COGNITIVE DECLINE IN MENOPAUSE WOMEN

A Thesis

Submitted for the partial fulfillment of the requirement for the award of degree of

MASTERS OF ARTS IN PSYCHOLOGY

Submitted by: **Aekam Mandaher**

862202005

UNDER THE GUIDANCE OF

Dr. Sarika Alreja

Assistant Professor

School of Liberal arts & Sciences

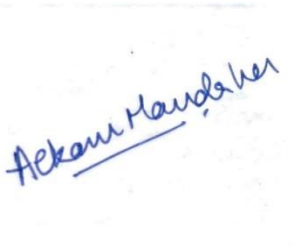
Thapar Institute of Engineering and Technology, Patiala

CERTIFICATE

This is to certify that the dissertation entitled "Cognitive decline in menopause women" is submitted in partial fulfilment of requirements for the award of the degree of Master of Arts in Psychology to Thapar Institute of Engineering and Technology, Patiala is a record of student work. The report has not been submitted for the award of any other degree or certificate in this or any other university or institute.

Date May 2024

Place Patiala



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CANDIDATE'S DECLARATION

I hereby declare that the work presented in this thesis entitled, "Cognitive decline in menopause women" is submitted in partial fulfilment of requirements for the award of the degree of Master of Arts in Psychology to Thapar Institute of Engineering and Technology, Patiala, is an authentic record of my own work carried out under the supervision and guidance of Dr. Sarika Alreja and refers other researchers work which is duly listed in the reference section. The content in the dissertation has not been submitted to any other university or institute for award of any other degree.

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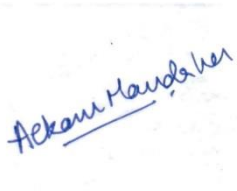

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(Dr. Sarika Alreja)

ACKNOWLEDGEMENT

I am grateful to each and every one who has helped me throughout the entire project for its successful completion. First of all thanks to Almighty for giving me strength and support so that the project could be completed peacefully.

I find myself privileged to acknowledge my guide Dr. Sarika Alreja (Assistant Professor), Thapar School of Liberal Arts and Sciences, Thapar Institute of Engineering & Technology, Patiala, Punjab for her guidance, kindness, motivation and splendid supervision during my work. I express my heartfelt thanks for her patient support and excellent advice. It was her constant encouragement, constructive criticism and ability to handle the obstacles that has helped me to gain a lot from her during this period.

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With all my heart, I specially thank my parents, Mr. Parabhdip Singh and Mrs. Kulwinder Kaur for their constant support and faith which resulted to be my strength always. Also credit goes to my sister Harpuneet Mandaher and my husband, Harkirat Singh Dhillon for their unshakeable faith in me which has always motivated me.

ABSTRACT

This study focuses on the cognitive decline in menopausal women. The sample size for this study consists of 100 women. The women included in this study completed their menstruation cycle. The age range for women in this study is 40 to 50 years. The sample size was divided into two groups. One group consisted of 50 women who had their menopause for one year and other group consisted of 50 women who had their menopause for 5 years. In this study, Wisconsin card sorting tests (WCST) was used for the assessment of cognitive flexibility. Stroop test was used for the assessment of selective attention. Rey's auditory verbal learning test (RAVLT) was used to assess of verbal memory. The result of the study demonstrated significant differences between both of groups. Women who were menopausal for one year performed better on Stroop test. The study showed similar results for RAVLT as well. For WCST, the result showed significant differences between the two groups in 11 WCST variables i.e., total correct, total errors, error percentage, perseverative error, perseverative error percentage, non-perseverative error, non-perseverative percentage, conceptual level response, conceptual level response percentage, category completed and learning to learn.

Keywords: Wisconsin card sorting test, Rey's auditory verbal learning test, Stroop test, cognitive flexibility, selective attention, verbal memory

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CHAPTER 1: INTRODUCTION

1.1 MENOPAUSE

Menopause occurs when a woman's menstrual periods stop permanently. Often referred to as the shift of life, this stage marks the end of a woman's ability to bear children. Many healthcare experts use the word menopause to describe the period of time when a woman's hormone levels begin to fluctuate. Menopause is thought to be complete when menstrual cycles stop for a year. The menopause is the lifelong stop of menstruation caused by a decline of ovarian follicular activity. It begins with by the menopausal transition, a period in which the endocrine, biochemical, and physical signs of menopause begin. The biology behind the menopausal transition includes, the most notable of which is change in ovaries , a significant reduction in follicle numbers, as well as central neuroendocrine changes. Follicle-stimulating hormone (FSH) is a recognized sign of follicular activity that occurs indirectly. Menopause is the most prevalent result of hormonal changes caused by aging. Around age 50, women's ovaries produce less estrogen and progesterone. In response, the pituitary gland generates increased follicle stimulating hormone (FSH).

There are basically 3 stages of menopause- perimenopause; menopause and postmenopause. Perimenopause is the interval before menopause. It refers to a period when hormones begin to diminish and menstrual cycles become inconsistent and irregular. You may begin to experience menopausal symptoms such as hot flashes and vaginal dryness. Perimenopause period is 5 years and its starts to show for like 7-8 years. Perimenopause is less used term in health departments and North America community for menopause association. Most of times it’s called menopause transition(Nasa N.G in 2009). Ferrell RJ and Pincus SM in a study done in 2006 showed that transition of menopause can be divided into early and late stages depending on their time of the

cycle and ovaries endocrine functions. Eaely peri- menopause cycle is for 7 days and for late perimenopause they don’t get their maturation for 2 weeks, show irregularities. In this stage FSH and luteinizing hormone are present more while ovaries functions are on deceases. For perimenopause no medication is required until its symptoms are seen like irregular cycles night sweating and hot flashes. Kimbery Peacook 2003 in his study defined Perimenopause is the transition period that occurs prior to menopause. During the transition period preceding menopause, a woman's ovaries' supply of mature eggs decreases, and ovulation becomes erratic. Progesterone and estrogen production both decrease at about the similar time.The significant decrease in estrogen levels leads to menopause.

Postmenopause by women and health study in 2000 defined post menopause a time periods which occurs after menopause and its starts when clearly amenorrhea has seen after 12 months or more. Menopause happens when you cease generating the hormones that trigger your menstrual cycle and have not had a period for 12 months. Once this occur, you come into postmenopause. The period following menopause is named as postmenopause. At this point, you will remain in postmenopause for your entire life. Women in this phase have more chances to have health issues like osteoporosis and heart disease. Dr. A. kesseler and his colleges in 2008 did a study on menopause and defined this stage of life mean complete cessation of menstrual cycle. Their research showed 90 percentage of cesseation women is age is more than 45, showed ovarian follicular functions levels decreased. The term menopause is defined endocrinologically by ovaries decline in function, biological its defined as infertility and clinically defined as changes in menstrual cycle. In a study done by Somja Mckinaly focused on normal memopause transition, found out that women in their 50 had menstruation completely stopped this is a natural age of memopause whereas smokers and substance abuse caused mempause 1.5-2 years earlier.

Women who experiences premature or early menopause has some health related issues(Lynne T.Rodes and Walter Rocca). Premature menopause which occurs around 40 years and early occurs around 40-45 years. despite of any cause women who had her menopause, with low level of estrogen even before reaching their normal age of menopause can effect their morbidity and morality. Along with this they face symptoms like mental disorders and heart problems. This effects can be pulled back a little with aid of estrogen treatment.

Any age can experience the menopause, from the 30s to the mid-50s or later. people who smoke and are underweight typically have an earlier menopause, whereas overweight people frequently have a later menopause. In general, a woman experiences menopause at approximately equal age as her mother. Menopause also come about for reasons other than natural ones. These include the following: Menopause that occurs before its time. Premature menopause can occur when an ovary fails before the age of 40. It could be caused by smoking, radiation exposure, chemotherapy medicines, or surgery that disrupts the ovarian blood supply. Premature ovarian failure is often referred to as primary ovarian insufficiency. Surgical menopause. Premenopausal women may have surgical menopause after having one or both ovaries removed or having radiotherapy of the pelvis, including the ovaries. This causes an abrupt menopause. These women frequently experience more severe menopausal symptoms than if they had menopause naturally. Symptoms of menopause-

Hot flashes - most seen indication menopause. Approximately 75 percentages of women faces these abrupt, transient, cyclical elevations in body temperature. usually, heat flashes occur earlier, of final period of a woman. Eighty percent of women experience heat flashes for a duration of two years or less. A minority of females endure hot flushes for a duration exceeding

two years. It seems to have a direct correlation between these flashes and estrogen reduction (Matthias Barton and Matthias Meyer in 2010)

Vaginal atrophy- Vaginal atrophy is characterized by the thinning and desiccation of vaginal and urethral tissues. This can contribute to pain during sexual activity and urinary tract infections.

Cardiac consequences-Periodic dizziness, atypical sensation, such as feeling numb, burning, sensations of ting and/or increased sensitivity, cardiac palpitations, and rapid heart rate may occur as symptoms of menopause.

Relaxation of pelvic muscles - Relaxation of the pelvic muscles, result in urinary tract infections. Raise the likelihood of the uterus, bladder intruding into the vagina.

It can lead to signs like fatigue, depression, crankiness, headaches, Joint and muscle aches and pains, weight gain, hair loss, changes in libido (sex drive)

Emotional changes, Depression, anxiety, and low mood are common during menopause. It is not unusual to experience times of irritability and crying spells. Mohammed Ali, Hassan Ahmed and Smail in 2020 did a study that examined the intensity of psychological symptoms and their correlations among peri- and postmenopausal Emirati females (N = 60, mean age = 54.88 ± 6 years). Participants were surveyed on the Menopause-Specific Quality of Life (MENQOL) and their feelings regarding menopause scales (ATMS). They found symptoms like weight gain laziness, fatigue, vasomotor symptoms had a straight effect on anxiety, depression and psychological conditioning. Fatigue strongly mediated the influence of vasomotor symptoms and weight gain on anxiety, depression , psychological distress, and problems with memory. In

conclusion, psychological distress is prevalent among menopausal females. In a study done by Rosie Bauld in 2019 showed effect of menopause symptoms on psychological stress. This study looked at the relationship between the two, and the results indicate that menopause symptoms were associated with greater degrees of stress, anxiety, and depression as well as lower levels of coping mechanisms.

1.2 COGNITIVE FLEXIBILITY

Cognitive flexibility- he ability to modify activity and material, transition between distinct task rules and associated behavioral responses, maintain multiple concepts all at once, and move internal attention among them is commonly referred to as cognitive flexibility. This term is typically used to describe one of the executive functions. Cognitive flexibility can be viewed flexible behavior. The two most popular methods for researching cognitive flexibility concentrate on the conscious and unconscious abilities to shift tasks and think in different ways. The Multiple Classification Card Sorting Task, the Wisconsin Card Sorting Task and the Stroop Test are some of the tools used to evaluate cognitive flexibility. In a study done by David E Hartley in 2006, found that women in their late postmenopause performed worse on cognitive flexibility along with the verbal fluency and memory and putting the notion that during menopause, cognitive deteriorates faster than other functions. Research done by Chloe Page and Andrew M Novck in 2022 showed cognitive problem in postmenopause. Evidence has shown that cognitive functions are most to get affected by memopause. Along with cognitive decline their id decline in attention, speedily response and working memory. Every womwn have a differnt effect on their cognition like one show strengthens while other show weakness in that same domaine.

Cognitive inflexibility along with sleep disturbance and depression has also shown in perimenopause (Christan A Metcall In 2022). Dementia is characterized by a substantial decline of cognitive function. The stage between normal cognition and dementia is represented by mild cognitive impairment. Women experience cognitive alterations more frequently than males do. This suggests that hormonal variables play a role in cognitive aging. In this way, around menopause, a time when hormone levels, particularly those of estrogen, drop, cognitive issues are more prevalent. Furthermore, women throughout menopause have been seen to have a propensity toward worsening cognitive function. Vasomotor symptoms, which include vaginal dryness, irritability, forgetfulness, and hot flashes, sweating, and dizziness, are prevalent and linked to a gradual decline in ovarian function and a corresponding drop in serum estrogen levels (Mohammed and Hassan in 2020)

Correlation between menopause symptoms and everyday cognition in china- This study was done by Wenjun Huang and Susu Jiag in 2020.Their goal was to study and asses relation between intensity of menopause symtoms and cognition in peri and post menopause women. There sample sixe was 290 and with the help of multiple liner regression and alteration of confounding parts like age, BMI, income ,occupation, the past of chronic disorders, were their any complaints of anxiety, laziness, tiredness, education qualification. They found everyday cognition had a positive correlation with menopause.

1.3 SELECTIVE ATTENTION

Selective Attention- The practice of concentrating on a certain object in the surroundings for a predetermined amount of time is known as selective attention. Selective attention enables us to ignore unnecessary things and concentrate on what really matters because attention is a finite

resource. There are a lot of things in the world vying for our attention, yet we can only pay attention to so much at once. To assist us pay attention to the things that are significant in our surroundings, we therefore rely on selective attention. It functions similarly to a spotlight or zoom lens, emphasizing information that is especially essential at any given time, according to some experts. A study conducted by Bozhgani, Fereidoni and Fadardi in 2017 to compare the attention in before and after puberty and during menopause. There finding were that, in immature females, low levels of estrogen may be linked to poorer executive control network performance in intentional network tests and decreased attention in the Stroop test. Additionally, postmenopausal women's low estrogen and high LH and FSH levels appear to have an impact on how well they pay attention on the Stroop test.

Attention and memory issues has being reported by women in menopause. To examine this relation M Schassfsma and A taylor in 2010 did a research a including 120 women in their perimenopause, premenopause and post menopause phase. Their result showed decline in attention reaction time.

A study was done by P. Pole-Kantola to see estrogen level, attention , memory and cognitive flexibility in menopausal women. Their study focused on working memoery, efficacy and their cognitive shits and flexibility. They also tried to see these changes in relationship with the estrogen level of the women in that phase. Total they took 60 women in their memopause aged between 45-65 years. These women were divided into 2 groups one group had high estrogen level and other group had a low estrogen level. Women in these study who came in high estrogen group were give supplements or given estrogen therapy so a high estrogen levels can be maintained for the study. They performed on test like digit span, object naming, PWA word accociated recall and block design. They found women in their menopause and who came in

group with low estrogen and were not going through estrogen replacement therapy were lower in their reaction time, made more errors in stroop test and their test resukted show thety had difficulties maintain attention.

1.4 VERBAL MEMORY

Verbal memory refers to the recall of information that has been spoken to. Verbal memory capacity can be assessed using a range of tasks, such as memorizing word lists, story recall and learning word sequences with paired words. When learning from lists, the student must be able to recite a word list that has been delivered aloud either right away or over a few minutes later. "Delayed recall" refers to the later memory situation, and "immediate recall" refers to the former. When it comes to verbal memory tests, women often outperform men, even in the post-puberty period. Menopause, however, diminishes women's advantage in verbal memory performance. During the menopausal transition, many women experience increased forgetfulness and "brain fog". The complex ways that menopause affects the brain and what keeps memory intact have been the subject of an increasing number of studies. Menopause, for instance, can alter how brain cells are formed, interact with one another, and even die; these changes have an impact on brain areas that are vital for memory. Additionally, menopause reduces brain glucose levels, which are the main source of energy for brain cells. When the brain runs out of gas to function, it turns to alternate metabolic supplies. In a study done by Jil M.Goldstein in 2021 found that women who were in menopause phase performed bad in their verbal memory test, even though they performed better than men in their post puberty phase.

Menopause and its effect on Verbal Memory Mary D Sammel et al in 2015 did this study. Cognitive complaints were their in post menopause women but its an hot topic that these declines are due aging or cognitive decline. This study was a 15 year long, longitudinal study in

which their behavior , encodrine and cognitive measurements were done in their pre and post menopause. They used Selective reminding test, digit symbol tasks and symbol copy task to assess theirs domains. A total sample of 200 women were included. They found that women in their post memopause period performed worse on thesis tests and showed decresed level of verbal memory , verbal recall and cognitive inflexibility.

CHAPTER 2: REVIEW OF LITERATURE

Comparison of attention in females prior to and past puberty and during menopause- This study done by Bozhgani a, Masoud Fereidoni a, Javad Salehi Fadardi in 2017 aims to assess the idea that shifts in sexuality over the menstrual cycle and see impact on attention because the brain contains estrogen and progesterone receptors. In this stust the sample size was 17 immature women , 15 young women and 17 postmenopause women. They found low amounts of estrogen in immature females may be linked to poorer executive control and decrease attention in the Stroop test. Furthermore, the decreased levels of estrogen in postmenopausal women seem to affect their ability to focus during the Stroop test.

Cognition in menopause: the effect of transition stage- This study was done by Weber,Leah H Rubin, M Maki in 2013. The purpose of this cross-sectional study is to determine whether perimenopause cognition is impacted by menopausal symptoms and whether there are variations in cognitive function between reproductive aging stages. Women in the late menopausal transition and early postmenopausal phases would do poorer than those in the late reproductive period, according to the study's premise, which involved attention and verbal memory tasks. Women in the first year of postmenopause significantly underperformed on verbal learning, verbal memory, and motor function assessments when compared to women in the late reproductive and late menopausal transition phases. They also scored far worse than women in the late menopausal transition stage on tests of attention and working memory. During the perimenopause, cognitive performance does not vary steadily. During the first year following the last menstrual cycle, declines in attention/working memory, linguistic, verbal memory, and fine motor speed may be particularly noticeable.

Cognition and mood in menopause – A study done by Miriam T Weber in 2014. It has been proposed that decreases in estrogen around menopause are linked to deteriorations in cognitive performance and a higher chance of developing depressive illnesses and signs and symptoms. When it came to delayed verbal memory skills and phonemic speaking tasks, postmenopausal women fared lower than both premenopausal and perimenopausal women. By using organized clinical interviews and conventional clinical inventories, postmenopausal and perimenopausal women were found to have a considerably higher risk for depressive disorders than premenopausal women. Menopause is associated with a higher likelihood of signs of depression and disorders, as well as an increased susceptibility to cognitive impairments. These result, can not always apply to other studies not covered in this study.

Cognitive function in late versus early postmenopausal phase- Elsabagh , David E. and Sandra in 2006. Relatively less study has done on cognitive function during the initial years after menopause, and nothing is known about whether different cognitive capacities diminish at different rates. Determining the type of cognitive deterioration across a variety of functions over a 5-year period from the beginning of to late postmenopausal phase was the goal of the current investigation. There finding was that, late postmenopausal phase women showed no differences in attention, verbal fluency, or memory, but they did have considerably lower executive function, indicating so as to this region of cognition deteriorates more quickly than other areas. It seems that this transition happened at any age implies that hormonal changes that take place between the early and late stages of postmenopause could be the cause.

Subjective cognitive complaint at menopause linked with decline in performance of verbal memory and attentional processes- J Homewood &A. Taylor in 2010 did a study, Menopause-related subjective cognitive problems are frequently observed. It is unknown if they are a sign of

true cognitive decline. Examine possible menopause-related, hormonal, psychological, and cognitive indicators of subjective complaints. Evaluate subjective complaints related to attention and memory in an overall population sample throughout the menopausal phases. Evaluate associations between subjective concerns and objective evaluations of cognitive performance. In the groups receiving hormone therapy and postmenopausal women, attention issues were more noticeable. Subjective cognitive issues were linked, to reductions in verbal recall as well as a fall in performance on attention-related reaction time tests. Menopause-related symptoms, psychosocial factors, psychological signs, and objective cognitive function were all predictive of subjective complaints.

Menopause and Cognitive decline- A study done by Mitchell and Woods in 2014. They found 62 percent of women from SMWHS with a sample size 230 and mean age of 45.7 years showed a level memory problems and remembering words or numbers in the post menopaused women. They were seen to need remembering tools or cues to recall.

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Comparison of attention in women before and after puberty and during menopause- A study done by Pegah , Masoud and Javad in 2017. As there is presence of estrogen and progesterone in

our body, this study focuses on how your sexuality changes with realtion to maturation and with menopause is there is a effect on attention. For this study 50 women was taken , equally divided into young , adult and postmenopause women groups. They performed stroop test and ANT. There result showed that postmenstrual women and young women was worse in stroop test. near to the ground levels of estrogen and progesterone is linked with attention deficit in post menopause women on stroop test and cognitive executive controlling functions. Also due to low level of Fsh levels have also produced these effects on postmwnopused women in stroop test.

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Attention, memory and cognitive flexibility in menopausal women- A study was done by P. Pole-Kantola Their study focused on working memoery, efficacy and their cognitive shits and flexibility. They also tried to see these changes in relationship with the estrogen level of the women in that phase. Total they took 60 women in their menopauses aged between 45-65 years. These women were separated into 2 groups one group had high estrogen level and other group had a low estrogen level. Women in these study who came in high estrogen group were give supplements or given estrogen therapy so a high estrogen levels can be maintained for the study. They performed on test like digit span, object naming, PWA word associated recall and block

design. They found women in their menopause and who came in group with low estrogen and were not going through estrogen replacement therapy were lower in their reaction time, made more errors in Stroop test and their test results show they had difficulties maintain attention.

CHAPTER 3: RESEARCH GAP

3.1 RESEACH GAP

Research gap for my study is that most of the studies focus on comparing peri and post menopause and also focus on transitional stages. Not much studies are focused solely on postmenopause and trying to study this phase of menopause how in cognitive decline progresses in relation to executive function, cognitive flexibility, selective attention and verbal memory. In the previous studies the age for postmenopause was 50-55 years.

3.2 OBJECTIVE

Objective for my study is to focus on cognitive decline in early postmenopause women whose menstruation cycle has stopped completely. We assessed their cognitive decline in relation to cognitive flexibly, selective attention and verbal flexibility.

3.3 HYPOTHESES

H1: There will be a significant difference between women experiencing menopause for one year and women experiencing menopause for five years in selective attention.

H2: There will be a significant difference between women experiencing menopause for one year and women experiencing menopause for five years in cognitive flexibility.

H3: There will be a significant difference between women experiencing menopause for one year and women experiencing menopause for five years in verbal memory.

CHAPTER 4: METHDOLOGY

4.1 SAMPLE

There are one hundred women in the study's sample size. The menstrual cycle was finished for the ladies who were part of this study. The study's female participants range in age from 40 to 50. Two groups were created based on the sample size. Fifty women who underwent menopause for a year made up one group, while fifty women who underwent menopause for five years made up the other.

4.2 RESEARCH DESIGN

A between group design was used in this study. It was a purposive sampling.

Independent variable - Menopause

Dependent variable - Cognitive flexibility, selective attention and verbal learning.

4.3 STATISTICAL ANALYSIS

The Statistical Package for Social Sciences 23 (SPSS 23) was used to assist with the statistical analysis.

In order to examine sociodemographic factors such as age differences between the two groups, descriptive statistics were generated.

To analyze scores of Wisconsin card sorting test, Stroop test and Rey’s auditory verbal learning test of the two menopausal groups (1 year & 5 years), Independent t-test was applied.

4.4 TOOLS

1. Wisconsin card sorting test (WCST) – this test was written by David A. Grant and Esta A. Berg. A neuropsychological test of set-shifting the ability to exhibit adaptability in the face of reinforcement changes, is the Wisconsin Card Sorting Test (WCST). It is widely employed to assess higher order cognitive functions as focus, persistence, working memory, abstract thought, continuous form, and set shifting. Measures of perseverative behaviors—a term used to describe a person's persistence in engaging in inappropriate behavior—are especially applied in the clinical domains. Moreover, having strong conceptual formation skills and a high degree of intellectual plasticity are necessary for being capable to switch categories. The subject is handed stimulus cards and given directions to match the cards. Rather than directions on how to pair the cards, students receive feedback on whether their matches are correct or incorrect. When the exam was first made available, the technique of displaying the cards involved the examiner utilizing paper cards, face the participant on one side of the desk. The test takes from 12 to 20 minutes to complete. The outcomes of the test yield several helpful statistical scores, such as values for trials, errors, preservative errors. The inter-scorer reliability coefficients for WCST all 11 test, the score diverse from .895 to 1.000 along with learning to learn score expectations(r = .658). The intra-scorer reliability coefficients were in the array of.828 and 1.000. WCST has adequate construct validity.

2. Stroop test- The test was first created by John Ridley Stroop in 1930s.The lag in response time between congruent and incongruent stimulus is known as the Stroop effect. The Stroop test is a psychological assessment that was developed using this effect and is frequently used in research

and clinical settings. When a color- such as blue or red - is written in a color other than its name—for example, green is written in blue ink rather than green ink—this effect can be easily seen in action. It takes more time and is more likely to be inaccurate when asked to name the color of a word when the ink's color is distinct from the name of the color. The test has fairly good test-retest reliability and a strong concurrent validity.

3. Rey's auditory verbal learning test- This test was created by Andre Rey in 1941.A memory test in which the subject must retain spoken information throughout multiple oral presentations, usually consisting of lists of unrelated words. The examiner speaks aloud a list of fifteen words in the typical format, asking the participant to recite as many of the terms as they can recall, in any sequence. The examiner repeats the list a further four times, with the participant recalling as many words as they can each time, after noting the words they can recall. The examiner then gives the individual a second list of fifteen words to recall, providing them with just one chance to do it right. The individual is then instructed to recall as many words as they can from the initial list. The examiner then gives the subject a 20 to 40-minute break before asking them to recollect as many words as they can in the first list. The participant may occasionally be asked to distinguish the initial 15-word list from a printed list of 30 to 50 words by the examiner. Assessing memory for recognition, delay recall, and immediate memory, the RAVLT is frequently used in conjunction with neuropsychological evaluations. Its has adequate divergent and convergent validity. The test has a good internal consistency.

4.5 PROCEDURE

In this study, entire sample size was 100 women whose menstruation cycle has stopped completely. The participants were divided into two groups, women who have their menopause

for 1 year and women who have their menopause for 5 years. The participants were asked to sit comfortably before starting with the assessment. Before starting with the tests participant's consent was taken. They were told that, they have to perform 3 tests that are WCST, Stroop test and Ray's auditory verbal learning test. They were told not to think too much before responding and be honest with their responses.

CHAPTER 5: RESULTS

5.1: DESCRIPTIVE STATISTICS

Variable		N	Mean of age	SD of age
Menopause	1 Year	50	42.84	1.09
	5 Years	50	48.84	0.99
	Total	100	45.84	3.10

The table presents the demographic information regarding the age of participants in a study examining cognitive functions in post-menopausal women. Participants in the study are separated into two group according to how long they have gone through menopause: those who have gone through the process in less than a year and those who have gone through it in five years.

Each group consists of 50 participants, making the total sample size 100. The mean age of participants in the 1-year menopause group is 42.84 years, with a standard deviation (SD) of 1.09 years. These result show the majority of participants of group are in their early 40s, with a small amount of variation around the mean age. In contrast, the mean age for the 5-year menopause group is significantly higher, at 48.84 years, with a slightly lower standard deviation of 0.99 years. Showing that, participants are in their late 40s with even less age variation.

Combining both groups, the overall mean age of the participants is 45.84 years, with a standard deviation of 3.10 years. This higher standard deviation for the total sample reflects the broader age range encompassed by including both groups, from early 40s to late 40s. These descriptive

statistics provide a clear picture of the age distribution within the study population, highlighting the age differences among the two menopausal groups.

5.2: Showing Wisconsin card sorting test scores for the two menopausal groups

Area of assessment		Menopause(1yrs) Mean±SD	Menopause(5yrs) Mean±SD	Independent T test t	Sig.
Wisconsin card sorting test	Total correct	83.16±12.66	73.98±11.00	3.86	0.000
	Total errors	32.66±13.40	48.40±16.82	-5.17	0.000
	Perseverative responses	8.50±7.01	18.22±23.96	-2.75	0.007(NS)
	Preservative error	6.80±5.18	12.82±17.84	-2.29	0.024
	Nonperseverative error	25.86±10.67	35.58±15.73	-3.61	0.001
	Conceptual level responses	74.84±14.76	59.52±15.52	5.05	0.000
	Categories completed	4.80±1.29	3±1.64	6.09	0.000
	Trials to complete 1st category	26.52±16.72	30.98±20.32	-1.97	0.234(NS)
	Failure to maintain set	2.36±1.86	2.78±1.65	-1.19	0.236(NS)
	Learning to learn	-9.74±19.05	1.71±15.72	-3.28	0.001

NS: Non sig.

The table presents results from the Wisconsin Card Sorting Test (WCST) comparing cognitive flexibility among two group of women: ones who had their menopause for 1 year and those for 5 years. The WCST is a neuropsychological test designed to assess executive functions, including problem-solving, cognitive flexibility, and the ability to learn from feedback. The table includes various measures from the WCST, next to means, standard deviations (SD), t-values, and significance levels (Sig.).

The total trials and total correct responses provide an overall view of the participants' performance. Women 5 years into menopause required more trials (Mean = 122.15, SD = 14.54) compared to those 1 year into menopause (Mean = 115.82, SD = 18.67), with a t-value of -1.86, showing a drift but not statistically significant (p = 0.065). Correct responses, women 1 year into

menopause performed better (Mean = 83.16, SD = 12.66) than those 5 years into menopause (Mean = 73.98, SD = 11.00), with a highly significant t-value of 3.86 ($p < 0.001$). This suggests a decline in overall correct responses with longer duration of menopause.

Significant differences are observed in the total errors and the error percentage. Women 5 years into menopause made more errors (Mean = 48.40, SD = 16.82) than those 1 year into menopause (Mean = 32.66, SD = 13.40), with a t-value of -5.17 ($p < 0.001$). The error percentage followed a similar pattern, with a higher percentage for the 5-year group (Mean = 38.62%, SD = 11.67) compared to the 1-year group (Mean = 23.30%, SD = 9.02), indicated by a significant t-value of -5.42 ($p < 0.001$).

Perseverative responses and perseverative errors were much high in 5-year group (Mean = 18.22, SD = 23.96; Mean = 12.82, SD = 17.84, respectively) compared to the 1-year group (Mean = 8.50, SD = 7.01; Mean = 6.80, SD = 5.18), with t-values of -2.75 ($p = 0.007$) and -2.29 ($p = 0.024$). This suggests that women 5 years into menopause struggle more with repeating mistakes. The percentages of these errors (PR% and PE%) also showed significant differences ($p = 0.008$ and $p = 0.028$, respectively).

Nonperseverative errors were also up in the 5-year group (Mean = 35.58, SD = 15.73) as compared to 1-year group (Mean = 25.86, SD = 10.67), with a significant t-value of -3.61 ($p < 0.001$). The error percentage for nonperseverative errors (NPE%) was similarly higher for the 5-year group, with a significant difference ($p = 0.001$).

Conceptual level responses (CLR) and their percentage (CLR%) were lower for the 5-year group (Mean = 59.52, SD = 15.52; Mean = 50.07%, SD = 17.14) compared to the 1-year group (Mean = 74.84, SD = 14.76; Mean = 65.92%, SD = 16.02), with highly significant t-values of 5.05 and

4.77, respectively (both $p < 0.001$). Result shows a decline in the capacity to form and uphold higher-level concepts with prolonged menopause.

Categories completed also showed a notable difference, with the 1-year group completing more categories (Mean = 4.80, SD = 1.29) compared to the 5-year group (Mean = 3.00, SD = 1.64), with a t-value of 6.09 ($p < 0.001$).

There were no appreciable variations between the two groups based on the first category's entire path or the inability to sustain predetermined points ($p = 0.234$ and $p = 0.236$, respectively), suggesting these specific aspects of cognitive flexibility may be less affected by the duration of menopause.

The learning to learn score, which reflects the ability to improve performance across trials, was significantly worse for the 5-year group (Mean = 1.71, SD = 15.72) compared to the 1-year group (Mean = -9.74, SD = 19.05), with a t-value of -3.28 ($p = 0.001$). This indicates a significant decline in the ability to learn from experience and adapt strategies over time.

The data highlights a pattern of cognitive decline in women with menopausal for 5 years compared to those for just 1 year. Key areas affected include total correct responses, error rates, perseverative responses, and conceptual level responses. These results imply that sustained low levels of estrogen are linked to deficits in executive processes, which affect learning, problem-solving, and cognitive flexibility. The WCST outcomes underscore the importance of addressing cognitive health in long-term menopausal women through targeted interventions and support strategies.

5.3: Showing Stroop test scores for the two menopausal groups

Area of assessment		Menopause(1yrs) Mean±SD	Menopause(5yrs) Mean±SD	Independent T test	
				t	Sig.
Stroop test	Time taken	148.62±6.03	155.78±3.14	-7.44	0.000

The Stroop Test results are shown in the table, which compares the cognitive abilities of two groups of women: those who have been going through menopause for a year and those who have been going through it for five years. The Stroop Test evaluates cognitive abilities like executive control, attention, and processing speed. It measures the capacity to prevent cognitive interference, which happens when processing one sensory characteristic interferes with processing another. The time it took to finish the test is the main metric in this table; it is shown as mean values with the corresponding standard deviations (SD), t-values, and significance levels (Sig.).

Women who had menopause for 1 year have a mean time of 148.62 seconds with a standard deviation of 6.03 seconds to complete the Stroop Test. But women who had menopause for 5 years take longer, with a mean time of 155.78 seconds and a standard deviation of 3.14 seconds.

The t-value for the comparison between the two groups is -7.44. A negative t-value indicates that the group with 1 year of menopause took significantly less time on average for test compared to the group with 5 years of menopause. The p-value associated with this t-test is 0.000, indicating that the dissimilarity in time taken between both groups is highly statistically significant. This p-value is well below the conventional threshold of 0.05, confirming that the observed difference is not due to random chance.

The results of the Stroop Test reveal a major turn down in cognitive performance as measured by the time taken to complete the test in women who have been experiencing menopause for 5 years compared to those who have been experiencing it for only 1 year.

The increased time taken by the 5-year group (155.78 seconds) compared to the 1-year group (148.62 seconds) suggests a decline in processing speed. This is a serious cognitive function that show individuals, quickly and efficiently process information. A slower processing speed can impact everyday activities and the ability to carry out tasks that need fast thinking and reaction.

The Stroop Test is also a measure of selective attention and executive control, particularly the ability to manage cognitive interference. The longer completion time in the 5-year group indicates greater difficulty in managing this interference. This suggests that prolonged menopause may impair the ability to focus attention and suppress irrelevant in sequence, which are important mechanism of executive function.

These cognitive declines be able to qualified to the prolonged effects of little estrogen levels that occur throughout menopause. Estrogen is known to participate in cognitive functions, particularly in areas of the brain involved in memory, attention, and executive functions, such as the prefrontal cortex and hippocampus. Over 5 years, the continuous low levels of estrogen likely contribute to the observed impairments in the Stroop Test performance.

5.4: Showing Rey's auditory verbal learning test scores for the two menopausal groups

Area of assessment	Menopause(1yrs) Mean±SD	Menopause(5yrs) Mean±SD	Independent T test	
			t	Sig.

Rey's auditory verbal learning test	Immediate recall	25.22±3.87	20.1±3.54	6.90	0.000
	Delayed recall	8.28±1.08	6.06±1.33	9.12	0.000
	Recognition of words	12.62±1.06	9.62±1.29	12.66	0.000

The table presents the results of the Rey Auditory Verbal Learning Test (RAVLT), comparing the cognitive performance between the two groups of women: those who have menopause for 1 year and those for 5 years. The RAVLT assesses various part of verbal memory, including immediate recall, delayed recall, and recognition memory. The table provides mean scores with standard deviations (SD) for each area of assessment, along with t-values and significance levels (Sig.).

Women who had their menopause for 1 year have a mean immediate recall score of 25.22 with a standard deviation of 3.87. Women who had menopause for 5 years have a lower mean immediate recall score of 20.1 with a standard deviation of 3.54.

The t-value for the comparison between the two groups is 6.90, with a p-value of 0.000, indicating a highly significant difference. This significant difference in immediate recall suggests that the ability to recall information shortly after it is presented is notably diminished in women who have been in menopause for 5 years. Immediate recall relies heavily on short-term memory and attention, which can be affected by prolonged hormonal changes associated with menopause.

The mean delayed recall score for the 1-year menopause group is 8.28 with a standard deviation of 1.08. The 5-year menopause group has a mean delayed recall score of 6.06 with a standard

deviation of 1.33. whereas the t-value for delayed recall is 9.12, with a p-value of 0.000, indicating a highly significant difference.

The delayed recall scores highlight a significant decline in the ability to retain and recall information after a delay in women who had menopausal for 5 years. This measure is critical for evaluating long-term memory, and the substantial difference suggests that prolonged low estrogen levels may impair the consolidation of memories over time.

The mean score for recognition of words in the 1-year menopause group is 12.62 with a standard deviation of 1.06. Whereas for the 5-year menopause group, the mean recognition score is 9.62 with a standard deviation of 1.29. The t-value for recognition of words is 12.66, with a p-value of 0.000, indicating a highly significant difference.

CHAPTER 6: DISCUSSION

Menopause occurs when a woman's menstrual periods stop permanently. Often it is related to the alteration of life, this stage marks the cease of a woman's ability to bear children and their reproductive life. Menopause is described as a period of time when a woman's hormone levels begin to fluctuate. Menopause is thought to be complete when menstrual cycles stop for a year.

The menopause is the lifelong stop of menstruation caused by a decline of ovarian follicular activity. It begins with by the menopausal transition, a period in which the endocrine, biochemical, and physical signs of menopause begin. Menopause can occur at any age, from the 30s to the mid-50s or beyond. There are basically 3 stages of menopause- perimenopause; menopause and postmenopause. Perimenopause is the time period just before menopause and is a period when hormones levels starts to decrease and maturation cycles become not consistent and irregular. Postmenopause, women and health study in 2000 defined postmenopause a time periods which occurs after menopause and its starts when clearly amenorrhea has seen after 12 months or more. Menopause happens when you cease generating the hormones that trigger your menstrual cycle and have not had a period for 12 months.

In this study we examine total of 100 women in their menopausal phases using three tests- WCST, Stroop test and Rey's auditory verbal learning test. We tried to study their cognitive decline and try to asses that if there is decline during menopause. The aim of this was to see if there will be a link of cognitive decline with postmenopause. We assessed the sample using WCST to examine their cognitive flexibility and executive functioning, Stroop test to examine their selective attention and Rey's auditory verbal test to examine their verbal memory, immediate recall, delayed recall and recognition. The sample size for my study is total of 100

women. These women included in this study completed their menstruation cycle. The range of age for women in my studies was 40 to 50. We divided the sample size into two groups. One group consists of 50 women with menopause for one year and other group consists of 50 women with menopause for 5 years. Each group consists of 50 participants, making the total sample size 100. The mean age of participants in the 1-year menopause group is 42.84 years and the mean age for the 5-year menopause group was 48.84 years. Hypotheses of this study, which was there will be a significant difference between women experiencing menopause for one year and women experiencing menopause for five years in selective attention , there will be a significant difference between women experiencing menopause for one year and women experiencing menopause for five years in cognitive flexibility and it showed a significant difference between women experiencing menopause for one year and women experiencing menopause for five years in verbal memory has been proved.

We performed Wisconsin cars sorting test to assess cognitive flexibility in women of both groups. Significant difference was found between two groups. Key areas affected include total correct responses, error rates, preservative responses, and conceptual level responses. The in general performance of both group , the total correct responses of group who their menopause for 1 year were significantly high then the group who had their menopause for 5 year. Total error and error percentage was higher for 5year menopause then the other group. This indicates that, this group's cognitive flexibility and problem solving abilities are lower than the other group. Preservative response that is making same response despite giving a negative response in feedback and preservative errors were higher on 5 year group of menopause then the other group. It shows that the group had difficulty in maintaining cognitive sets and overall cognitive control. Conceptual level responses and categories completed were higher in one year group, which

shows that ability to comprehend and use abstract conceptual were better in this group. Learning to learn which means showing improvement in trails were worse in group who had menopause for five years then the other group. Correlation between menopause symptoms and everyday cognition in china- This study was done by Wenjun Huang and Susu Jiag in 2020.Their goal was to study and asses relation between intensity of menopause symptoms and cognition in peri and post menopause women. There sample size was 290 and with the help of multiple liner regression and alteration of confounding parts like age, BMI, income ,occupation, the past of chronic disorders, were there any complaints of anxiety, laziness, tiredness, education qualification. They found everyday cognition had a positive correlation with menopause. In a study by Richard Beare in 2023, saw cognitive trajectories during the menopause transition. It was a longitudinal study focusing on menopausal women in relation with reaction time, reasoning, visual and working memory and attention. Their study showed that postmenopausal women had poorer baseline cognitive function then premenopausal women in all cognitive modalities.

We performed Stroop test on both of the group. It showed group of menopause of five years took more time to complete Stroop test then other group of one year of menopause. Women who have menopause for five year had a slower cognitive processing of speed. This tests measure cognitive flexibility and control, significant increases in time taken to response suggest that five year menopause group has a cognitive skill of a lower level. This group took more time which tell that there is an effect of prolonged insufficiency estrogen on cognition. P. Pole-Kantola in their research focused on working memory, efficacy and their cognitive shits and flexibility. They also tried to see these changes in relationship with the estrogen level of the women in that phase. Total they took 60 women in their menopauses aged between 45-65 years. Sample was divided

in to 2 groups one group had high estrogen level and other group had a low estrogen level. Women in these study who came in high estrogen group were give supplements or given estrogen therapy so a high estrogen levels can be maintained for the study. They performed on test like digit span, object naming, PWA word associated recall and block design. They found women in their menopause and who came in group with low estrogen and were not going through estrogen replacement therapy were lower in their reaction time, made more errors in Stroop test and their test results show they had difficulties maintain attention.

A study conducted by Bozhgani, Fereidoni and Fadardi in 2017 to compare the attention in before and after puberty and during menopause. There finding were that, in immature females, low levels of estrogen may be linked to poorer executive control network performance in intentional network tests and decreased attention in the Stroop test. Additionally, postmenopausal women's low estrogen and high LH and FSH levels appear to have an impact on how well they pay attention on the Stroop test.

Attention and memory issues have being reported by women in menopause. To examine this relation M Schassfsma and A taylor in 2010 did a research a including 120 women in their perimenopause, premenopause and post menopause phase. Their result showed decline in attention reaction time mainly in postmenopause.

In this research we also performed Rey's auditory verbal learning test on both of the groups. This test measures immediate recall, delayed recall and recognition. Immediate recall is the ability to recall the word right after its presentation. Immediate recall was significant higher in one year menopausal women as compared to other group. Its shows estrogen plays a role in synaptic plasticity, which is important for memory and retention. Delayed recalls which shows your ability recall and retrieve following a delay was better in one year menopausal women then the

five year menopausal women. Recognition was also higher in women with one year menopausal then the other group. Recognition of words is one's ability to recognize earlier learned words along with the distracters. Low score in five year group show decline in memory and attentional processes. Finding suggest that symptom of menopauses, the decline in hormone can cause memory and attention decline resulting in on the whole decline in cognition (Greendale et al., 2009). In a study done by Jil M.Goldstein in 2021, showed women in menopause phase performed bad in their verbal memory test, yet they had showed performance better than men in their post puberty phase. Menopause and its effect on Verbal Memory a research by Mary D Sammel et al in 2015 did this study. Cognitive complaints were there in post menopause women but it's an hot topic that these declines are due aging or cognitive decline. This study was a 15 year long, longitudinal study in which their behavior, endocrine and cognitive measurements were done in their pre and post menopause. They used Selective reminding analysis, digit symbol tasks and symbol copy task to assess their domains. A total sample of 200 women was included. They found that women in their post menopauses period performed worse on thesis tests and showed decreased level of verbal memory, verbal recall and cognitive inflexibility.

CHAPTER 7: CONCLUSION, LIMITATION, IMPLICATION, FUTURE DIRECTION

7.1 COCLUSION

The study's goal was to observe menopause-related cognitive deterioration in women. The Stroop test, the Wisconsin card sorting exam, and Rey's auditory verbal memory test were all used in this investigation. In every test, the results revealed a substantial disparity between the two groups. In verbal memory, cognitive flexibility, and selective attention, the women who experienced menopause for a year fared better.

7.2 LIMITATION

The sample for this study was taken simply from Patiala district. So, the findings couldn’t be generalized to a larger population. Most of the sample consists of women from urban area with middle or higher socio-economic status and not much representation is given to women from rural areas or low socio-economic status.

7.3 IMPLICATION

The study provides us with insight into the progression of cognitive decline in menopausal women. It can be helpful in development of cognitive training and rehabilitation programs with the aim of assisting to decrease the cognitive decline. The study helps in creating awareness about the effects of menopause on cognition.

7.4 FUTURE DIRECTION

In future studies longitudinal research design can be used for the in-depth study into the gradual progression of cognitive decline in menopausal women. Sample from different regions can be

taken for the study. Women from different socio-demographic status can be included in the future studies to increase representation.

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APPENDIX A: CONSENT FORM

Dear Participant,

You are invited to participate in a research study conducted by Aekam Mandaher, a master's candidate in Psychology at Thapar Institute of Engineering and Technology, Patiala. The purpose of this study is to assess cognitive functions in post-menopausal women.

Before you decide to participate, it is important that you understand the purpose of the study, what your participation will involve, and any risks or benefits. Please read the following information carefully and feel free to ask any questions you may have.

Purpose of the Study is to assess and compare cognitive functions in women who have been menopausal for 1 year and those who have been menopausal for 5 years.

Risks and Benefits:

- There are no significant risks associated with this study. However, some participants might experience slight discomfort during the memory tests.
- There are no direct benefits to you from participating in this study. However, your participation will contribute to a better understanding of cognitive changes in post-menopausal women.

Confidentiality:

- Your responses will be kept confidential and used only for research purposes.
- Data will be stored securely and only accessible to the investigator.

- Your name or any other identifying information will not be used in any reports or publications resulting from this study.

Voluntary Participation:

- Your participation in this study is entirely voluntary.
- You are free to withdraw from the study at any time without any penalty or loss of benefits to which you are otherwise entitled.

Consent: By signing below, you acknowledge that you have read and understood the information provided above, and you voluntarily agree to participate in this study. You understand that you may withdraw from the study at any time without penalty.

Participant's Name:

Participant's Signature:

Date:

Thank you for your participation.

Aekam Mandaher

Master's Candidate in Psychology

Thapar Institute of Engineering and Technology, Patiala

APPENDIX B: REY'S AUDITORY VERBAL LERANING TEST

NIMHANS NEUROPSYCHOLOGY BATTERY -2004

MANUAL

Appendix

AUDITORY – VERBAL LEARNING TEST

DATE:

Hindi Version

	LIST-A	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5	LIST-B		IR - A	DR-A	Recognition
1	Arm						Shoes				Mirror
2	Cat						Monkey				**Hammer**
3	Axe						Bowl				**Knife**
4	Bed						Cow				Candle
5	Plane						Finger				Motorcycle
6	Ear						Dress				**Axe**
7	Dog						Spider				**Clock**
8	Hammer						Cup				**Chair**
9	Chair						Bee				**Plane**
10	Car						Foot				Turtle
11	Eye						Hat				Leg
12	Horse						Butterfly				**Dog**
13	Knife						Kettle				Table
14	Clock						Mouse				**Cat**
15	Bike						Hand				Lips
											Tree
											Arm
											Nose
											Sun
											Truck
											Eye
											Fish
											Ear
											Horse
											Bike
											Bus
											Bed
											Car

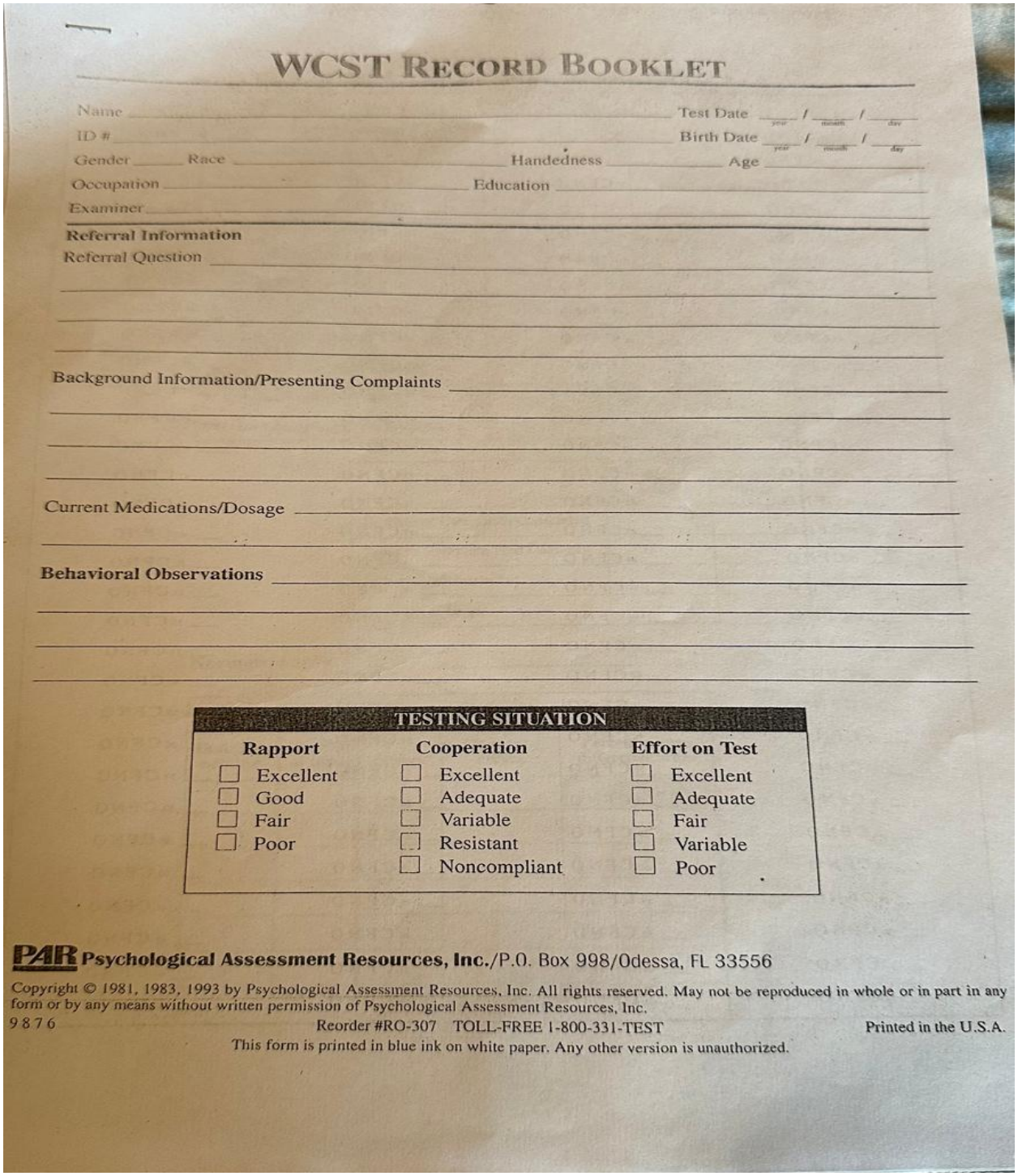
TOTAL SCORES

TRIAL 1	TRIAL 2	TRIAL 3	TRIAL 4	TRIAL 5	LIST B	IR-A	DR	RECOGNITION	
								HITS	
								OMMISSION	
								COMMISSION	

APPENDIX C: STROOP TEST

Red	Yellow	Blue	Green	Black
Pink	Orange	Brown	Gray	Purple
Green	Gray	Black	Blue	Yellow
Gray	Brown	Pink	Orange	Blue
Yellow	Red	Green	Black	Gray
Black	Brown	Purple	Orange	Pink
Purple	Black	Yellow	Red	Green
Orange	Pink	Brown	Gray	Purple

APPENDIX D: Wisconsin card sorting test (WCST)



WCST Record Booklet

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Examiner _____

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Referral Question _____

Background Information/Presenting Complaints _____

Current Medications/Dosage _____

Behavioral Observations _____

TESTING SITUATION

Rapport	Cooperation	Effort on Test
☐ Excellent	☐ Excellent	☐ Excellent
☐ Good	☐ Adequate	☐ Adequate
☐ Fair	☐ Variable	☐ Fair
☐ Poor	☐ Resistant	☐ Variable
	☐ Noncompliant	☐ Poor

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Scoring Area

	Raw score	Standard score	T score	Percentile score
Number of Trials Administered				
Total Number Correct				
Total Number of Errors				
Percent Errors				
Perseverative Responses				
Percent Perseverative Responses				
Perseverative Errors				
Percent Perseverative Errors				
Nonperseverative Errors				
Percent Nonperseverative Errors				
Conceptual Level Responses				
Percent Conceptual Level Responses				

	Raw score	Percentile range
Number of Categories Completed		
Trials to Complete First Category		
Failure to Maintain Set		
Learning to Learn		

Normative table _____

Learning to Learn Score Worksheet				
Category number	**Number of trials**	**Errors**	**Percent errors**	**Percent errors difference score**
1				
2				
3				
4				
5				
6				
Average difference				