

Assessing Planning Function in Alzheimer's Patients

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Received:16/12/2025; Accepted:13/04/2026; Published: 16/06/2026

Abstract:

The study aims to evaluate one of the most important executive functions, which is the planning function, in Alzheimer's patients in both the first and second stages of the disease. This is done by applying several tools such as the semi-structured interview and the Brief Mental State Examination (MMSE), in addition to applying the Tower of London test to test the planning function. This is done on a sample of (2) elderly people aged between (76-78 years) with Alzheimer's. We used the case study approach to delve deeper into the condition of the patients, and the results of applying the tests and the clinical interview showed that the Alzheimer's patient suffers from a disruption in the planning function, and the results were similar in both the first and second stages, which we attributed, according to the current study, to the environment in which the elderly person lives, which is considered the main indicator in this study.

Keywords: Alzheimer's, Executive functions, Planning.

Introduction:

Aging is considered a stage of growth that a person must reach during the course of his normal life. However, this late stage of human life may be accompanied by several diseases and imbalances in his health, whether physical or neurological. Alzheimer's disease is considered one of the disorders that are classified as degenerative diseases because it causes the death and gradual atrophy of nerve cells as a result of the intensive spread of senile plaques. It is also one of the diseases that develops in a hidden and slow manner, as the patient shows several hidden cognitive disorders that become more severe as the disease progresses, which are represented in forgetfulness, lack of concentration, memory disorders, in addition to the loss of some independence and lack of sleep, The patient also suffers from a disorder in executive functions, which refers to a set of higher mental processes that allow an individual to organize their behavior and direct their thinking to achieve a specific goal. These functions either work in an integrated manner or are divided into separate sub-abilities to perform other tasks depending on the nature of the task. They include working memory, problem-solving, programming, and execution. Through our study, we focused on the planning function, which means putting in place organized steps in advance in order to accomplish a specific goal.

The problem:

Executive function refers to a broad cognitive process used to guide behavior, specifically in situations where some responses must be suppressed and others initiated. It includes components of various cognitive processes such as planning, goal persistence, cognitive flexibility, abstract reasoning, and rule acquisition (Baltruschat & et al., 2011). Executive

function develops as a child grows and declines with age. Executive functions are impaired in degenerative diseases such as Parkinson's, Alzheimer's, multiple sclerosis, and others.

According to the cognitive approach of TRAYKOV et al. (2002), Alzheimer's patients suffer from many cognitive difficulties, primarily memory on the one hand and executive function difficulties on the other. The cognitive difficulties of memory of all kinds and language disorders have received a large share of studies and research compared to executive functions. The latter have been studied from several aspects, but the planning function has been rarely studied in degenerative diseases in general. Ben Aarab (2012) addressed, within the framework of a master's thesis, the evaluation of executive functions in Alzheimer's patients in the primary stage. The results showed a deficit in three executive functions, namely mental flexibility, updating, and inhibition, but it did not address the planning function in the study.

While Jaafar Sharif studied the role of neuropsychological counseling in the early diagnosis of Alzheimer's disease and the position of the neuropsychologist within the multidisciplinary team, the sample consisted of four patients with early-stage Alzheimer's disease in an Algerian hospital setting. She employed a clinical approach using a case study methodology, utilizing a range of neuropsychological tests and a set of executive function tests, including the Luria de Sequences test to measure programming (the ability to plan coordinated behavior) and the Reverse Instruction test to measure working memory and motor planning as a prelude to the following instruction. The results showed that planning problems were minor in the early stages of the disease, with mild impairment recorded in two cases and moderate impairment in the remaining two. (Jaafar Sharif, 2024).

AMBRE PIQUART et al. (2004) studied planning and daily activities in Alzheimer's patients and patients with frontotemporal degeneration. The study aimed to compare the links between difficulties in daily living and planning deficits in cases with frontotemporal dementia and cases with Alzheimer's disease. Methodologically, a comparison was made between 11 patients with frontotemporal degeneration and 11 cases with Alzheimer's who were likely in the same stage of the disease, and there were 29 cases as a control group. Mental status was assessed by the DRSM and MMSE. As for daily living activities, they were examined by filling out 3 questionnaires by the partner or caregiver of the patient. As for planning, it was carried out by the Tower of London test and three tests derived from the BADS battery, which are key search, The zoo map and the six elements. The results showed no quantitative differences between patients with frontotemporal dementia and Alzheimer's patients in assessments of daily living, planning tests, or daily living activity questionnaires, and the results were correlated with the severity of cognitive deficits. The results suggest that standard planning tests cannot adequately detect planning disorders.

Also, in the context of comparing planning in normal old age and in Alzheimer's patients, Amieva (2004) studied thinking flexibility and formulation planning abilities, and the results indicated that Alzheimer's patients fail to maintain a mental work plan and are easily distracted due to the absence of cognitive inhibition abilities, which makes multi-step planning impossible for them compared to healthy elderly people.

In a study by P. ALLAIN et al. (2007) entitled "Action Planning Study Using the Zoo Map Test in Alzheimer's Patients," the two components of planning—formulation of the plan and execution of the action—were examined. The Zoo Map Test was administered to 18

Alzheimer's patients and 15 healthy individuals as a control group. The results showed statistically significant differences in favor of the control group in all performance evaluation criteria (time, sequence score, errors). The planning difficulties in Alzheimer's patients were mainly related to behavioral changes (motivation and drive) observed by the patients' relatives in daily life.

While several studies have confirmed that planning disorder appears from the early stages of the disease, such as the study by researchers PERRY and HODDGES (1999), which concluded that there is a weakness in the abilities of Alzheimer's patients to plan for the future or organize the steps necessary to complete a simple task such as preparing a meal or scheduling an appointment, and that this planning disorder is one of the early indicators of the disease and this occurs even before the deterioration of long-term memory.

In the same context, Albert and others (1996) in their study of planning in Alzheimer's disease found an early and clear deficit in sequential planning tasks through the use of the Tower of London test, and the results proved that the defect is linked to atrophy of the frontal lobe and the neural networks associated with it.

Through what was presented, we found studies that confirm that planning disorder appears from the beginning of the disease, and other studies indicate a delayed appearance of planning disorder from the early stages. Based on this controversy and the lack of local studies that dealt with the function of planning in Alzheimer's disease, we wanted to address this topic with research, and accordingly we formulate the following questions and hypotheses:

Does Alzheimer's disease cause impaired planning function?

Questions:

- Does a patient with early-stage Alzheimer's disease cause impaired planning function?
- Does a patient with early-stage Alzheimer's disease cause impaired planning function?

General Hypothesis:

- A patient with Alzheimer's disease causes impaired planning function.

Hypotheses:

- A patient with early-stage Alzheimer's disease causes impaired planning function.
- A patient with early-stage Alzheimer's disease causes impaired planning function.

Significance of the Study:

The significance of this study stems from the age group it addresses—old age—a stage often accompanied by several diseases that exacerbate its complexity and sensitivity. We have attempted to examine the first and second stages of Alzheimer's disease to determine the extent of impairment in executive functions, particularly planning.

Objectives of the Study:

- To determine if individuals with Alzheimer's disease in the first stage experience impaired planning function.
- To determine if individuals with Alzheimer's disease in the second stage experience impaired planning function.
- To determine if there is a difference between the first and second stages of Alzheimer's disease in planning function.

Définition of Key Concepts:

Alzheimer's:

Technically: It is the degeneration of brain cells, gradually progressing to brain shrinkage and eventually neuronal loss if intervention is not implemented in the early stages. The disease occurs as a result of psychological conditions, traumas, or external factors that exceed the brain's capacity. Negative charges are not discharged from nerve cells at the appropriate time, which affects the brain's structure and function, leading the patient to experience various symptoms. (Fatiha Wahiba, Khalida Yaalaoui 2018)

Procedurally: It is a type of dementia that begins with memory disturbances resulting from damage to the medial temporal structures, particularly the hippocampus. The symptoms worsen as the association areas of the neocortex are affected, leading to cognitive decline.

Planning:

Technically: It is the function of ensuring the organization (arranging) of the various intermediate states necessary to execute a task.

(Darbil and Darqini: 2021, p. 333).

Operationally: It refers to the results obtained by the sample of Alzheimer's patients in the Tower of London test.

Conceptual Framework:

Definition of Alzheimer's: It is a memory disorder accompanied by other cognitive impairments that have a significant impact on an individual's daily life. According to the French Ministry of Solidarity and Health, Alzheimer's is a neurodegenerative disease and a developmental neurological injury that leads to the death of nerve cells. It is characterized by a gradual loss of memory and some mental functions. (Kamilia Sider, Zainab Shatibi: 2022, p. 17).

According to the World Health Organization, Alzheimer's is characterized by a decline in cognitive functions (i.e., the ability to think) at a rate greater than expected in normal old age. It occurs due to a variety of brain diseases that affect memory, thinking, behavior, and the ability to perform daily activities.

(World Health Organization: 2017, p. 1)

Alzheimer's disease is classified as a degenerative form of dementia, meaning it is a neurodegenerative disease of the central nervous system characterized by a progressive and continuous decline in cognitive functions and specific brain lesions.

The primary neurological lesions in Alzheimer's disease include significant amyloid deposits, senescent plaques, and neurofibrillary tangles, along with the loss of nerve cells and synapses. (Ben Arab Asia, 2011, p. 20) The progression of Alzheimer's disease: The disease stages can be divided, based on the Mini-Mental State Examination (MMSE), into.

Stage 1 MMSE score greater than 20 :

It lasts from two to four years, and this stage is characterized by loss of speech while speaking, in addition to losing objects and forgetting the place in which they were placed. He also appears indifferent and has difficulty performing usual duties at home or work. It also takes a longer time to complete tasks and the appearance of mood disturbances, in addition to a lack of concentration and attention.

The second phase MMSE between 10-20:

It extends from 2 to 6 years, and this phase is characterized by negative relapses, and the overall symptoms that were in the first phase increase in severity and severity, as severe disturbances in memory and in temporal and spatial orientation appear clearly and clearly. The affected person also finds great difficulty in understanding and a clear imbalance in cognitive processes, with neglect of his personal hygiene and appearance, and he also forgets the names of his acquaintances.

Stage Three MMSE less than 10:

This stage extends from 2 to 4 years of age. During this time, various cognitive processes are disrupted, and the patient becomes dependent on others, unable to meet even their most basic needs. They also suffer from a complete impairment in spatial and temporal orientation, exhibit severe language and behavioral disorders, and may experience aphasia. They are often bedridden.

Executive Functions:

Executive functions encompass all processes involved in regulating and controlling behavior. Specifically, they are involved in managing non-routine situations that necessarily require development, evaluation, and implementation of a plan (and perhaps correction) to ultimately achieve a specific goal (Amer and Baghoul: 2018, p. 90).

Executive functions refer to a set of interrelated cognitive and behavioral skills responsible for purposeful, goal-oriented activity. They encompass the highest levels of human performance, such as intelligence, reasoning, self-control, and social interaction. More specifically, executive functions are responsible for coordinating activities related to achieving a goal, such as anticipating and selecting the goal, planning, initiating the activity, self-regulating, distributing attention, and utilizing feedback (Russell, 2012, p. 5).

Planning:

Planning involves the mental representations and practical execution of actions aimed at achieving a future goal. Current definitions indicate that planning requires the coordination of various interrelated cognitive and motivational processes. In this regard, Tranel showed us that planning requires internal abilities, including a precise assessment of (Where is the thing? Where must the thing be? What is the most effective strategy to move it from here to there?). Planning thus includes the ability to think about the future and generate various possible answers.

The difference between planning and problem solving:

Tunstall highlights the line between planning and problem solving, saying that although it is difficult to distinguish Between planning and problem solving in many situations (both seek to create a series of actions intentionally Solving a problem), but planning is often considered a limited term and is limited to events that They will take place in the future while problem solving may relate to past, present or future events, as well as Planning asks the question (How can something happen?) while the problem-solving process poses Other questions include (Why does something happen?) But despite all these distinctions, there is overlap between these two terms and most problem-solving research are closely related to planning (Qalfat: 2023, p. 15) .

Practical Aspect:

Methodology Used :

The descriptive method, specifically the case study approach, was used, as it was the most suitable for the study topic.

Sample:

The sample consisted of two individuals with Alzheimer's disease. The first case was in the second stage of the disease, i.e., at the onset of symptoms. This elderly man was 78 years old and lived at home with his children. The second case was in the first stage of the disease and was a 76-year-old man residing in a nursing home.

Study Tools:

1- Semi-Structured Interview: We conducted clinical interviews with those around the patient to gain a deeper understanding of the patient's condition, assess their psychological well-being, and learn about how they interact with them, their acceptance of the patient's health condition, their adherence to medical appointments, and their responsiveness to the patient's specific needs.

2 - Mental Status Scale MMSE :

It is a survey test to follow the development of the disease and evaluate cognitive functions such as attention and memory, as well as temporal and spatial orientation, spatial fluidity, and other cognitive processes. This test was prepared by (Folstien) and others in 1975. It consists of 11 items, which is equivalent to a full score of 30/30 points. It is scored by providing a point (1) for each correct answer and (0) for each incorrect answer. We must also take into account the age of the subject as well as his academic level, as it can The illiterate person's answer drops to 23/30.

3- Planning Test The Tower of London Test :

This test, derived from the Tower of Hanoi, consists of 12 problems of increasing difficulty. This means it involves an increasing number of stimulating transitions that must be planned. The examiner uses a device called the Tower of London, which consists of a wooden base arranged linearly with three posts of varying heights, and three balls of different colors. The largest post holds three balls, the middle one holds two, and the smallest one holds one. The examinee is given cards and informed of the number of moves allowed, and is told that they have three attempts in case of a mistake.

Where: Cards 1 and 2 require two moves. Cards 3 and 4 require three moves.

Cards 5 to 8 require eight moves. Cards 9 to 12 require five moves. Scoring: 3 points if successful on the first attempt.

2 points if successful on the second attempt.

1 point if successful on the third attempt.

0 points if unsuccessful on all three attempts. Therefore, the overall score for each individual is between 0/36 and 36/36. (Belkadi Nahed: 2025)

Adapting the Instrument to the Algerian Clinical Setting :

As part of her Master's thesis in Neuropsychology, researcher Chamoul Radhia adapted the test to the Algerian clinical setting by administering it to 30 cases to calculate the indices of self-validity (validity = root of reliability) and reliability using Spearman and Brown's split-half method (Chamoul Radhia: 2011, p. 90

Psychometric Properties :

Researchers Bouflih Zakia and Rabii Ferial recalculated the psychometric properties of the test by administering it to a sample of 30 typically developing children.

1- Estimating Reliability: The Guttman coefficient was used to estimate reliability because it does not require equal variance between the two parts of the test. This was done using SPSS version 27.

Coefficient de Guttman :

test	Number of shapes	The Guttman coefficient
Consistency of all tests	12	0.808

The overall score for the test is 0.808, indicating a high degree of reliability, thus making it acceptable for the current study

Test Validity Assessment:

Discriminatory validity (CVV) was assessed by comparing the lowest and highest scores of the test using an independent samples test (ISST) with SPSS version 27.

CVV Table for Discriminatory Validity :

grades	Number of individuals	Statistical significance value
Lower grades	10	0.000
Higher grades	10	

The table shows a statistical significance value of 0.000, which is less than the significance value of 0.05. Therefore, there is a statistically significant difference between the lowest and highest scores of the individuals, indicating that the test distinguishes between these two categories. (Bouflah Zakia, Rabii Ferial, 2025).

Results Presentation:

Case 1: (B, Mahmoud) is an elderly man who has been suffering from Alzheimer's disease for three and a half years. He is now 78 years old and lives at home with his wife, children, and grandchildren. According to the clinical interview, this case is characterized by the significant care and attention he receives from those around him. He is also literate and has memorized the Quran.

He has exhibited several symptoms of forgetfulness that have negatively impacted his independence and daily life. These recurring forgetfulness symptoms include: - Forgetting the names of those around him.

- Forgetting purchases made outside the home.
- Frequent getting lost in the street and in familiar places.
- Instantly forgetting news he was told or saw on television.
- Forgetting when to take his medication.
- Forgetting when to eat.

Results of the mental status assessment:

Case name	Degree	Percentage of success
Mahmoude	19/30	%63.33

Qualitative analysis :

The patient scored 19/30 on the MMSE test, which is equivalent to 63.33%. The patient was only able to recall one of the three previously learned words. As for spatial orientation, he scored 3 out of 5. He was unable to perform mental arithmetic and could not continue with it. He received the same result in the recall section. In the naming section, he scored 2 out of 2. His results were average in the oral language section. Therefore, the test results indicated that he suffers from Alzheimer's disease in its second stage, which is consistent with the results of the brain imaging.

View the results of the Tower of London test :

Case name	Degree	Percentage of success
Mahmoude	19/36	52.77%

Quantitative analysis :

The table above represents the case results and percentages of success in the Tower of London test, where the first case obtained 19 points out of 36 with a percentage estimated at 52.77% in a time period between 30 mins and 35 mins.

Qualitative analysis :

In the table above, we note the results of the cases obtained in the Tower of London test, which consists of 12 cards. The examinee inserts 3 balls of different colors into three columns of different lengths according to the desired shape. Here, the first case encountered difficulty with most of the cards, as it made many attempts and ultimately failed, with errors in cards 5 and 6. This is due to the lack of good planning and the difficulty of executing the tasks. Also, the case took a long time thinking and was confused, and did not remember the information and instructions provided.

Case Two: (M. Rashid) is an elderly man who has been diagnosed with Alzheimer's disease for approximately four years. He is now 76 years old and resides in a nursing home. He is in the early stages of the disease and is bilingual, able to read and write in both French and Arabic.

He has been experiencing symptoms of forgetfulness that have affected his independence. Some of the recurring symptoms include:

Forgetting the names of his grandchildren.

Forgetting when to take his medication.

Forgetting the names of his relatives.

Instantly forgetting the last news he saw on television.

Results of the Mental State Examination Test: MMSE for the second case

Case name	Degree	Percentage of success
Rachide	24/30	80%

Qualitative analysis :

The patient scored 24/30 on the MMSE test, which is equivalent to 80%. The patient was able to answer about spatial orientation and obtained the full mark. In the storage section, the patient was able to retrieve one word from the three previously learned words. She was also unable to find a single result regarding attention and mental arithmetic. She also obtained the full mark regarding naming and understanding spoken and written language. The test results indicated that he suffers from Alzheimer's disease in its second stage, which is consistent with the results of brain imaging.

:Presenting the results of the Tower of London test for the second case :

Case name	Degree	Percentage of success
Rachide	20/36	55.55%

Quantitative analysis: -

The table above represents the results of the five cases and the percentages of success in the Tower of London test, where the first case obtained 20 points out of 36 with a percentage estimated at 55.55% in a time period between 30 to 35 minutes.

Qualitative Analysis:

In the table above, we note the results of the cases obtained in the Tower of London test, which consists of 12 cards in which the examinee inserts 3 balls of different colors into three columns of different lengths according to the desired shape. The second case had difficulty understanding the method by which it should be done, which made us repeat the explanation on each card. Also, the examinee's execution of the instruction was very slow and hesitant, and his gaze was filled with confusion.

Discussion of Hypotheses :

General Hypothesis: The general hypothesis states that individuals with Alzheimer's disease suffer from impaired planning function.

By applying the planning test to both groups, it was found that there is an impairment in planning function in individuals with Alzheimer's disease. This was confirmed by the study (Recarda Groug and Valentina Lodera 2018), which aimed to assess the planning ability of individuals with Alzheimer's disease. The results concluded that there are statistically significant differences between Alzheimer's patients and the control group in planning function, meaning that Alzheimer's disease contributes to weakening planning function in particular.

Discussion of the first hypothesis:

The hypothesis states that individuals with early-stage Alzheimer's disease experience impairment in their planning function. In the early stages of Alzheimer's, the individual may have difficulty remembering current events, close contacts, or the location of objects and belongings. However, they can still perform their daily activities independently or with minimal family support. Administering the planning test to the second individual, who also had early-stage Alzheimer's, revealed a problem and decline in their planning function, with a success rate of approximately 55.55%. This indicates a slight impairment in this function, specifically in setting goals and outlining the necessary steps and procedures to achieve a specific outcome,

This means that the primary symptom at this stage is memory impairment, where executive functions begin to be affected. This highlights that the patient has not completely failed in the planning task. Although Alzheimer's is associated with the deterioration of the temporal lobe, the neural networks connected to the prefrontal cortex, which are responsible for executive functions, begin to be affected gradually. The damage initially occurs in the hippocampus and is usually associated with areas related to memory and difficulty recalling recent events. Since planning is an executive function that relies primarily on the prefrontal cortex, in the first stage, the damage has not yet reached this area significantly. Therefore, we did not observe a major impact on planning. However, the time taken to execute the task was considerable compared to the time it would take an average elderly person without Alzheimer's. This was addressed in the study by Green and All (1995), which examined the detection of executive function impairment at a very early stage of Alzheimer's compared to healthy elderly individuals. The results revealed an early decline in executive function performance during the initial stages of the disease. Patients showed particular deficits in tests that require the execution and processing of multiple pieces of information simultaneously, as well as in In this early stage of the disease, the abilities of the Alzheimer's patient to form verbal concepts are less affected.

Discussion of the second hypothesis:

This hypothesis states that individuals with Alzheimer's disease in the second stage suffer from impaired planning function.

The middle stage of Alzheimer's is characterized by a decline in daily activities and social and personal apathy. At this stage, he cannot even adjust or coordinate his clothes or personal belongings. He may forget how to perform the simplest tasks such as brushing his teeth or combing his hair. He also becomes unable to think or speak clearly, or even read and write. By applying the planning test to the second case, which was suffering from Alzheimer's in its second stage, it became clear that there was a slight decline in the planning function, as the success rate in the Tower of London test ranged around 52.77%. Although the planning function is mainly related to the frontal and parietal lobes, which are responsible for executive organization and controlling behavior, the time taken and the wandering had the greatest share in applying the test items. The patient would wander a lot during the application, and we would try each time to bring him back to the content of the test. As confirmed by the study (Lotfi 2017), the disruption of executive functions that Alzheimer's patients suffer from makes them similar to the mentally retarded.

What distinguished this particular case was the percentage obtained in the planning test, which was relatively close to the case of someone suffering from Alzheimer's in its first stage, knowing that the case lives with her family and enjoys great attention and care from all family members, and enjoys great social interaction, which suggests that this is the reason for the lack of great deterioration in executive processes and functions. This was confirmed by the study (Valori 2005), which aimed to identify social interaction and cognitive functions in Alzheimer's patients. The results of her study concluded that elderly women who enjoy weak social interaction developed Alzheimer's disease, and their percentage was large compared to elderly women who have good social interaction.

General conclusion :

By applying the Tower of London test to the two samples, it was found that the person suffering from Alzheimer's disease has impaired planning function

However, according to this study, the test results were close between the first and second cases, and this convergence in results may be due to the results of the clinical interview that we conducted with those around both cases, which showed the psychological, moral, and emotional support that the first case experiences, which lives near its children and among its grandchildren. Perhaps the family atmosphere was a factor inhibiting the development of the disease and the rapid deterioration of its executive functions. As stated by Al-Qa'im, one of the sons of the elderly person taking care of him, that his father "is the holder of the key to heaven, and even he did not ask for help and care. I know that he He needs my help and I will take care of him as if he were one of my children." Without forgetting that the case is that he has memorized the Book of God, which is another reason that could be a positive factor in the test results not deteriorating, and these results remain within the limits of the sample for this study.

Although the other case was in the first stage of the disease and although he was bilingual, which made him benefit from a cognitive reserve, his results were lower than those of the patient in the second stage. The rapid onset of his planning disorder may be attributed to the psychological conditions he lives in, as he resides in a nursing home and is not surrounded by family care. The results of the two study cases were consistent with the study by P. ALLAIN et al. (2007), which sees that planning difficulties in Alzheimer's patients are mainly related to behavioral changes (motivation and drive) that are observed by the patients' relatives in daily life.

Conclusion:

Despite the widespread prevalence of Alzheimer's disease and the abundance of related studies, research focusing on its integration with executive functions is limited, particularly in the Arab world, to the best of our knowledge. Therefore, in this study, we attempted to focus on evaluating executive functions in individuals with Alzheimer's, specifically the planning function, between the first and second stages of the disease. This function is crucial in an individual's daily life. To arrive at our research findings, we formulated the following hypotheses:

- Individuals with Alzheimer's in the first stage experience impairment in the planning function.
- Individuals with Alzheimer's in the second stage experience impairment in the planning function.

After applying the Tower of London test to the two subjects, it became clear that the two hypotheses were true, but the deterioration of executive functions was not complete in both cases, meaning that the cognitive functions of an Alzheimer's patient are not damaged immediately after his diagnosis, but rather are damaged partially. This was confirmed by the study conducted by Brooks et al. in 1996, a study aimed at trying to determine the time of the onset of disorders affecting executive functions in light of the developmental process of the disease by following up longitudinally on patients who were suffering from mild cognitive impairment, then the disorders developed into Alzheimer's disease, and comparing them to a

group of healthy elderly people, based on a battery of neuropsychological tests to assess memory and executive functions, in addition to brain imaging. The results showed that executive function disorders rank second after memory disorders, and they explain this by the presence of early damage to the neural communication network that connects the complex nervous system to the frontal lobe.

What was observed in this study is that the test results were similar between the two cases, despite the difference in the stage of the disease. The elderly person with stage two Alzheimer's lived with his family and grandchildren and enjoyed great care and attention. He was also a memorizer of the Quran. This led us to hypothesize that the brain of this individual was able to compensate for the neurological damage in order to maintain cognitive function through what is called cognitive reserve. The brain uses two mechanisms in this process: neurological efficiency (the brain has a high reserve that allows it to use neural networks more efficiently and with less effort) and neuroplasticity (which enables healthy areas of the brain to compensate for partially damaged areas). According to our current study, this is due to the warmth of family life and maintaining the patient's position within the family despite the cognitive decline he is experiencing. These surrounding factors will not cure the patient or prevent the onset of the disease, but they can delay the cognitive decline that the patient may reach. This is what several studies on the role of family care on the quality of life of the elderly have confirmed, such as the study by Belkadi Nahed (2024), which compared the quality of life of elderly people living with their families with the quality of life of elderly people living in nursing homes. The results concluded The higher quality of life for elderly people living with their families compared to those living in nursing homes. (Nahed Belkadi: 2025)

In light of the findings of our study, we offer some suggestions and recommendations that can contribute to greater attention being paid to this field and the formulation of research hypotheses that can address different aspects of the topic:

- Establishing centers specializing in developing executive functions and cognitive processes in the elderly.
- Establishing Quran memorization societies for the elderly.
- Establishing centers to teach the elderly new skills that enhance cognitive competence.
- Developing tests to assess executive functions that are adapted to the Algerian context.
- Conducting similar studies with larger samples to increase confidence in the results and the possibility of generalizing them or studying other functions in this group.
- Designing therapeutic programs to rehabilitate the functions of control, planning, and cognitive flexibility in Alzheimer's patients at various stages.

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