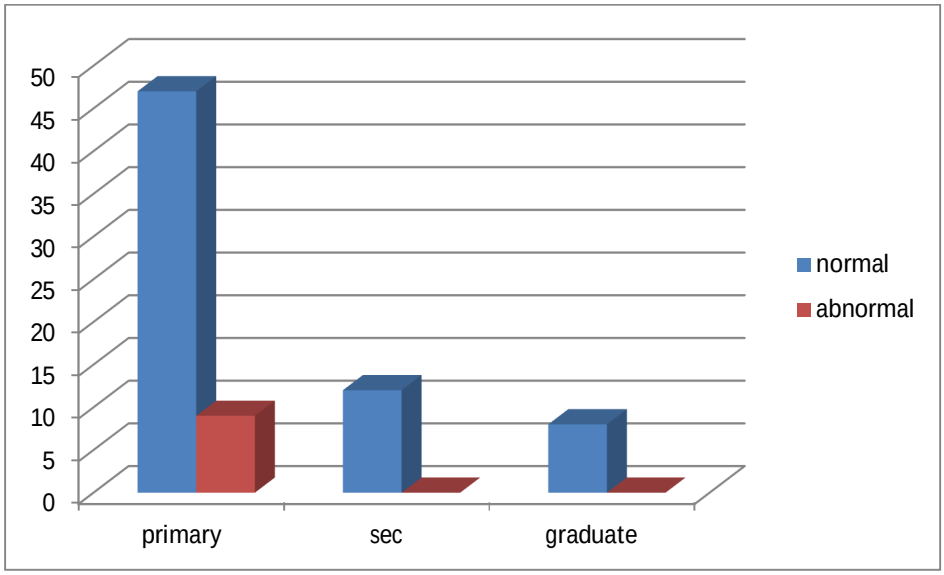
MMSE Score in Controls and Cases



There is a statistically significant relationship between MMSE scores and education as well as MMSE scores and age. i.e. decline in the cognitive domains assessed by MMSE is seen with aging and higher the educational status, better the scores.

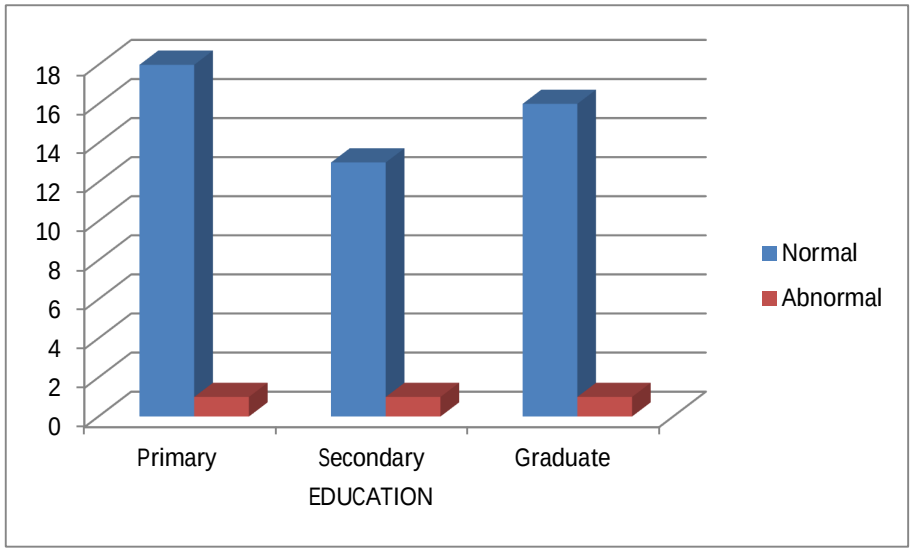
PATTERN OF PERFOMANCE IN ATTENTION TASK IN CASES

	Primary	Secondary	Graduate
Normal	47	12	8
Abnormal	9	0	0



ATTENTION in CONTROL GROUP

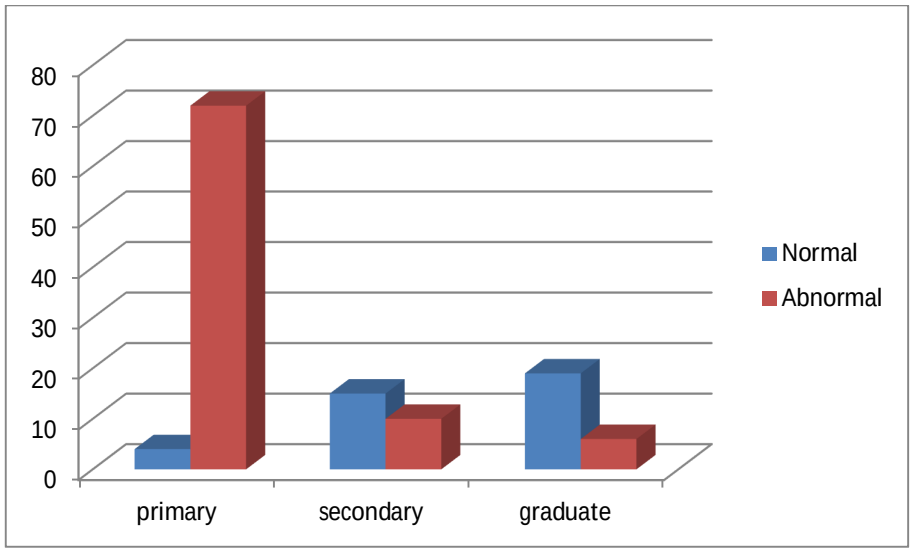
	Primary	**Secondary**	**Graduate**
Normal	**18**	**13**	**16**
Abnormal	**1**	**1**	**1**



Test of attention does not show any statistically significant relation to age or educational status

VERBAL FLUENCY

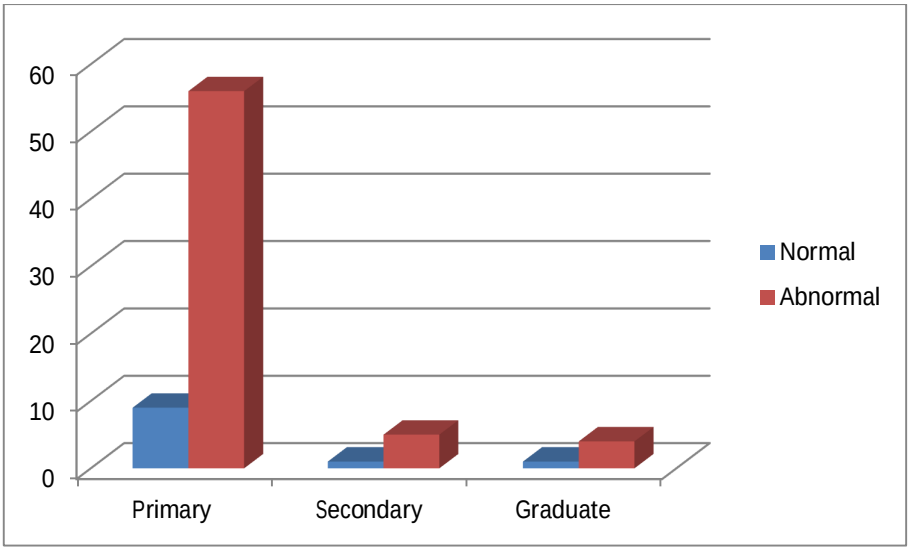
	Normal	Abnormal
Primary	4	72
Secondary	15	10
Graduate	19	6



Test of language(verbal fluency) shows a statistically significant relationship with level of education as well as aging. Higher the level of education, better the performance on test of verbal fluency. Also, as age advances, there is a decline in verbal fluency. Other aspects of language show no variation with aging and no statistically significant relation to educational status.

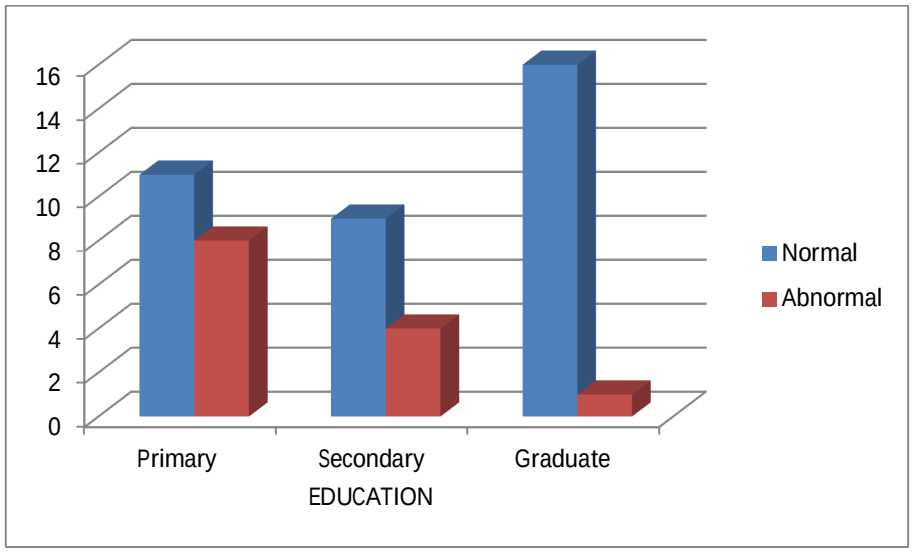
RECENT MEMORY IN CASES

	Primary	Secondary	Graduate
Normal	**9**	**1**	**1**
Abnormal	**56**	**5**	**4**



RECENT MEMORY IN CONTROLS

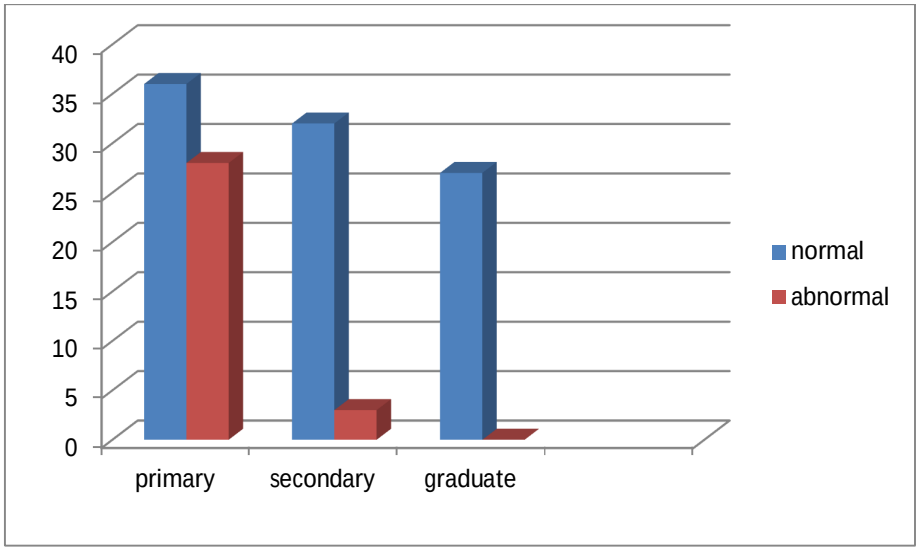
	Primary	Secondary	Graduate
Normal	11	9	16
Abnormal	8	4	1



Test of Recent memory shows a statistically significant relationship with age. No significant relationship is seen with level of education.

TRAIL MAKING TEST AND EDUCATION

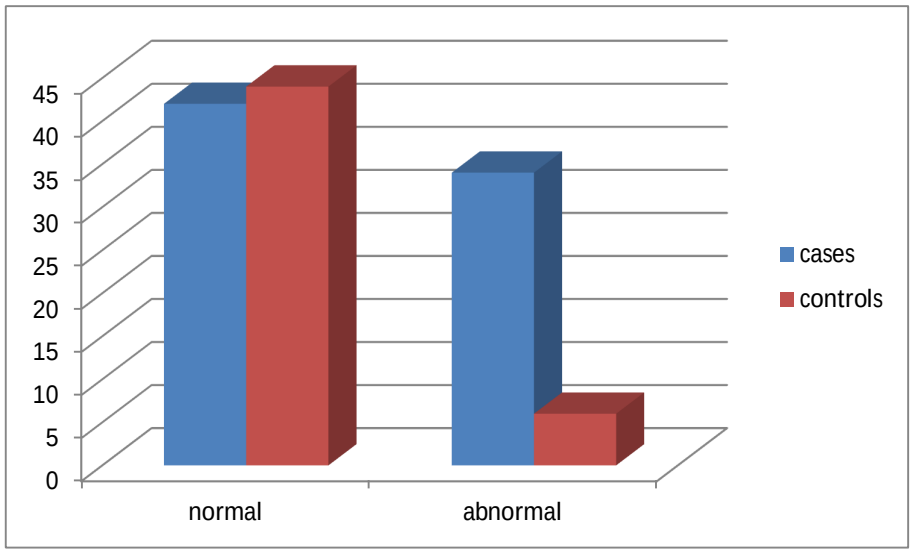
	Normal	Abnormal
Primary	36	28
Secondary	32	3
Graduate	27	0



Trail making test as a part of executive function shows that there is a statistically significant relation between age and performance on TMT and education and performance on TMT.

PATTERN OF PERFORMANCE OF TMT IN AGING

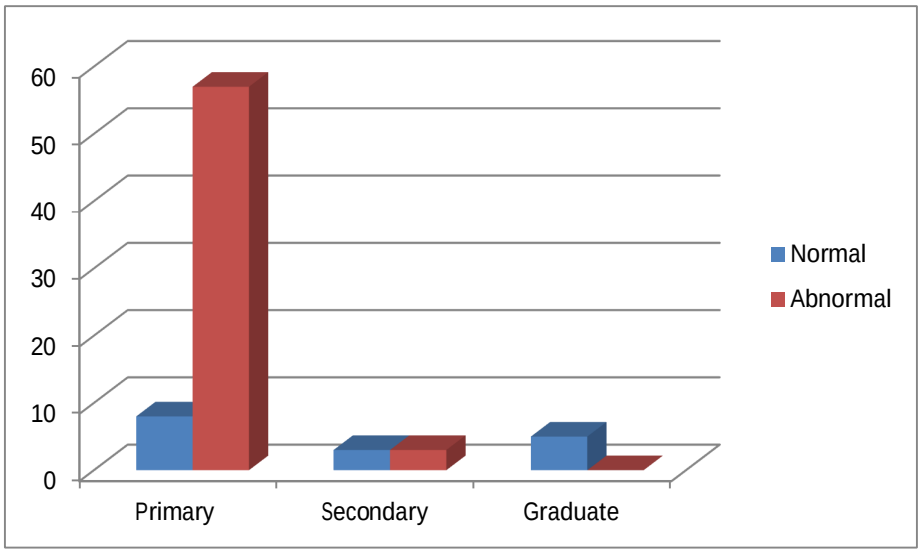
	Normal	Abnormal
Cases	42	34
Controls	44	6



Trail making test as a part of executive function shows that there is a statistically significant relation between age and performance on TMT and education and performance on TMT.

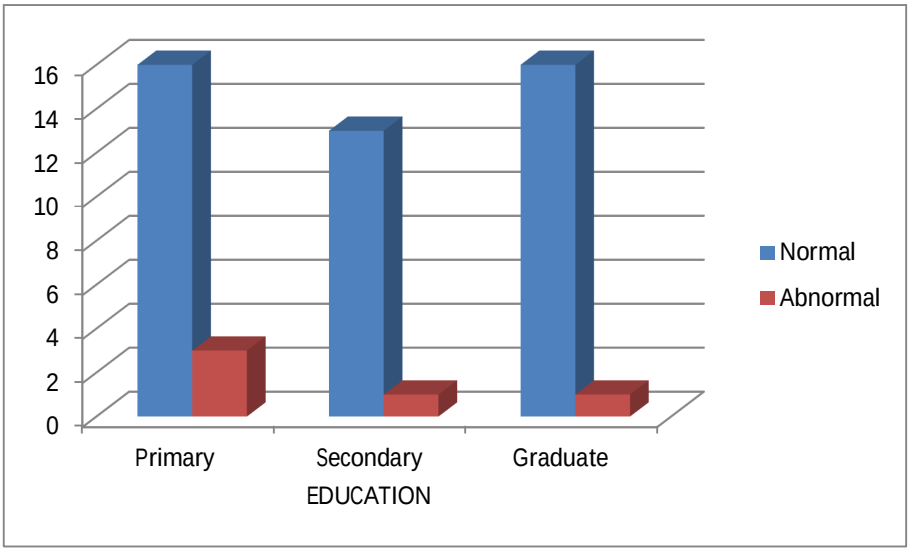
SIMILARITIES SUBSET OF WAIS IN CASES

	Primary	Secondary	Graduate
Normal	8	3	5
Abnormal	57	3	0



SIMILARITIES TEST IN CONTROLS

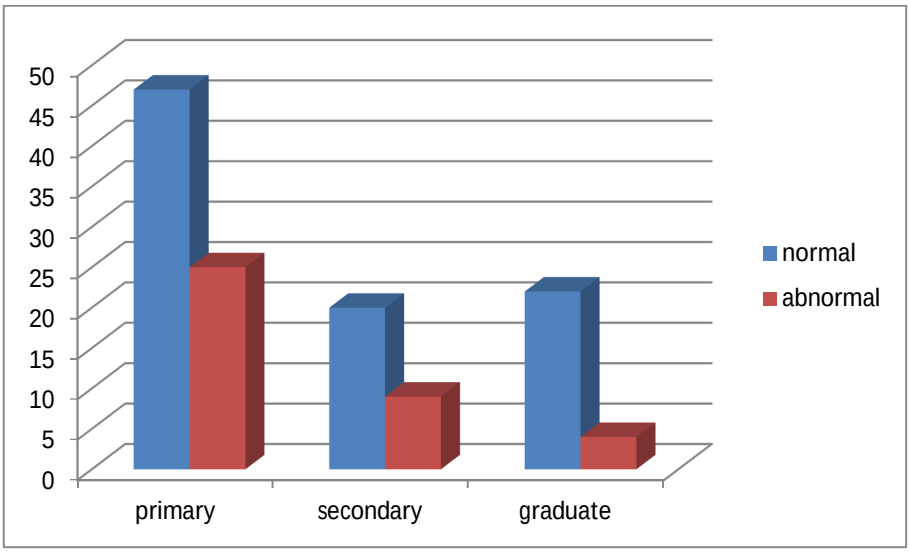
	Primary	Secondary	Graduate
Normal	16	13	16
Abnormal	3	1	1



Similarities subtest of WAIS also show a statistically significant relationship with age and educational status. Better the educational status, better performance on similarities test and this tends to decline with age.

RELATIONSHIP OF COPYING INTERLOCKING PENTAGON TO EDUCATION

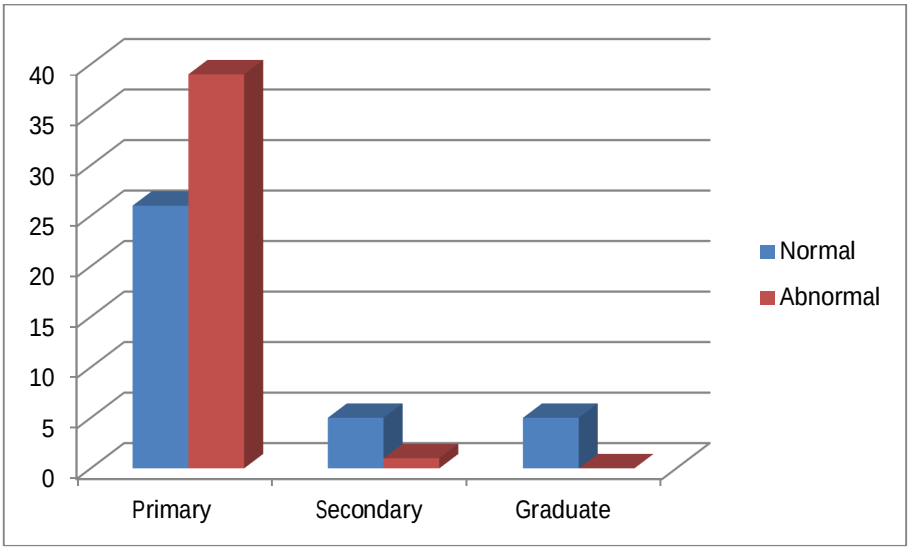
	Normal	**Abnormal**
Primary	**47**	**25**
Secondary	**20**	**9**
Graduate	**22**	**4**



Test of visuospatial ability(Copying figure of interlocking pentagons and Clock drawing test):both show a statistically significant relation with age and education with a stronger association between level of education and performance in the Clock drawing test.

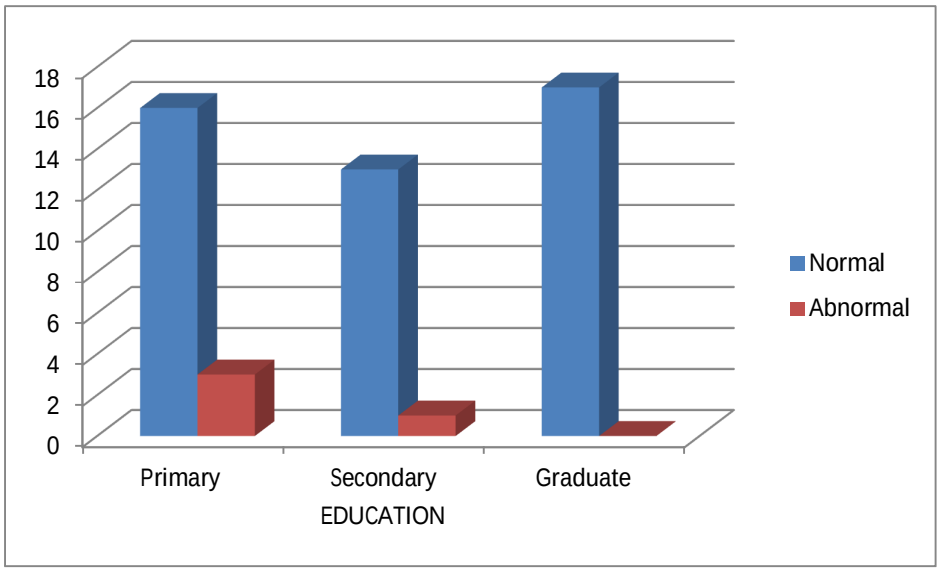
PERFORMANCE IN CLOCK DRAWING TEST IN CASES

	Primary	Secondary	Graduate
Normal	26	5	5
Abnormal	39	1	0



CDT IN CONTROL

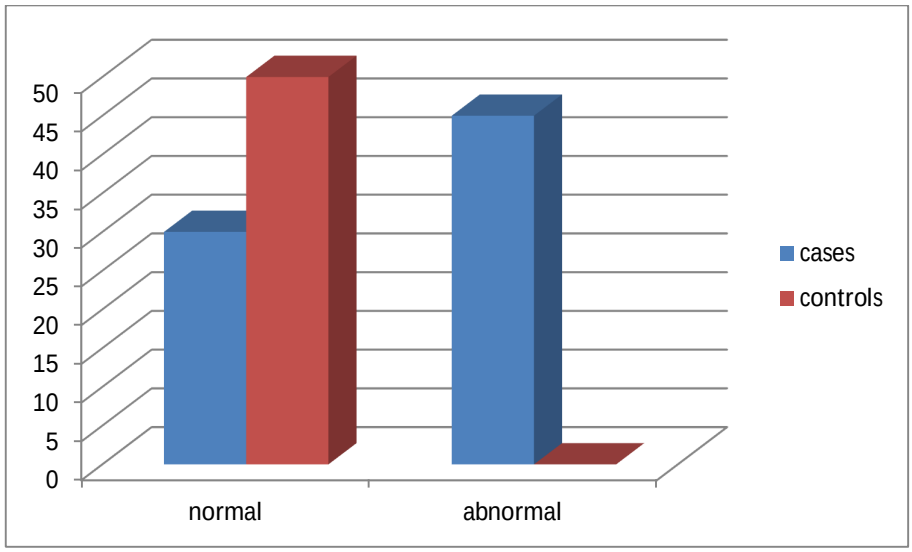
	Primary	Secondary	Graduate
Normal	16	13	17
Abnormal	3	1	0



Test of visuospatial ability(Copying figure of interlocking pentagons and Clock drawing test):both show a statistically significant relation with age and education with a stronger association between level of education and performance in the Clock drawing test.

PSYCHOMOTOR CHANGES WITH AGING

	Normal	Abnormal
Cases	30	45
Controls	50	0



Test of psychomotor function shows a statistically significant relationship with age. As age advances, psychomotor function declines.

CORELATION OF VARIABLES WITH AGE

Variables	Chi sq value	p value
Attention	2.2	0.138
DF	1.8	0.18
DB	6.4	0.011
Remote	0.7	0.415
Recent	27.7	<0.0001
Episodic	35.8	<0.0001
Semantic	0.7	0.415
Repetition	1.3	0.247
Naming	0	0
Reading	0.9	0.334
writing	2.7	0.102
Comprehensive	0	0
verbal fluency	8.1	0.0045
TMT	14.9	0.0001
IP	7.6	0.005
CDT	12.3	0.0004
psycho motor	46.9	<0.0001
Int similarities	15.5	<0.0001
Int DF	2.8	0.093
Int DB	6.2	0.0127

CORELATION OF VARIABLES WITH AGE AND EDUCATIONAL STATUS

Variables	Chi sq value	p value	SIGNIFICANCE
Attention primary	1.9	0.162	NIL
Attention secondary	0.5	0.501	NIL
Attention graduate	0.3	0.578	NIL
DF	1.8	0.18	NIL
DB	6.4	0.011	YES
Remote	0.7	0.415	NIL
Recent primary	8.2	0.004	YES
Recent secondary	4.5	0.032	YES
Recent graduate	12.1	0.0005	YES
Episodic primary	14.4	0.0001	YES
Episodic secondary	11	0.0009	YES
Episodic graduate	6.3	0.012	YES
Semantic	0.7	0.415	NIL
Repetition	1.3	0.247	NIL
Naming	0	0	NIL
Reading	0.9	0.334	NIL
writing	2.7	0.102	NIL
Comprehensive	0	0	NIL
verbal fluency	64	<0.0001	YES
TMT	22.4	<0.0001	YES
IP	15	0.0001	YES
CDT	12.3	0.0004	YES
psycho motor	46.9	<0.0001	YES
Int similarities	15.5	<0.0001	YES
Int DF	2.8	0.093	NIL
Int DB	6.2	0.0127	YES

DISCUSSION

The study on cognitive functioning in aging is a case control study done over a period of one year. Subjects included in the study were 76 elderly above the age of 65 years and 50 young individuals in the age group of 20 to 30 years.

Cases and controls were matched on the basis of their educational status (i.e. uneducated and primary education as one group, secondary education and graduates).All the seven cognitive domains were compared between cases and controls with same level of education. First the average MMSE scores were compared, then each domain of cognitive function was compared.

The mean MMSE score in elderly group with primary education was found to be 25,secondary education 27.5,graduates 28.5.The mean scores in the control group was 27.5 for primary education,28.6 for secondary and 29,9 for graduates.

There is a statistically significant relationship between MMSE scores and education as well as MMSE scores and age. i.e. decline in the cognitive domains assessed by MMSE is seen with aging and higher the educational status, better the scores.

Test of attention does not show any statistically significant relation to age or educational status.

Test of language(verbal fluency) shows a statistically significant relationship with level of education as well as aging. Higher the level of education, better the performance on test of verbal fluency. Also, as age advances, there is a decline in verbal fluency. Other aspects of language show no variation with aging and no statistically significant relation to educational status.

Test of Recent memory shows a statistically significant relationship with age. No significant relationship is seen with level of education.

Test of episodic memory also shows a statistically significant relationship with age. It declines as age advances. No relation is seen with educational status.

Trail making test as a part of executive function shows that there is a statistically significant relation between age and performance on TMT and education and performance on TMT.

Similarities subtest of WAIS also show a statistically significant relationship with age and educational status. Better the educational

status, better performance on similarities test and this tends to decline with age.

Test of visuospatial ability(Copying figure of interlocking pentagons and Clock drawing test):both show a statistically significant relation with age and education with a stronger association between level of education and performance in the Clock drawing test.

Test of psychomotor function shows a statistically significant relationship with age. As age advances, psychomotor function declines.

There is no significant relation to education.

To perform well on all tasks of cognitive function assessment requires a good speed of Information processing and fast reaction time. Since there is a significant decline in the speed of information processing an d psychomotor functions as age advances, this could in part contribute to the decline seen in aging in other cognitive domains as well.

Individuals with primary education both the control group and elderly found it difficult to answer the questions regarding orientation to time l, specifically year ,month and date; orientation to place-country, state.

Also older individuals with primary education found it difficult to complete the read and obey task in MMSE .i.e they read the sentence but failed to obey the command.

Individuals with primary education found it difficult to perform the digit backward span task.

In the Clock drawing test, among elderly individuals, some could draw the circle alone well ,majority drew the circle and wrote the numbers but had problems in marking the time correctly.

In the copying of interlocking pentagons task ,majority of elderly who were not able to successfully complete the task, were able to draw simple figures correctly.

Most of the elderly population with primary education had a problem completing the Trail making test part but could successfully complete part A of the trail making test.

In the Stroop interference test for psychomotor functions, older individuals failed in the third phase of the test where the actual colour-word interference occurred.

CONCLUSION

Cognitive changes show a positive correlation with both aging and educational status.

- Verbal fluency shows a decline with age ,but shows a stronger association to the level of education. Higher the level of education, better performance on verbal fluency .

- Recent memory, episodic memory, Executive functions, Visuospatial skills, and psychomotor functions also decline as age advances.

- Performance on tests of executive functions, visuospatial skills, verbal fluency show a positive correlation to the level of education.

- Performance on tests of Recent memory, episodic memory and psychomotor function a decline with aging irrespective of the educational status.

ABBREVIATION

DF	-	Digit Forward
DB	-	Digit Backward
TMT	-	Trail making Test
IP	-	Interlocking Pentagons
CDT	-	Clock Drawing Test
MCI	-	Minimal Cognitive Impairment
AD	-	Alzheimer's Disease
AAMI	-	Age Associated Memory Impairment
VaD	-	Vascular Dementia
PD	-	Parkinson's Disease
MMSE	-	Mini Mental State Examination

BIBLIOGRAPHY

1. Folstein M, Folstein S & McHugh PR. “Mini-mental State”. A practical method for grading the cognitive state patients for the clinician. *Journal of Psychiatric Research* 1975; **12**:189–98.

2. Adunsky, A., Fleissig, Y., Levenkrohn, S., Arad, M., & Noy, S. (2002). Clock drawing task, Mini-Mental State Examination and cognitive-functional independence measure: Relation to functional outcome of stroke patients.Archives of geriatrics and gerontology.

3. Waugh NC,Norman DA(1965)Primary memory.Psychol Rev 72:89-104.

4. Kyllonen, P. C., & Christal, R. E. (1990). Reasoning ability is (little more than) working memory capacity? *Intelligence, 14,* 389–433.

5. Weschler D:Wechsler Memory Scale-third edition,Psychological corporation,San Antonio,1997.

6. Bayels KA,Kasznik Aw(1987).Communication and cognition in normal aging and dementia.Boston:Little Brown

7. Brickman, A. M., Paul, R. H., Cohen, R. A.,Williams, L. M.,MacGregor, K. L., Jefferson, A. L., Tate, D. F., Gunstad, J., & Gordon, E.(2005). Category and letter verbal fluency across the adult lifespan: Relationship to EEG theta power. *Archives of Clinical Neuropsychology,20*, 561–573.

8. Weschler D:Manual for the Weschler adult intelligence scale-revised. New York, Psychological corporation,1981.

9. Salthouse TA: Theoretical Perspectives on Cognitive functioning.Hillsdale,N.J.,Erlbaum,1991.

10. Clark, M. S., Dennerstein, L., Elkadi, S., Guthrie, J. R., Bowden, S. C., & Henderson, V.W. (2004). Normative data for tasks of executive function and working memory for Australian-born women aged 56-67. *Australian Psychologist, 39,* 244–250.

11. Freedman, M.,Kaplan, E., Delis,D.,& Morris, R. (1994). *Clock Drawing: A neuropsychological analysis.* New York: Oxford University Press

12. Kane, M. J., & Engle, R. W. (2003). Working-memory capacity and the control of attention: The contributions of goal neglect, response competition, and task set to Stroop interference. J*ournal of Experimental Psychology: General, 132*, 47–70.

13. Visser PJ. Predictors of Alzheimer Type Dementia in Subjects with Mild Cognitive Impairments 2000; Neuropsych Publishers, Maastricht.

14. Petersen R, Smith G, Waring S et al. Mild cognitive impairment. Clinical characterization and outcome. Archives of Neurology 1999; 56:303–8.

15. Crook T, Bartus RT, Ferris SH *et al.*, Report of the National Institute of Mental Health Work Group. Age-associated memory impairment: proposed criteria and measures of clinical change. *Developmental Neuropsychology* 1986; **2**:261–76.

16. Bruscoli M & Lovestone S. Is MCI really just early dementia? A systematic review of conversion studies. International Psychogeriatrics 2004; 16:129–40.

17. Visser PJ. Diagnosis of predementia AD in a clinical setting. In RW Richter & B Zoeller-Richter (eds) Alzheimer's Disease. A Physician's Guide to Practical Management 2003, pp 157–64; Humana Press, New Jersey.

18. Morris JC, Storandt M, Miller JP et al. Mild cognitive impairment represents early-stage Alzheimer disease. Archives of Neurology 2001; 58:397–405.

19. Petersen RC, Doody R, Kurz A et al. Current concepts in mild cognitive impairment. Archives of Neurology 2001; 58:1985–92.

20. DeCarli C. Mild cognitive impairment: prevalence, prognosis, aetiology, and treatment. *Lancet. Neurology* 2003; **2**:15–21.

21. 13 Freels S, Cohen D, Eisdorfer C *et al.* Functional status and clinical findings in patients with Alzheimer's disease. *The Journals of Gerontology. Series A, Biological Sciences and Medical Sciences* 1992; **47A**:M177–82.

22. Knopman D, Donohue JA & Gutterman EM. Patterns of care in the early stages of AD: impediments to timely diagnosis. *Journal of the American Geriatrics Society* 2000; **48**:300–4.

23. Ashman TA COGNITION AND AGING; Principle of Geriatric medicine& Gerontology sixth edition Hazzard and Blass.

24. Spreen O and Strauss,E A Compendium of Neuropsychological tests,ed.2,Oxford University Press,NewYork,1998.

25. Reitan,RM and Wolfson, D: The Halstead–Reitan Neuropsychological Test Battery: Theory and Clinical interpretation, ed 2, Neuropsychology Press,Tueson,Az,1993.

26. Ryan,JJ and Paolo, AM:A Scoring procedure for estimating premorbid intelligence in the elderly. Clin. Neuropsychol 6:53,1992.

27. Mesulam,M-M:Principles of Behavioural tests of Directed Attention and Memory ,F A Davis,Philadelphia,1985.

29. Baltes PB: The aging mind: Potential and limits. Gerontologist 333:580,1993

30. Brocklehurst,Tallis,Fillit:Brocklehurst's Textbook of geriatric medicine and gerontology.6th ed,Churchill Livingstone.

31. Keefover RW: Aging and Cognition: Neurologic clinics-The Neurology of Aging., Riggs JE. Volume 16.No 3 Aug1998.W.B.Saunders company

32. Merck Manual of Geriatrics: Aging and Mental health, Section 4;Chapter 32.Memory and Aging centre-UCSF;http://memory.ucsf.edu/Education/education-mci.html

33. Kelly C:Alzheimers disease handbook, Merit Publishing International, 2000.

PROFORMA

OP no:

Name: **Age:** **years**

Sex:M/F

Address:

Educational status: **Uneducated**

Primary

Secondary

Graduate

Postgraduate

Socio-economic status:

Habits:

Comorbidities:

EXAMINATION:

Physical examination

Neurological examination

Mini Mental state examination:

orientation to time:

place:

Registration:

Serial 7s:

Recall:

Name 2 objects:

Repetition:

3 stage command:

Read and obey:

Write a sentence:

Copy design:

Test of Attention

-sustained:

-divided:BTA score:

Test of Memory

-immediate:DF/DB

-recent:free recall/cued recall

-remote

-episodic

-semantic

Test of Language

-verbal fluency+MMSE

Test of conceptualization &mental flexibility

-similarities subtest of WAIS

-trail making test:part A/part B

Test of Visuospatial ability

-interlocking pentagons

-clock drawing test

Test of psychomotor function

-phase 1

-phase 2

-phase 3

Judgement

Apraxia

Agnosia

Test of intelligence

INFORMATION SHEET

We are conducting **A study of cognitive functioning in aging** among patients attending Rajiv Gandhi Government General Hospital, Chennai.

The purpose of this study is to identify the pattern of cognitive decline in aging.

We are screening all patients above 65 years and comparing their performance with a control group which consists of young adults 20 to 30 yr of age.

The privacy of the patients in the research will be maintained throughout the study. In the event of any publication or presentation resulting from the research, no personally identifiable information will be shared.

Taking part in this study is voluntary. You are free to decide whether to participate in this study or to withdraw at any time; your decision will not result in any loss of benefits to which you are otherwise entitled.

The results of the special study may be intimated to you at the end of the study period or during the study if anything is found abnormal which may aid in the management or treatment.

Signature of Investigator **Signature of Participant**

Date :

Place :

PATIENT CONSENT FORM

Study detail

"A STUDY OF COGNITIVE FUNCTIONING IN AGING"

Study centre: Rajiv Gandhi Government general hospital, Chennai.

Patients Name :

Patients Age :

Identification Number :

Patient may check ( ) these boxes

I confirm that I have understood the purpose of procedure for the above study. I have the opportunity to ask question and all my questions and doubts have been answered to my complete satisfaction.	☐
I understand that my participation in the study is voluntary and that I am free to withdraw at any time without giving reason, without my legal rights being affected.	☐
I understand that sponsor of the clinical study, others working on the sponsor's behalf, the ethical committee and the regulatory authorities will not need my permission to look at my health records, both in respect of current study and any further research that may be conducted in relation to it, even if I withdraw from the study I agree to this access. However, I understand that my identity will not be revealed in any information released to third parties or published, unless as required under the law. I agree not to restrict the use of any data or results that arise from this study.	☐

I agree to take part in the above study and to comply with the instructions given during the study and faithfully cooperate with the study team and to immediately inform the study staff if I suffer from any deterioration in my health or well being or any unexpected or unusual symptoms. ☐

I hereby consent to participate in this study.

I hereby give permission to undergo complete clinical examination and diagnostic tests including hematological, biochemical, radiological tests. ☐

Signature/thumb impression:

Patients Name and Address:

Signature of investigator :

Study investigator's Name :

Place :

Date :

INSTITUTIONAL ETHICS COMMITTEE
MADRAS MEDICAL COLLEGE, CHENNAI -3

Telephone No: 04425305301
Fax : 04425363970

CERTIFICATE OF APPROVAL

To

Dr. Arya Chandran. S
PG in MD Geriatrics
Madras Medical College, Chennai -3

Dear Dr. Arya Chandran. S

The Institutional Ethics Committee of Madras Medical College reviewed and discussed your application for approval of the proposal entitled "A study of cognitive functioning in Aging" No. 12062012.

The following members of Ethics Committee were present in the meeting held on 27.06.2012 conducted at Madras Medical College, Chennai -3.

1.	Prof. S.K. Rajan, MD, FRCP, DSc.	-- Chairperson
2.	Prof. Pregna B. Dolia MD Vice Principal / Director , Instt. of Biochemistry , M M C, Ch-3	-- Member Secretary
3.	Prof K.M. Sudha MD Prof . of Pharmacology, MMC, Ch-3	-- Member
4.	Prof. C. Rajendiran, MD Director , Institute of Internal Medicine, MMC, Ch-3	-- Member
5.	Prof. Karkuzhali MD Director i/c, Prof of Pathology, MMC, Chennai -3	-- Member
6.	Thiru. S. Govindasamy . BA.BL	-- Lawyer

We approve the proposal to be conducted in its presented form

Sd /. Chairman & Other Members

The Institutional Ethics Committee expects to be informed about the progress of the study, any SAE occurring in the course of the study, any changes in the protocol and patient information / informed consent and asks to be provided a copy of the final report

Member Secretary, Ethics Committee

Turnitin Originality Report

A STUDY CO COGNITIVE FUNCTIONING IN AGING by Arya Chandran 20105701 M.D. Geriatrics

From Medical (TNMGRMU APRIL 2013 EXAMINATIONS)

- Processed on 26-Dec-2012 22:35 IST
- ID: 294852004
- Word Count: 8059

Similarity Index
19%
Similarity by Source

Internet Sources:
9%
Publications:
12%
Student Papers:
5%

sources:

1 3% match (publications)
Antony J. Bayer. "Memory Clinics", Principles and Practice of Geriatric Medicine, 12/12/2005

2 2% match (Internet)
http://www.mindstreamshealth.com/content/TestDescriptions.pdf

3 1% match (publications)
Peggy A. Szwabo. "Psychological Aspects of Aging", Principles and Practice of Geriatric Medicine, 12/12/2005

4 1% match (Internet from 7/9/09)
http://web.uvic.ca/psyc/coursematerial/psyc315.m01/315/LectureMaterial/Memory%20Part%20II.ppt

5 1% match (Internet from 10/21/11)
http://www.accessmedicine.com/content.aspx?aID=5121585

6 1% match (publications)
Stephanie Cosentino. "Clock Drawing Errors in Dementia", Cognitive and Behavioral Neurology, 06/2004

7 1% match (Internet from 8/10/12)
http://www.mhprofessional.com/downloads/products/007149992X/RopperCh29.pdf

8 1% match (student papers from 12/03/12)
Submitted to Bridgepoint Education on 2012-12-03

9 1% match (Internet from 3/7/12)
http://www.citeulike.org/user/elena_m/tag/consolidation

turnitin

Your digital receipt

This receipt acknowledges that Turnitin received your paper. Below you will find the receipt information regarding your submission.

Paper ID	294852004
Paper title	A STUDY CO COGNITIVE FUNCTIONING IN AGING
Assignment title	Medical
Author	Arya Chandran 20105701 M.D. Geriatrics
E-mail	novrit@gmail.com
Submission time	26-Dec-2012 09:47AM
Total words	8059

First 100 words of your submission

INTRODUCTION Cognitive functioning in individuals changes with aging.The extent and pattern of decline varies among various cognitive domains and also among individuals .Certain cognitive domains tend to decline as a person ages in comparison to his younger counterpart .Some elderly individuals may not show a decline in cognitive functioning. High intelligence, well organized work habits and sound judgement compensate for many of the progressive shortcomings of old age. Cognitive decline is thought to start after the age of 30 years. Little that is new and original is learned after the age of forty. Attention,language,and memory are the basic proceeses that serve as building blocks for the...

MASTER CHART - CASES

							MEMORY						LANGUAGE						EXECUTIVE FUNCTION		VISUO-SPATIAL			INTELLIGENCE	
S NO	**AGE**	**SEX**	**EDUCATION**	**SOCIO ECCONOMIC STATUS**	**MMSE**	**ATTENTION**	**DF**	**DB**	**RECENT**	**REMOTE**	**EPISODIC**	**SEMANTIC**	**NAMING**	**REPETITION**	**READING**	**WRITING**	**COMPREHENSION**	**VERBAL FLUENCY**	**SIMILARITIES**	**TMT**	**IP**	**CDT**	**PSYCHOMOTOR**	**DF/DB**	**SIMILARITIES**
1	65	M	P	POOR	24	5	Y	N	1	Y	Y	Y	Y	Y	Y	Y	Y	10	4	N	Y	Y	N	Y/N	4
2	65	F	P	POOR	27	5	Y	N	1	Y	Y	Y	Y	Y	Y	Y	Y	12	6	Y	N	Y	Y	Y/N	6
3	84	M	P	POOR	29	5	Y	N	2	Y	N	Y	Y	Y	Y	Y	Y	10	6	Y	N	Y	Y	Y/N	6
4	75	M	P	POOR	29	5	Y	N	2	Y	Y	Y	Y	Y	Y	Y	Y	10	4	Y	Y	Y	N	Y/N	4
5	65	F	P	POOR	28	5	Y	N	2	Y	N	Y	Y	Y	Y	Y	Y	8	6	Y	Y	Y	Y	Y/N	6
6	75	M	P	POOR	25	5	N	N	0	Y	N	Y	Y	Y	Y	Y	Y	7	0	N	Y	N	Y	N/N	0
7	65	F	P	POOR	28	5	Y	Y	2	Y	Y	Y	Y	Y	Y	Y	Y	9	4	Y	Y	N	Y	Y/Y	4
8	70	M	P	MIDDLE	29	5	Y	N	3	Y	N	Y	Y	Y	Y	Y	Y	8	0	Y	N	Y	Y	Y/N	0
9	78	M	P	MIDDLE	23	5	Y	N	0	Y	N	Y	Y	Y	Y	Y	Y	8	4	N	N	N	Y	Y/N	4
10	93	M	P	POOR	24	5	Y	N	2	Y	N	Y	Y	Y	Y	Y	Y	7	4	N	Y	Y	N	Y/N	4
11	69	F	UN	POOR	23	5	Y	N	1	Y	N	Y	Y	Y	N	N	Y	8	4	N	Y	N	Y	Y/N	4
12	68	F	P	POOR	27	4	Y	N	1	Y	Y	Y	Y	Y	Y	Y	Y	10	4	Y	Y	Y	Y	Y/N	4
13	74	M	P	POOR	30	5	Y	Y	3	Y	Y	Y	Y	Y	Y	Y	Y	12	6	Y	Y	Y	N	Y/Y	6
14	82	M	P	MIDDLE	24	5	Y	Y	3	Y	Y	N	Y	Y	Y	Y	Y	8	6	Y	Y	Y	N	Y/Y	6
15	75	M	P	GOOD	28	5	Y	Y	3	Y	Y	Y	Y	Y	Y	Y	Y	15	6	Y	Y	Y	N	Y/Y	6
16	65	F	P	POOR	26	5	Y	N	2	Y	N	Y	Y	Y	Y	Y	Y	10	4	Y	Y	Y	N	Y/N	4
17	66	M	P	POOR	23	5	N	N	2	Y	N	Y	Y	Y	N	N	Y	8	2	N	N	N	N	N/N	2
18	65	F	UN	POOR	22	1	Y	N	3	Y	Y	Y	Y	Y	N	N	Y	6	2	N	N	N	N	Y/N	2
19	65	F	UN	POOR	21	5	Y	N	2	Y	N	Y	Y	Y	N	N	Y	5	0	N	N	N	N	Y/N	0
20	72	M	UN	POOR	26	4	N	N	3	Y	N	Y	Y	Y	N	N	Y	9	2	Y	Y	Y	N	N/N	2
21	72	M	P	POOR	27	5	Y	N	0	Y	N	Y	Y	Y	Y	Y	Y	5	2	Y	Y	Y	N	Y/N	2
22	70	M	P	POOR	23	5	Y	N	3	Y	N	Y	Y	Y	Y	Y	Y	7	0	N	N	N	N	Y/N	0
23	65	F	P	POOR	28	5	Y	N	2	Y	Y	Y	Y	Y	Y	Y	Y	6	1	N	Y	Y	N	Y/N	1
24	70	M	P	POOR	25	5	Y	N	3	Y	Y	Y	Y	Y	Y	Y	Y	7	1	Y	Y	Y	N	Y/N	1
25	82	M	P	MIDDLE	23	4	Y	N	2	Y	N	Y	Y	Y	Y	Y	Y	6	6	N	N	N		;. ;/	6
26	72	F	P	POOR	24	5	Y	N	0	Y	Y	Y	Y	Y	Y	N	Y	5	2	N	Y	Y	Y	Y/N	2
27	75	M	P	MIDDLE	24	4	N	N	1	Y	N	Y	Y	Y	Y	Y	Y	3	3	N	N	N	N	N/N	3
28	77	M	P	POOR	30	5	N	N	3	Y	Y	Y	Y	Y	Y	Y	Y	10	2	Y	Y	Y	N	N/N	2
29	65	M	P	POOR	28	5	N	N	1	Y	N	Y	Y	Y	Y	Y	Y	10	3	N	Y	Y	N	N/N	3
30	71	F	P	POOR	27	5	Y	N	1	Y	Y	Y	Y	Y	Y	Y	Y	8	8	Y	Y	Y	N	Y/N	8
31	65	F	UN	POOR	16	3	N	N	0	N	Y	Y	Y	Y	N	N	Y	5	2	N	N	N	N	N/N	2
32	94	M	P	MIDDLE	25	5	N	N	2	Y	N	Y	Y	Y	Y	Y	Y	7	3	N	Y	Y	N	N/N	2
33	77	M	P	POOR	26	5	N	N	0	Y	Y	Y	Y	Y	Y	Y	Y	12	0	N	Y	Y	N	N/N	0
34	65	M	P	POOR	25	5	N	N	0	Y	N	Y	Y	Y	Y	N	Y	6	0	N	Y	N	N	N/N	0
35	65	F	P	POOR	18	1	Y	N	2	Y	N	Y	Y	Y	N	N	Y	5	0	N	N	N	N	Y/N	0
36	67	M	P	POOR	22	5	Y	N	2	Y	N	Y	Y	Y	Y	N	Y	5	1	N	Y	Y	N	Y/N	1
37	65	F	P	POOR	22	4	Y	N	2	Y	Y	Y	Y	Y	N	N	Y	8	0	N	N	N	N	Y/N	0
38	67	F	P	POOR	26	5	Y	Y	0	Y	N	Y	Y	Y	Y	Y	Y	6	0	Y	Y	Y	Y	Y/Y	0
39	65	F	P	POOR	27	5	Y	N	2	Y	Y	Y	Y	Y	Y	Y	Y	10	4	Y	Y	Y	N	Y/N	4

40	70	M	UN	POOR	21	5	N	N	2	Y	N	Y	Y	Y	N	N	Y	5	2	N	N	N	N	N/N	2
41	65	M	P	MIDDLE	27	5	Y	N	1	Y	Y	Y	Y	N	Y	Y	Y	12	6	N	Y	Y	Y	Y/N	6
42	65	F	P	MIDDLE	27	5	N	N	1	Y	Y	Y	Y	Y	Y	Y	Y	7	0	N	Y	N	N	N/N	0
43	75	M	P	MIDDLE	25	5	Y	N	3	Y	Y	Y	Y	Y	Y	Y	Y	8	4	Y	Y	Y	Y	Y/N	4
44	68	F	UN	POOR	22	5	Y	N	2	Y	N	Y	Y	Y	N	N	Y	9	2	N	N	N	N	Y/N	2
45	77	F	P	POOR	27	5	Y	N	1	Y	N	Y	Y	Y	Y	Y	Y	8	8	Y	Y	Y	N	Y/N	8
46	65	F	P	POOR	27	5	Y	N	1	Y	N	Y	Y	Y	Y	Y	Y	4	1	N	N	N	N	Y/N	1
47	65	M	P	POOR	27	5	Y	N	3	Y	Y	Y	Y	Y	Y	N	Y	8	0	N	Y	N	N	Y/N	0
48	65	M	P	POOR	30	5	Y	N	3	Y	Y	Y	Y	Y	Y	Y	Y	10	8	Y	Y	Y	Y	Y/N	8
49	65	M	UN	POOR	18	4	N	N	0	Y	N	Y	Y	Y	N	N	Y	11	4	N	N	N	N	N/N	4
50	65	F	P	POOR	26	5	N	N	1	Y	Y	Y	Y	Y	N	Y	Y	4	4	N	Y	N	Y	N/N	4
51	65	M	P	POOR	20	4	N	N	3	Y	Y	Y	Y	Y	N	N	Y	6	1	N	Y	N	N	N/N	1
52	75	M	P	POOR	25	5	N	N	0	Y	N	Y	Y	Y	N	N	Y	6	1	N	Y	N	Y	N/N	1
53	83	F	P	POOR	30	5	Y	N	3	Y	N	Y	Y	Y	Y	Y	Y	10	2	N	Y	Y	N	Y/N	2
54	65	M	P	MIDDLE	30	5	Y	Y	3	Y	N	Y	Y	Y	Y	Y	Y	8	8	Y	Y	Y	Y	Y/Y	8
55	68	F	P	POOR	26	5	Y	Y	1	Y	Y	Y	Y	Y	Y	N	Y	9	8	Y	Y	N	N	Y/Y	8
56	73	M	P	POOR	26	5	Y	N	2	Y	Y	Y	Y	Y	Y	Y	Y	6	6	Y	N	N	Y	Y/N	6
57	65	M	S	MIDDLE	29	5	Y	Y	3	Y	Y	Y	Y	Y	Y	Y	Y	13	4	Y	Y	Y	Y	Y/Y	4
58	80	M	S	POOR	29	5	Y	Y	2	Y	N	Y	Y	Y	Y	Y	Y	10	8	Y	Y	Y	Y	Y/Y	8
59	77	F	S	GOOD	29	5	Y	N	2	Y	N	Y	Y	Y	Y	Y	Y	8	3	N	Y	Y	Y	Y/N	3
60	65	F	S	MIDDLE	29	5	Y	Y	2	Y	Y	Y	Y	Y	Y	Y	Y	13	8	Y	Y	Y	Y	Y/Y	8
61	65	M	S	POOR	27	5	Y	N	0	Y	Y	Y	Y	Y	Y	Y	Y	7	8	Y	Y	Y	Y	Y/N	8
62	80	M	S	POOR	28	5	Y	N	2	Y	N	Y	Y	Y	Y	Y	Y	8	8	Y	Y	Y	N	Y/N	8
63	65	F	S	MIDDLE	27	5	Y	Y	3	Y	N	Y	Y	N	Y	Y	Y	9	6	Y	N	N	N	Y/Y	6
64	71	F	S	MIDDLE	29	5	Y	N	2	Y	N	Y	Y	Y	Y	Y	Y	10	4	Y	Y	Y	N	Y/N	4
65	80	M	S	MIDDLE	27	5	Y	Y	0	Y	Y	Y	Y	Y	Y	Y	Y	8	8	Y	Y	Y	Y	Y/Y	8
66	94	F	S	MIDDLE	27	5	Y	Y	2	Y	Y	Y	Y	Y	Y	Y	Y	5	0	N	Y	Y	N	Y/Y	0
67	65	F	S	MIDDLE	27	5	N	N	3	Y	Y	Y	Y	Y	Y	Y	Y	8	4	Y	Y	N	N	N/N	4
68	84	M	S	MIDDLE	22	5	N	N	1	Y	N	Y	Y	Y	Y	Y	Y	7	6	Y	Y	Y	N	N/N	6
69	70	M	G	MIDDLE	29	5	Y	N	2	Y	Y	Y	Y	Y	Y	Y	Y	10	6	Y	Y	Y	Y	Y/N	6
70	66	M	G	MIDDLE	29	5	Y	Y	2	Y	Y	Y	Y	Y	Y	Y	Y	8	6	Y	Y	Y	N	Y/Y	6
71	69	F	G	MIDDLE	29	4	Y	Y	3	Y	Y	Y	Y	Y	Y	Y	Y	11	6	Y	Y	Y	N	Y/Y	6
72	72	M	G	MIDDLE	29	5	Y	Y	2	Y	N	Y	Y	Y	Y	Y	Y	7	6	Y	Y	Y	Y	Y/Y	6
73	66	M	G	MIDDLE	29	5	Y	N	2	Y	N	Y	Y	Y	Y	Y	Y	10	6	Y	Y	Y	Y	Y/N	6
74	65	M	G	GOOD	29	5	Y	N	2	Y	Y	Y	Y	Y	Y	Y	Y	15	6	Y	Y	Y	Y	Y/N	6
75	76	F	G	GOOD	28	5	Y	N	1	Y	N	Y	Y	Y	Y	Y	Y	12	6	Y	Y	Y	Y	Y/N	6
76	65	M	G	MIDDLE	26	5	Y	N	3	Y	Y	Y	Y	Y	Y	Y	Y	8	8	Y	Y	Y	Y	Y/N	8

MASTER CHART - CONTROLS

								MEMORY						LANGUAGE						EXECUTIVE FUNCTIONS		VISUO-SPATIAL			INTELLIGENCE	
S.NO	AGE	SEX	EDUCATION	SOCIO ECONOMIC STATUS	MMSE	ATTENTION	DF	DB	RECENT	REMOTE	EPISODIC	SEMANTIC	NAMING	REPETITION	READING	WRITING	COMPREHENSION	VERBAL FLUENCY	SIMILARITIES	TMT	IP	CDT	PSYCHOMOTOR	DF/DB	SIMILARITIES
1	30	F	P	POOR	30	5	Y	N	3	Y	Y	Y	Y	Y	Y	Y	Y	15	6	Y	Y	Y	Y	Y/N	6
2	30	M	P	POOR	30	5	Y	N	3	Y	Y	Y	Y	Y	Y	Y	Y	8	6	Y	Y	Y	Y	Y/N	6
3	29	F	UN	POOR	25	5	N	N	3	Y	Y	Y	Y	Y	N	N	Y	8	4	Y	N	N	Y	Y/N	4
4	25	M	P	POOR	30	5	Y	N	3	Y	Y	Y	Y	Y	Y	Y	Y	10	4	N	Y	Y	Y	Y/N	4
5	30	M	P	POOR	30	5	Y	N	3	Y	Y	Y	Y	Y	Y	Y	Y	10	6	Y	Y	Y	Y	Y/N	6
6	27	M	P	POOR	24	5	N	N	3	Y	Y	Y	Y	Y	N	N	Y	10	4	N	Y	Y	Y	N/N	4
7	28	M	P	POOR	28	5	N	N	3	Y	Y	Y	Y	Y	Y	Y	Y	10	4	Y	Y	Y	Y	N/N	4
8	30	F	P	POOR	26	5	Y	N	2	Y	Y	Y	Y	Y	N	N	Y	12	7	Y	Y	N	Y	Y/N	7
9	28	F	P	POOR	26	5	Y	N	2	Y	Y	Y	Y	Y	N	N	Y	10	6	Y	Y	Y	Y	Y/N	6
10	28	M	P	POOR	27	5	Y	N	2	Y	Y	Y	Y	Y	Y	Y	Y	10	8	Y	Y	Y	Y	Y/N	8
11	27	M	P	POOR	30	5	Y	N	3	Y	Y	Y	Y	Y	Y	Y	Y	10	8	Y	Y	Y	Y	Y/N	8
12	26	F	P	POOR	27	5	Y	N	2	Y	Y	Y	Y	Y	Y	Y	Y	10	6	Y	N	Y	Y	Y/N	6
13	27	M	P	POOR	27	5	Y	N	2	Y	Y	Y	Y	Y	Y	Y	Y	10	6	Y	N	Y	Y	Y/N	6
14	20	F	P	POOR	28	5	N	N	2	Y	Y	Y	Y	Y	Y	Y	Y	8	4	Y	Y	Y	Y	N/N	4
15	20	M	P	POOR	30	5	N	N	3	Y	Y	Y	Y	Y	Y	Y	Y	7	6	Y	Y	Y	Y	N/N	6
16	24	M	P	POOR	26	5	Y	Y	2	Y	Y	Y	Y	Y	Y	Y	Y	11	4	Y	Y	Y	Y	Y/Y	4
17	30	F	P	POOR	30	5	Y	Y	3	Y	Y	Y	Y	Y	Y	Y	Y	9	8	Y	Y	Y	Y	Y/Y	8
18	30	F	UN	POOR	24	5	N	N	1	Y	Y	Y	Y	Y	N	N	Y	9	1	N	Y	N	Y	N/N	1
19	24	M	P	POOR	25	4	N	N	3	Y	Y	Y	Y	Y	N	N	Y	10	4	N	Y	Y	Y	N/N	4
20	30	F	P	POOR	30	4	Y	N	3	Y	Y	Y	Y	Y	Y	Y	Y	15	4	Y	Y	Y	Y	Y/N	4
21	28	M	S	MIDDLE	30	5	Y	Y	3	Y	Y	Y	Y	Y	Y	Y	Y	14	6	Y	Y	Y	Y	Y/Y	6
22	26	F	S	MIDDLE	30	5	Y	N	3	Y	Y	Y	Y	Y	Y	Y	Y	14	4	Y	Y	Y	Y	Y/N	4
23	21	F	S	MIDDLE	30	5	Y	Y	3	Y	Y	Y	Y	Y	Y	Y	Y	16	6	Y	Y	Y	Y	Y/Y	6
24	25	M	S	POOR	29	5	Y	Y	3	Y	Y	Y	Y	Y	Y	Y	Y	16	8	Y	Y	Y	Y	Y/Y	8
25	24	F	S	MIDDLE	28	5	Y	Y	1	Y	Y	Y	Y	Y	Y	Y	Y	12	6	Y	Y	Y	Y	Y/Y	6
26	25	M	S	MIDDLE	30	5	Y	Y	3	Y	Y	Y	Y	Y	Y	Y	Y	12	8	Y	Y	Y	Y	Y/Y	8
27	26	F	S	POOR	29	5	Y	N	3	Y	Y	Y	Y	Y	Y	Y	Y	6	6	Y	Y	Y	Y	Y/N	6
28	27	M	S	MIDDLE	30	5	Y	N	3	Y	Y	Y	Y	Y	Y	Y	Y	7	8	Y	Y	Y	Y	Y/N	8
29	30	M	S	MIDDLE	30	5	Y	N	3	Y	Y	Y	Y	Y	Y	Y	Y	10	6	Y	Y	Y	Y	Y/N	6
30	30	F	S	POOR	29	5	Y	Y	3	Y	Y	Y	Y	Y	Y	Y	Y	12	6	Y	Y	Y	Y	Y/Y	6
31	30	M	S	POOR	22	5	Y	N	2	Y	Y	Y	Y	Y	Y	Y	Y	7	4	N	Y	Y	Y	Y/N	4
32	20	F	S	POOR	29	5	Y	N	2	Y	Y	Y	Y	Y	Y	Y	Y	11	8	Y	Y	Y	Y	Y/N	8

33	24	M	S	POOR	25	5	Y	N	2	Y	Y	Y	Y	Y	Y	Y	Y	10	2	N	Y	N	Y	Y/N	2
34	20	F	G	POOR	30	5	Y	Y	3	Y	Y	Y	Y	Y	Y	Y	Y	11	6	Y	Y	Y	Y	Y/Y	6
35	26	F	G	MIDDLE	29	5	Y	Y	2	Y	Y	Y	Y	Y	Y	Y	Y	7	6	Y	Y	Y	Y	Y/Y	6
36	27	M	PG	GOOD	30	5	Y	N	3	Y	Y	Y	Y	Y	Y	Y	Y	15	8	Y	Y	Y	Y	Y/N	8
37	25	F	G	MIDDLE	30	5	Y	N	3	Y	Y	Y	Y	Y	Y	Y	Y	17	8	Y	Y	Y	Y	Y/N	8
38	29	M	G	MIDDLE	30	5	Y	Y	3	Y	Y	Y	Y	Y	Y	Y	Y	12	8	Y	Y	Y	Y	Y/Y	8
39	30	M	PG	MIDDLE	30	5	Y	Y	3	Y	Y	Y	Y	Y	Y	Y	Y	10	6	Y	Y	Y	Y	Y/Y	6
40	26	F	G	POOR	29	4	Y	Y	3	Y	Y	Y	Y	Y	Y	Y	Y	10	6	Y	Y	Y	Y	Y/Y	6
41	29	F	G	GOOD	30	5	Y	Y	3	Y	Y	Y	Y	Y	Y	Y	Y	12	8	Y	Y	Y	Y	Y/Y	8
42	25	M	G	MIDDLE	30	5	Y	Y	3	Y	Y	Y	Y	Y	Y	Y	Y	12	6	Y	Y	Y	Y	Y/Y	6
43	20	F	G	MIDDLE	30	5	Y	Y	3	Y	Y	Y	Y	Y	Y	Y	Y	10	6	Y	Y	Y	Y	Y/Y	6
44	22	M	G	MIDDLE	30	5	Y	Y	3	Y	Y	Y	Y	Y	Y	Y	Y	14	8	Y	Y	Y	Y	Y/Y	8
45	30	M	PG	MIDDLE	30	5	Y	Y	3	Y	Y	Y	Y	Y	Y	Y	Y	15	6	Y	Y	Y	Y	Y/Y	6
46	27	M	G	MIDDLE	30	5	Y	Y	3	Y	Y	Y	Y	Y	Y	Y	Y	15	8	Y	Y	Y	Y	Y/Y	8
47	20	M	G	MIDDLE	30	5	Y	N	3	Y	Y	Y	Y	Y	Y	Y	Y	11	6	Y	Y	Y	Y	Y/N	6
48	20	F	G	MIDDLE	30	5	Y	N	3	Y	Y	Y	Y	Y	Y	Y	Y	12	3	Y	Y	Y	Y	Y/N	3
49	20	F	G	MIDDLE	30	5	Y	Y	3	Y	Y	Y	Y	Y	Y	Y	Y	8	6	Y	Y	Y	Y	Y/Y	6
50	20	F	G	MIDDLE	30	5	Y	Y	3	Y	Y	Y	Y	Y	Y	Y	Y	12	6	Y	Y	Y	Y	Y/Y	6