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Games and stroke: perspectives of occupational therapy in the field of neuropsychological rehabilitation

Jogos e acidente vascular cerebral: perspectivas da terapia ocupacional no campo da reabilitação neuropsicológica

Juegos e accidente cerebrovascular: perspectivas de la terapia ocupacional en el ámbito de la rehabilitación neuropsicológica

Fernanda Castro Feitosa[1], Glória Gomes dos Santos[2], Suelem Pereira Santos[2]
Ápio Ricardo Nazareth Dias[3], Camila Nunes da Silva[4], Alna Carolina Mendes Paranhos[3]

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Objective: to evaluate the effectiveness of educational games as a neuropsychological rehabilitation resource in people affected by stroke. **Methods:** pre-experimental clinical research of a single case, carried out between March 2017 and August 2018 at the Centro Especializado em Reabilitação, linked to the Universidade Estadual do Pará, PA, Brazil. The Montreal Cognitive Assessment was used to identify cognitive alterations and the Direct Assessment Fuctional Scale to detect functional alterations. Participants were divided into 3 groups, and each group received occupational therapy interventions twice a week, lasting 1 hour each, totaling 10 group sessions. The following games were used: *Jogo da mesada, Kaleidos, Super Lince, Bingo das letras*, *Hora certa e Un*. **Results:** eight men and six women participated. The age was 49.5 years (+8.7). Of these, six were included in Group 1, five in Group 2 and three in Group 3. The evaluation carried out with the MoCA showed that the cognitive domains that presented the greatest alterations were: memory, visuospatial and executive function, language and attention. There was a statistically significant increase in the total scores of the Direct Assessment Functional Scale (79.4+17.5 in the assessment to 84.9+12.9 in the reassessment). **Conclusion:** the effectiveness of games was observed as a resource in the rehabilitation of patients with stroke sequelae. **Descriptors**: Stroke; Cognition; Games, Recreational.

Objetivo: avaliar a eficácia dos jogos lúdicos pedagógicos como recurso de reabilitação neuropsicológica em pessoas acometidas por acidente vascular cerebral. **Método:** pesquisa clínica de caráter pré experimental de caso único, realizado entre março de 2017 e agosto de 2018 no Centro Especializado em Reabilitação, vinculado à Universidade Estado do Pará. Utilizou-se o *Montreal Cognitive Assessment* para identificação de alterações cognitivas e o *Direct Assessment Fuctional Scale* para detecção de alterações funcionais. Os participantes foram divididos em 3 grupos, e cada grupo recebeu intervenções de terapia ocupacional duas vezes por semana, com duração de 1h cada atendimento, totalizando 10 sessões grupais. Utilizou-se os seguintes jogos: Jogo da mesada, Kaleidos, Super Lince, Bingo das letras, Hora certa, e Uno. **Resultados:** houve a participação de oito homens e seis mulheres. A idade foi de 49.5 anos (± 8.7). Destes, seis foram inclusos no Grupo 1, cinco no Grupo 2 e três no Grupo 3. A avaliação realizada com o MoCA mostrou que os domínios cognitivos que apresentaram maiores alterações foram: memória, função viso-espacial e executiva, linguagem e atenção. Verificou-se aumento estatisticamente significativo dos escores totais do *Direct Assessment Fuctional Scale* (79.4±17.5 na avaliação para 84.9±12.9 na reavaliação). **Conclusão:** observou-se eficácia dos jogos como recurso na reabilitação de pacientes com sequelas de acidente vascular cerebral.
Descritores: Acidente Vascular Cerebral; Cognição; Jogos Recreativos.

Objetivo: evaluar la eficacia de los juegos lúdicos pedagógicos como recurso de rehabilitación neuropsicológica en personas afectadas por un accidente cerebrovascular. **Método:** investigación clínica de carácter preexperimental de caso único, realizada entre marzo de 2017 y agosto de 2018 en el Centro Especializado de Rehabilitación, vinculado a la Universidade do Estado do Pará, PA, Brasil. Se utilizó el *Montreal Cognitive Assessment* para identificar los cambios cognitivos y el *Direct Assessment Fuctional Scale* para detectar los cambios funcionales. Los participantes fueron divididos en 3 grupos y cada grupo recibió intervenciones de terapia ocupacional dos veces por semana, con una duración de 1 hora cada una, totalizando 10 sesiones de grupo. Se utilizaron los siguientes juegos: *Jogo da mesada, Kaleidos, Super Lince, Bingo de letras*, *Hora certa* y *Uno*. **Resultados:** participaron ocho hombres y seis mujeres. La edad fue de 49,5 años (± 8,7). De ellos, seis se incluyeron en el Grupo 1, cinco en el Grupo 2 y tres en el Grupo 3. La evaluación realizada con el MoCA mostró que los dominios cognitivos que presentaron mayores alteraciones fueron: memoria, función visoespacial y ejecutiva, lenguaje y atención. Se verificó un aumento estadísticamente significativo de las puntuaciones totales del *Direct Assessment Functional Scale* (79,4±17,5 en la evaluación a 84,9±12,9 en la reevaluación). **Conclusión**: se observó la eficacia de los juegos como recurso en la rehabilitación de pacientes con secuelas de accidente cerebrovascular.
Descriptores: Accidente Cerebrovascular; Cognición; Juegos Recreacionales.

Corresponding author: Fernanda Castro Feitosa - fcfeitosa4@gmail.com

1. Clínica Cuidare, Palmas/TO, Brazil.
2. Occupational Therapist, Belém/PA, Brazil.
3. Universidade do Estado do Pará, Belém/PA, Brazil.
4. Universidade Federal do Pará, Belém/PA, Brazil.

INTRODUTION

Cerebrovascular Accident (CVA) or stroke is defined as a neurological disorder caused by an abrupt interruption in cerebral circulation, being one of the main causes of disability worldwide[1]. It is estimated that there will be a total of 70 million stroke survivors in the year 2030 worldwide[2]. In Brazil, the annual incidence of stroke corresponds to 108 cases per 100,000 inhabitants, with approximately 100,000 deaths per year due to stroke[3], causing a public health problem worldwide due to the high incidence of disabilities presented by survivors.

Among the sequelae caused by stroke, there are cognitive ones, which affect more than 65% of this population, and significantly interfere in the daily activities of individuals[4]. The physical and cognitive impacts caused in the short and long term in individuals affected by stroke require greater efforts on the part of rehabilitation professionals in the search for new treatment strategies. Among these searches, neuropsychological rehabilitation (NR) stands out, which, in recent years, has been studied more closely, especially after neuroscience findings in relation to the mechanisms of neuroplasticity[5].

NR refers to any technique or strategy that aims to improve the capabilities of individuals with cognitive impairment and, consequently, favors the autonomy and independence of people in the performance of their daily activities. The NR seeks the appropriate management of cognitive alterations, with the purpose of favoring the improvement in the individual's mental, social and emotional potential, with a view to integrating him into the community[6].

Occupational Therapy (OT) interventions in NR include: Cognitive Rehabilitation, Cognitive Training and Cognitive Stimulation, in addition to favoring the individual's occupational engagement. In cognitive rehabilitation, OT identifies the main deficits and difficulties in performing routine activities and, after that, creates strategies to promote improvement in cognitive-functional performance and involvement in meaningful occupations[7].

Within the NR, the use of educational ludic games is frequent, which have functions to be fulfilled, which go beyond entertaining and amuse, helping to learn new skills in a simple and playful way. Such games are presented as a resource for health professionals, especially OT, which uses it in the treatment of people with deficient skills, whether physical, social, cognitive[8] or emotional[9], in addition to being used in education, professional and personal development[10], as they create the possibility of reproducing real situations, without influencing

patient safety[11]. Therefore, the game must be selected according to the therapeutic goals outlined.

Although educational games are often used as therapeutic resources in cognitive rehabilitation programs as a stimulus for memory, attention, concentration, language, visual perception[12], there are few studies that report and evaluate their use in OT practices. Among these, one of them evaluated the contribution of educational ludic games in cognitive stimulation and socialization in a group of institutionalized elderly people, after nine workshops with the use of different games and strategies for cognitive, motor, affective and social stimulation; resulting in the contribution of games to the stimulation and maintenance of cognitive, affective and social skills of the elderly, as well as the improvement of daily activities and their quality of life in general[12].

Cognitive disorders caused by stroke are disabling, as they lead to the individual's removal from their occupations, harming their quality of life and the economy. Research in the area of neuroscience and cognition, which has the potential to develop innovative therapies and the expansion of knowledge about such cognitive disorders, is considered of paramount importance. Therefore, this research aimed to evaluate the effectiveness of educational games as a resource for neuropsychological rehabilitation in people affected by stroke.

METHODS

This is a single-case pre-experimental clinical study, during which a group is exposed to a treatment followed by an outcome measure[13]. The collection was carried out on the premises of the Type II Specialized Rehabilitation Center (CER), linked to the Universidade do Estado do Pará (UEPA).

The research was approved by the Ethics Committee for Research with Human Beings (CAE: 86100218.4.0000.5174), following the ethical principles contained in the Declaration of Helsinki and Resolution No. 466/2012 of the National Health Council.

Inclusion criteria were being in the age group between 30 and 59 years old, having been affected by stroke (ICD I64), with a diagnosis issued by a neurologist, having complaints of cognitive impairment related to stroke and having a score below 26 points in the test of Montreal Cognitive Assessment (MoCA) cognitive screening.

The MoCA is a brief cognitive screening instrument that assesses different domains, such as attention, executive functions, memory, language, visual-constructive abilities, abstraction, calculation and orientation[14]. The test duration is estimated at 20 minutes, with a maximum score of 30 points and a cut-off score of 26 points[15].

As exclusion criteria, the following were listed: having suspected or diagnosed dementia and/or other psychiatric disorders, as well as having aphasia and having NR sessions during the research period.

The research took place in four stages, namely: sample selection, assessment, intervention and reassessment. The recruitment of research participants was carried out through access to the waiting list of patients in the morning and afternoon shifts of the CER, indications of health professionals and dissemination on social networks. From this, the first contact with the patients was made throughphone calls and, later, evaluations were scheduled for the application of the MoCA cognitive screening test.

In participants with a minimum score on the MoCA, the Direct Assessment of Functional Status (DAFS) was applied, which is an instrument that assesses various functional capacities, composed of simulated daily tasks. This instrument was used as a comparative measure, being applied before the beginning of the sessions and after the end of the Occupational Therapy sessions[16].

Subsequently, they were divided into three groups - 1, 2, and 3 (G1, G2 and G3). The groups took place at different times between March 2017 and August 2018. Occupational Therapy sessions took place twice a week, with an average duration of 1 hour each group session.

The group sessions started with the presentation and detailing of the rules of the games, as well as the therapeutic propositions to be worked through the resources. The games were previously selected, with emphasis on those that could act on the main cognitive deficits presented after stroke and on the domains evaluated by the MoCA (Chart 1). Each group used five games, which were used twice, totaling 10 sessions.

In the reassessment step, DAFS was used as outcome measures. The collected data were stored using Microsoft® Excel 2007 software and, later, spreadsheets were generated and the graphs presented were created.

Statistical analysis was performed using the Bioestat® 5.3 Software. For normality analysis, the Shapiro-Wilk test was used. For variables with parametric distribution, Student's t-test and ANOVA were listed, while for non-parametric variables, Wilcoxon's, Chi-square and Fisher's Exact tests were listed. The α level of 0.05 was adopted to reject the null hypothesis.

Chart 1. Games used and their therapeutic potential for training the deficits identified in the participants. Belém do Pará, 2018.

Name	Description	Stimulated cognitive domains
Jogo da mesada	Skill game to deal with money, the player who ends the game with the most money wins.	- Executive functions - Memory - Language - Calculation skills
Kaleidos	Set of 4 cards with scenes containing several overlapping objects, in which the player must find as many objects as possible from the selected category in a given time. The game has three difficulty levels.	- Memory - Attention - Visuospatial perception
Super Lince	It consists of a board containing several images. Such images are randomly drawn, and players need to be quick to find the image first. The player who finds the most figures wins.	- Memory - Attention - Language - Visuospatial perception
Bingo das Letras	It's a word bingo game. Letters are drawn and whoever completes the four words on the card wins.	- Memory - Attention - Language - Visuospatial perception
Hora Certa	Made up of 4 boards, which contain several images of analog and digital clocks. It can be played in three different ways, namely: image pairing, time pairing or association of time and clock image.	- Memory - Time orientation - Visual perception - Logical reasoning
Uno	Card game with four different colors and numbered from one to nine, and several cards have specific rules. The player who runs out of cards in their hand wins, using the best strategies for discarding.	- Memory - Attention - Visual perception - Logical reasoning - Problems solution

RESULTS

Eight men and six women participated, in a total of 14 participants. The mean age was 49.5 years (+ 8.7). Of these, six were included in the G1 Group, five in the G2 and three in the G3. Table 1 shows the mean age and the mean scores in the MoCA protocol.

Table 1. Participants according to age and MoCa score. Belém do Pará, 2018.

	All (No=14)	Men (No=8)	Women (No= 6)
Age (years)	49.5 $\pm$ 8.7	51.1 $\pm$ 7.3	47.3 $\pm$ 10.7
MoCa (score)	17.5 $\pm$ 6.5	19.3 $\pm$ 5.7	15.2 $\pm$ 7.2

Figure 1 shows the percentage of participants who presented deficits in the cognitive domains assessed by the MoCA.

Figure 1. Patients with cognitive deficits by domain of the MoCA (Montreal Cognitive Assessment). Belém do Pará, 2018.

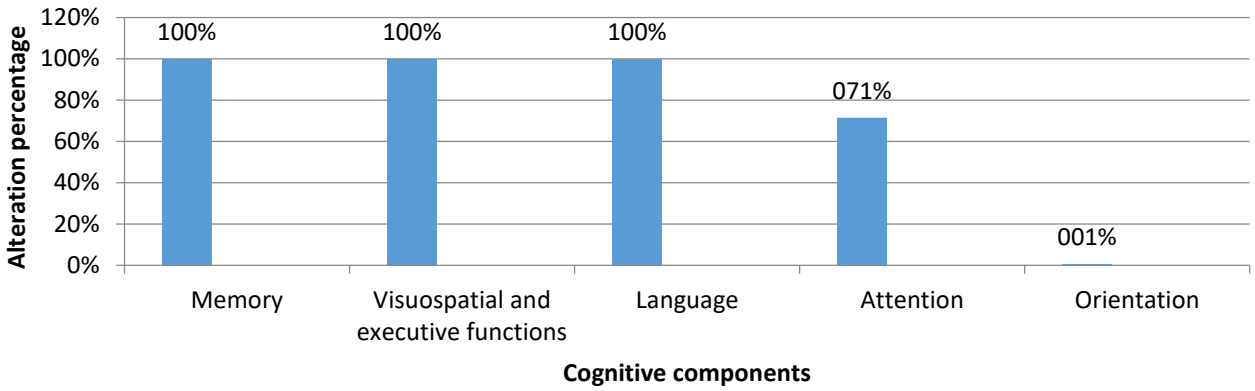

Table 2 shows the average total DAFS score of the participants, as well as the average scores by domain, both in the assessment and in the reassessment..

Table 2. Participants according to DAFS scores by domain. Belém do Pará, 2018.

	Assessment (No= 14)	Reassessment (No=14)	p-value
Total Score	79.4 ± 17.5	84.9 ± 12.9	0.02*
Time Orientation	12.4 ± 3.8	12.6 ± 4.8	0.47
Communication	11.8 ± 3.0	13.6 ± 1.7	0.00*
Handling Money	20.4 ± 8.1	23.1 ± 6.7	0.05#
Shopping	11.4 ± 3.3	14.0 ± 3.4	0.02*
Clothing and Hygiene	11.9 ± 1.7	13.2 ± 3.1	0.03*
Food	9.4 + 1.7	9.1 + 2.0	0.15

Observations: Values in mean + standard deviation; Statistical tests used: Wilcoxon ($p<0.05$)*, t-student test ($p<0.05$)#

DISCUSSION

The average age of the participants (49.5 + 8.7) corroborates the data of another research, which indicates a higher prevalence of stroke in the age group of 50 years[17], however, a considerable part of the individuals (No=6) was in the age group between 30 and 50 years, reinforcing the trend of increased incidence of stroke in young adults, mainly due to smoking[18].

Regarding gender, there was a greater number of men (No=8) than women (No=6), a result that points to a higher prevalence among males[19]. Data also similar to that found in an epidemiological study conducted in Brazil in 2014, which showed a higher incidence of hospitalizations due to stroke in men, with 72,187 records, against 67,147 hospitalizations for women[3].

The evaluation carried out with the MoCA showed that the cognitive domains that showed the greatest changes were: memory, visuospatial and executive function, language and attention. These domains also showed changes in research on the prevalence of cognitive deficit

in 140 post-stroke patients treated at a Basic Health Unit, with memory alteration in 70%, followed by alteration in attention and language, with 60% each[17].

Studies show that games can enable improvements in cognitive domains that showed changes in MoCA, in addition to promoting creativity, perceptual skills, concentration and abstract thinking, through the knowledge acquired in games[20-21]. The development of skills such as cognitive flexibility, working memory, planning, selective and sustained attention, inhibitory control and monitoring are part of the concept defined by neuropsychology as "executive functions" and correspond to a set of cognitive and metacognitive processes that help people to engage in occupations[22-23]. Evidence of promotion of executive functions in clinical groups leads to the hypothesis that games can be used in neuropsychological rehabilitation contexts[24], reinforcing the results obtained in this research, showing improvements in participants.

Games can also improve functional performance, directly influencing the way activities of daily living are performed[25], generating great influence on everyday functionality[26], a fact observed in the pre and post intervention results of the DAFS, suggesting the effectiveness of games in the cognitive rehabilitation process of this population, evidenced by the statistically significant increase both in total DAFS scores and in its specific domains of Communication, Shopping, Clothing, Hygiene and Handling Money, the latter being the one that showed the best results (pre-intervention: 20.4+8.1/ post-intervention: 23.1 + 6.7, p=0.05). It is believed that this result is due to the use of the "*Jogo da Mesada*", which directly stimulated monetary skills, suggesting that games and other cognitive stimulation activities favor gains in cognitive domains directly trained during the activity[27].

The feeding and temporal orientation domains did not show statistically significant differences between the assessment and reassessment moments, which is justified by the presence of higher scores in these domains since the assessment.

It was also verified, in another study, the effectiveness of cognitive table games that aimed at socialization, fun and learning of the elderly who showed improvement in cognitive skills, such as attention and executive functions, as well as behavioral changes[28].

The game, as it is present in various spheres and stages of human life, can and should be used as an occupational therapeutic resource. When used by health professionals as a resource, they perform the function of training deficient skills, re-education and socialization[9]. Pedagogical ludic games may seem like just fun, but they are important occupational therapeutic resources in the rehabilitation of people with cognitive deficits. In this sense, the

combination of the game with the specific deficit, such as memory, attention, concentration, language, visual perception, are skills that can be stimulated through games.

CONCLUSION

The results of this research suggest the effectiveness of educational ludic games as an occupational therapeutic resource in the neuropsychological rehabilitation of post-stroke patients participating in this study, and its use is suitable for cognitive training in specific domains such as attention and memory, with favorable repercussions on functional performance.

Another differential of this study was the use of the cognitive-functional instrument DAFS-R, which allowed the assessment of the impact of interventions for the performance of important daily tasks, not limited to the measurement of isolated cognitive domains such as attention and memory.

However, as a limitation, it is not possible to generalize such results, making it necessary to conduct further research that uses educational games as a therapeutic resource both with stroke patients and with other populations treated in the context of neuropsychological rehabilitation, such as Parkinson's patients and mild cognitive impairment, considering that cognitive sequelae are characterized as demands that interfere with the autonomy and independence of individuals and, therefore, the target of occupational therapists' practices.

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CONTRIBUTIONS
Fernanda Castro Feitosa and **Glória Gomes dos Santos** participated in the design, collection and analysis of data and writing. **Suelem Pereira Santos** contributed to the design, collection and analysis of data. **Alna Carolina Mendes Paranhos** and **Ápio Ricardo Nazareth Dias** collaborated in the design, collection and analysis of data, writing and review. **Camila Nunes da Silva** contributed to the writing and review.

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