



# Characterization of memory in hospitalized adults and elderly

## Caracterização da memória de adultos e idosos hospitalizados

## Caracterización de la memoria en adultos y adultos mayores hospitalizados

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### **Abstract**

**Introduction:** memory alterations influence communication interfering in quality of life. **Purpose:** characterize the semantic, working and short-term memory in hospitalized adults and elderly patients. **Method:** thirty hospitalized adults and elderly in a regional hospital were submitted to memory tests: message recall, word and digits repetition (direct and reverse order), verbal fluency and phonological and semantic abstraction and semantic memory. **Results:** 76.7% of patients had some difficulty recalling the message. A median score in repetition test was verified: 5.5 for words, 5.0 to digits in direct order and 4,0 to digits in reverse order. Verbal Fluency Semantic and Phonological proved to be correlated. In abstraction and semantic memory task data indicated more difficulty in proverbs interpretation. **Conclusion:** a significant number of hospitalized patients demonstrated difficulties in memory tests.

**Keywords:** Memory; Communication; Hospitalization; Speech, Language and Hearing Sciences.

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## Resumo

**Introdução:** as alterações de memória podem influenciar a comunicação interferindo assim na qualidade de vida do indivíduo. **Objetivo:** caracterizar a memória semântica, memória operacional e de curto prazo em adultos e idosos hospitalizados. **Materiais e Método:** participaram trinta pacientes, adultos e idosos, internados na ala de clínica médica de um Hospital Regional. Todos foram submetidos às provas de recordação de um recado, repetição de palavra e dígitos (ordem direta e inversa), fluência verbal semântica e fonológica e à prova de abstração e memória semântica. **Resultados:** 76,7% dos pacientes apresentaram alguma dificuldade na recordação do recado. A mediana de pontuação na prova de repetição foi 5,5 para palavras, 5,0 para dígitos e 4,0 para dígitos na ordem inversa. A Fluência Verbal Semântica e Fonológica apresentaram-se relacionadas. Na tarefa de abstração e memória semântica a maior dificuldade foi na interpretação de provérbios populares. **Conclusão:** um número expressivo de pacientes apresentou dificuldade em alguma das provas de memória.

**Palavras-chave:** Memória; Comunicação; Hospitalização; Fonoaudiologia.

## Resumen

**Introducción:** las alteraciones en la memoria pueden influir en la comunicación y, de esta forma, interferir con la calidad de vida del individuo. **Objetivo:** caracterizar la memoria semántica, la memoria operacional y de corto plazo en adultos y adultos mayores hospitalizados. **Materiales y Método:** participaron treinta pacientes, adultos y adultos mayores, ingresados en la ala de clínica médica de un hospital regional. Todos fueron sometidos a test de recordación de un mensaje, repetición de palabras y dígitos (orden directa e inversa), fluidez verbal semántica y fonológica, y a prueba de abstracción y memoria semántica. **Resultados:** 76,7% de los pacientes tenía leve dificultad para recordar el mensaje. El promedio de puntuación en la prueba de repetición fue de 5,5 para palabras, 5,0 para dígitos y 4,0 para dígitos en orden inverso. La fluidez verbal semántica y la fonológica se presentaron correlacionadas. En la tarea de abstracción y memoria semántica la mayor dificultad fue la interpretación de proverbios populares. **Conclusión:** un número significativo de pacientes demostró dificultad en algunas de las pruebas de memoria.

**Palabras claves:** Memoria; Comunicación; Hospitalización; Fonoaudiología.

## Introduction

Memory, defined as the ability to modify a behavior according to previous experiences, involves processes such as coding, storage and retrieval of information and presents systems that are classified by both the type of information (its nature - explicit, implicit or operational / work ) and the time limit for the maintenance of this information (short and long term)<sup>1</sup>.

Short Term Memory is characterized by the ability to store small amount of information for a short time, from seconds to few minutes. However, these can be maintained for longer through the repetition of information<sup>2</sup>. Regarding its nature, operational memory or working memory fall within this category, however, this is completely different from other types of memory, because it is not simply a short-term memory. It allows information

to constantly reach the brain, to be analyzed and compared with pre-existing in long-term memory information, thus allowing the storage and temporary manipulation of the information needed to perform complex cognitive tasks<sup>3</sup>.

It is subdivided into components, and in the area of language, the most studied component is the phonological loop. For the evaluation of this type of memory, the recall of digits test (in the direct and reverse orders) and the repetition of pseudo words and not words are often used<sup>3,4</sup>.

The long-term memory corresponds to the memory stored for a long period of time, as well as for an indefinite period<sup>1</sup>. This system includes declarative or explicit memory and procedural or implicit memory. Declarative or explicit memory is linked to a knowledge system in which information is stored in order to remember or consciously recognize facts and events experienced, being evoked

according to the demand and can be subdivided into Episodic and Semantic<sup>5</sup>.

The Episodic refers to autobiographical memory, including content learned in a particular episode of time and space. This system contains information about the context in which an event occurred. Semantic memory, however, is independent of context and contains information about logical relations between environmental events, such as general concepts, language, facts, and functioning rules of the world. Many of which are explicitly accessible and are often evaluated through the semantics verbal fluency test<sup>5,6</sup>.

The procedural or implicit memory is characterized by performance and is acquired and consolidated by repetition, with learning being expressed by the improvement in performance, with difficulties to express it orally<sup>1,5,6</sup>.

Memory alterations are frequent complaints among the elderly and are present in more than 50% of this population<sup>7</sup>, with several processes and systems being impaired. The causes of these complaints can vary from a sharper perception of memory lapses, altered attention, medication effect and systemic diseases, alcohol abuse and depression, which can show a significant improvement through detection and early intervention. Even the dementia syndrome, in which there is an impairment of memory and of more than one other cognitive area (language, praxis, orientation, executive function, among others), is enough to interfere in the daily activities of the patient.

However, memory alterations are often underdiagnosed and, considering the importance of processes and memory systems for human communication, the present work aims to identify the changes in semantic, procedure and phonological memory in hospitalized adults and elderly.

## Method

The present study was approved by the Research Ethics Committee (CAAE 29046414.0.0000.5546), followed the ethical recommendations of resolution 496/2012 and was carried out in the infirmary of a University Hospital.

Thirty individuals of both sexes, hospitalized for more than 24 hours in the Clínica Médica infirmary, who refused the feeling of pain or discomfort during the tests and participated in the study, signing the Informed and Consent Term. Patients with a

lowered level of consciousness, with a diagnosis of psychic and neurological diseases, using calmatives or sedatives, and those who had to interrupt the procedure, or gave up the tests during the application, were excluded from the study.

For the data collection, an anamnesis was initially performed, with questions about the data identification, health history and specific difficulties caused by possible memory loss. Then, the patients were submitted to the memory evaluation tests, based on the Memory Assessment Protocol proposed by Capuano<sup>8</sup>, which consists only of verbal tasks to evaluate memory processes that influence language behavior. The tests were applied on the patient's own hospital bed, in the morning, after bathing and feeding.

For the evaluation of the short-term memory and the operational memory capacity, the Direct Order Digit (DO) and Reverse Order (RO) subtests of the Wechsler Memory Scale<sup>9</sup> and the Word Group Repetition tests were performed. In the Word Group Repetition test, the examiner issues ten groups of two to six words, with a variation in their length, which the patient should repeat immediately after the utterance. For each word correctly issued, 1 point was counted. In the Digit Repeat test, which consists of twenty series with increasing numbers of digits, the examiner asked the patient, in the first ten sequences, to repeat, immediately, in the same order (DO). In the following 10 sequences, the patient was asked to repeat immediately but in reverse order (RO). The number of correct answers was counted separately by series in direct and reverse order.

Also for the evaluation of operational memory, it was performed the Information Recall Test<sup>1</sup>, in which the patient is asked to memorize a message that would be required after ten minutes. In this period, other memory tests were applied, to make the mnemonic strategy of mental articulation of the information impossible to be memorized. After the stipulated time, the patient was asked about the number (five digits), the name and the place / object contained in the message, thus verifying the ability to retain information until they are used.

To evaluate the Verbal Fluency<sup>10</sup>, which assesses the ability to access the vocabulary from a given category, the Verbal Phonological Fluency test (VPF) was applied, in which the patient was asked to emit as many words as possible with the letter A in one minute, and the Semantic Verbal Flu-

ency test (SVF), in which the name of animals was requested. The emission was recorded, enabling the counting of the number of words per minute and, for general analysis, the number of words emitted in blocks of 15 seconds was counted. The patient was advised that he / she should not use derivations, as augmentative and diminutive, or proper names. For each word evoked, a point was counted.

Lastly, the test of abstraction and semantic memory was performed. Initially, they were asked about the similarity between two words. The patient was then asked to describe the meaning of a proverb and, finally, the patient had to identify the word that was not semantically related to the others. The number of correct answers was noted for each task.

The data were tabulated in an Excel® worksheet (Microsoft® Office package) for descriptive data analysis and processed by the SPSS® 15.0 for Windows. The Pearson's bivariate correlation test was used and a significance level of 5% ( $p$  value  $<0.05$ ) was considered. Values of  $R$  below 0.30 were considered as evidence of low correlation, between 0.41 and 0.59 with moderate correlation and, higher than 0.7, strong correlation<sup>11</sup>.

## Results

The sample of this study consisted of 30 subjects, distributed equally between gender, with an

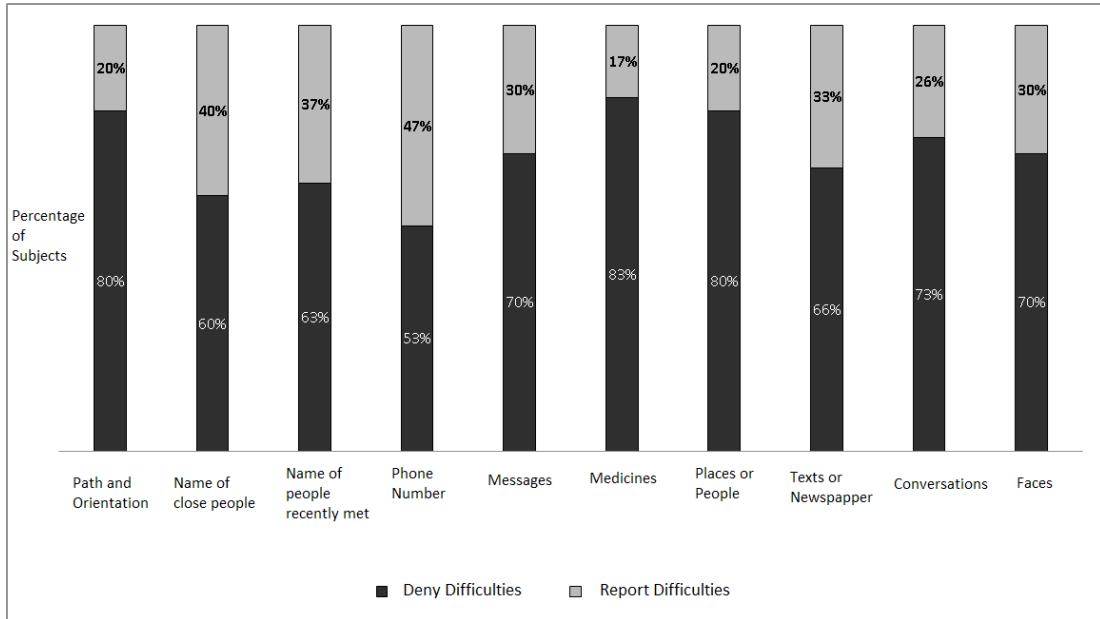
average age of 58.1 years old ( $SD \pm 16.2$ ). Ten patients (33.3%) were in the age range of 26-50 years old, five (16.7%) were 50-59 years old and 15 (50%) were 60 years old or older. As to schooling, ten subjects (33.3%) were not literate; fourteen (47%) attended, incompletely, the elementary school, two (7%) completed elementary education, three (10%) completed high school and one subject (3%) was college graduated.

Regarding the reason for hospitalization, eight subjects (26%) presented gastrointestinal or urinary problems, seven (24%) had cardiorespiratory alterations and fifteen (50%) were hospitalized due to various causes.

Figure 1 describes the specific memory difficulties reported by patients in the anamnesis.

More than half of the subjects (53%) stated that memory difficulties are progressive, while a low number of participants (11%) reported that the changes appeared abruptly. Eleven subjects (36%) did not know how to report this information. Regarding the impact of these changes on daily life, nine people (30%) stated that daily activities were affected by memory difficulties.

Figure 2 shows the results of recall of the context of the message, to evaluate operational memory, in which 76.7% of the patients presented some difficulty in remembering the message.



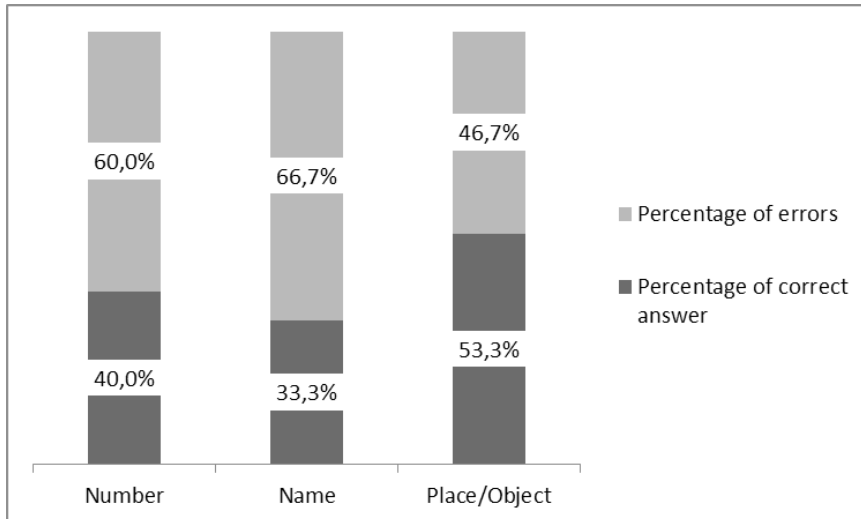
**Figure 1.** Percentage of subjects that denied or reported memory difficulties for different everyday situations.

Figure 3 presents the distribution of the values in the repetition tests of words and digits in DO and RO.

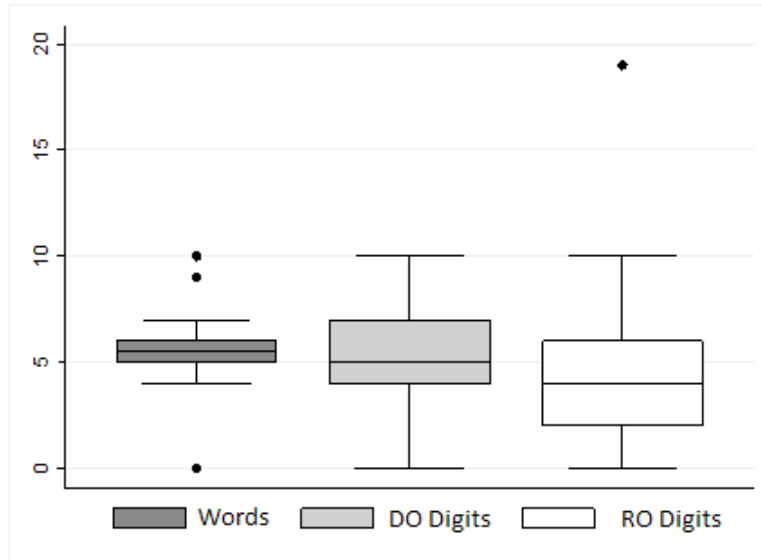
The Pearson's correlation test analyzed the correlation between these tests and obtained 0,5 for the p-value, regarding the three possible combina-

tions (Words / DO Digits, Words / RO Digits, DO Digit / RO Digits).

Figure 4 presents the performance of the subjects in the SVF and VPF tasks, and it was possible to verify that the subjects presented a better performance in the semantic category.

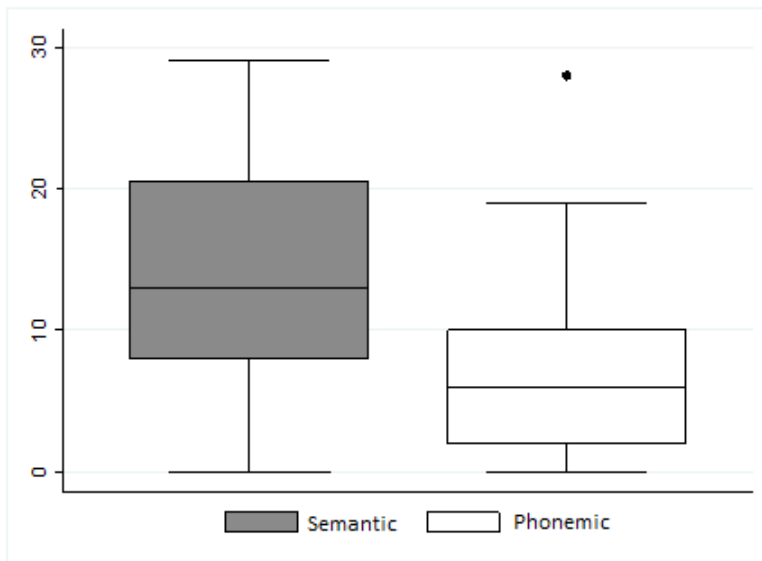


**Figure 2.** Recall, after 10 minutes, of the number, name and place / object contained in the message.



\* Discrepant values, higher or lower.

**Figure 3.** Description of the performance of the subjects in the word repetition tests, of digits in direct order (DO) and reverse order (RO). The vertical axis indicates the number of correct answers.

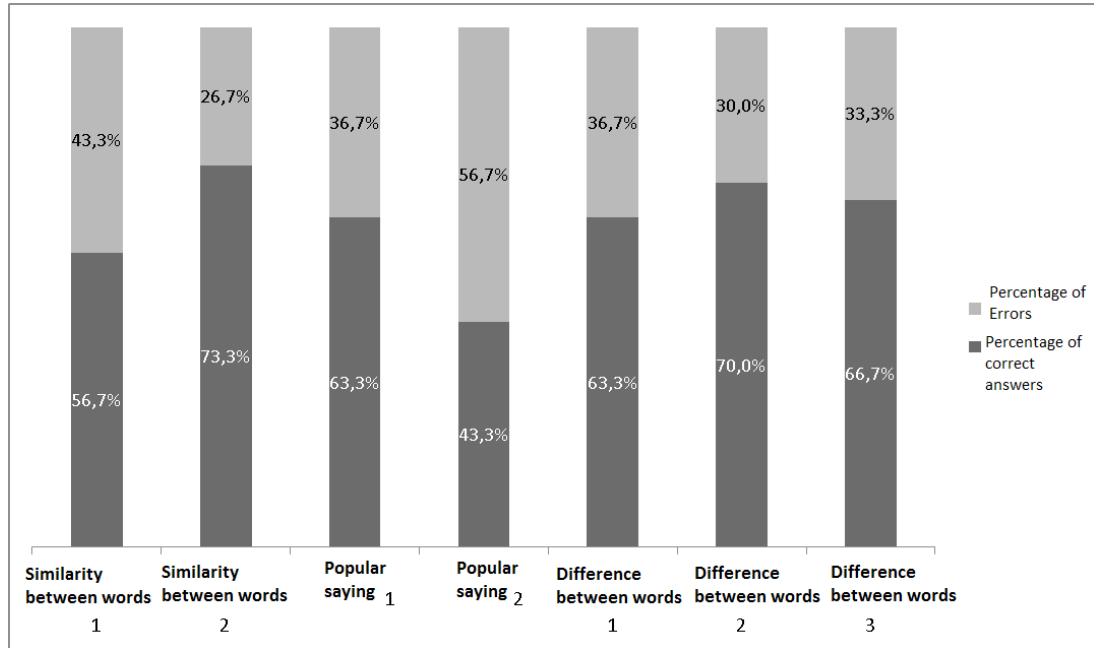


**Figure 4.** Description of the subjects' performance in the verbal fluency test. The vertical axis indicates the number of words evoked.\* Superior discrepant value.

The correlation between the various tests of repetition of digits and words and the tasks of verbal fluency were also performed.

When comparing the results of SVF with VPF, there was a moderate correlation ( $R = 0.6$ ,  $p < 0.01$ ). The results of DO and RO digit repetition were also moderately correlated ( $R = 0.5$ ,  $p < 0.01$ ).

Figure 5 presents the performance of patients in the tests of abstraction and semantic memory, with the greatest difficulty being the interpretation of popular proverbs.



**Figure 5.** Frequency of performance in the abstraction and semantic memory tests

## Discussion

Analyzing in general the expressive number of patients, in this research, who presented semantic, procedural and operational memory alterations, it becomes possible to discuss some probable causes for the findings presented.

The low level of schooling of the sample studied may have influenced the performance of the tests, since several studies indicate the influence of schooling on memory test performances<sup>12-15</sup>. It is also known that, regarding elderly, there is a decrease in mnemonic capacities<sup>16,17</sup> and, in addition, another important factor to be highlighted is the fact that the patients are hospitalized at the moment of the evaluation. This can lead to transient stress and / or depression, associated with memory complaints in the elderly<sup>18,19</sup>. However, it is extremely important to characterize if the memory deficits found indicate cognitive degenerations and, for this, more detailed studies should be performed.

It is known that the changes that characterize dementia are sufficiently serious to interfere in work and social activities, since they influence memory, judgment, concentration, communication, language, personality, passivity, among others<sup>14,20</sup>. In this study, although the patients were

not hospitalized due to cognitive or neurological alterations, an important finding is that 30% of the participants reported that memory difficulties are capable of affecting their daily activities. And, in the Recall of Messages test, the smaller percentages of correctness were in the memory of names and numbers. This can be explained by the difficulty of establishing clues and strategies for recalling numbers and names, in comparison with place / object recall.

Specifically in the Digit Repetition test, the subjects of the research obtained more errors in the reverse order repetition of digits test. A similar fact was observed in other studies<sup>21,22</sup>, in which, in all age groups, there was more memorization of numbers in the direct order than in the reverse order. Although the subjects presented worse results in the repetition in reverse order, in this research a moderate correlation between this finding and the repetition in direct order was identified. This indicates that even with different numbers of correct answers, the two results seem to be related, that is, a poor performance in one test often comes with another poor performance in the other test.

The SVF test provides information about the storage capacity of the semantic memory system, the ability to recover information stored in

memory and the processing of executive functions, especially those involved in the ability to organize thinking and the strategies used to search for words. It requires greater activation of the temporal lobe regions and depends on the access and integrity of semantic memory, which is a component of long-term memory that contains the permanent representation of our knowledge about objects, facts and concepts, as well as words and their meanings<sup>17</sup>.

In VPF also occurs a greater activation of the frontal lobe. The differences are attributed to the different strategies used during this task. The search process is less automatic and requires the creation of unusual strategies, based primarily on lexical representations, since generating words based in the orthographic criterion is not a task usually performed by people<sup>24</sup>. Also, regarding the quantitative differences normally observed between the performances of Semantic and Phonological Verbal Fluency, it may reflect basic structural differences in the representations of memory, since in the semantic test, the subject follows a hierarchical organization in the memory, divided into subcategories, and there is no such organization in the phonological fluency.

Due to this, it is expected a greater difficulty in evoking words in the VPF test than in the SVF, as well as for the findings of this research, justifying the smaller number of words evoked in the unit of time stipulated, as observed in other studies<sup>15,23</sup>. Furthermore, most of the subjects in the research are not literate, which, for Abwender and collaborators<sup>23</sup>, can influence the performance, since less educated individuals have a more restricted vocabulary, regarding graduated individuals.

Although the results of this research evidenced a discrepancy between the number of words evoked in the two tests of verbal fluency, it was observed that the two results are moderately correlated, which means that low results in one predicts the same findings in the other, even with different final absolute numbers.

However, in the tests of abstraction and semantic memory, the questions about the similarity and the difference between the two evaluate the semantic categorization. In these tests, it was observed that the highest error rate was concentrated in the similarity between the words “Vinho e Laranja” – wine and orange juice –, perhaps due to the novelty of the evidence. In the test of understanding proverbs, in addition to linguistic

knowledge, it is necessary for the individual to enlist other knowledge contained in collective, cultural, semantic, autobiographical, operational, episodic, and discursive long-term memory<sup>24</sup>. This may explain the high error rate (56.7%) in the interpretation of the popular saying “água mole em pedra dura tanto bate até que fura” - “soft water in hard stone, a lot of hits, until it sticks”. In a previous study, with a similar population, that is, hospitalized adults and elderly, it was observed greater difficulty in the tests involving auditory comprehension, as well as semantic access<sup>25</sup>.

The expressive number of patients with memory impairment found in this study demonstrates the need for cognitive assessments in hospitalized individuals, regardless of the reason for hospitalization, reinforcing the importance in training health professionals capable of multidimensional assessment of both hospitalized patients and their care network<sup>26</sup>.

This happens because the identification of memory changes in hospitalized patients will directly influence the relationship between the health team and the patient, often requiring the development of strategies to facilitate therapeutic communication and training of caregivers, thus contributing to comprehensive care and promotion of quality of life after hospital discharge.

However, the concepts of study, as well as the longitudinal studies, of Coorte, that could accompany the subjects would be of extreme importance, in order to ascertain if the damages are temporary or not, due to the hospitalization. Besides that, researches with a control group, a greater number of subjects, and an assessment of auditory acuity can corroborate with the findings of this research, considering that in recent studies it has been observed that when the acoustic information received is lowered, it is more vulnerable to forgetfulness, especially in the elderly<sup>27</sup>.

## Conclusion

An expressive number of hospitalized patients with semantic, procedural and operational memory changes were observed, demonstrating that other studies in this area are necessary to clarify all the variables that may have influenced these findings and to relate them to possible language alterations.



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