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The neurological state and cognition of patients after a stroke*

ESTADO NEUROLÓGICO E COGNIÇÃO DE PACIENTES PÓS-ACIDENTE VASCULAR CEREBRAL

ESTADO NEUROLÓGICO Y COGNICIÓN DE PACIENTES POST ACCIDENTE CEREBRO-VASCULAR

Fabírcia Azevêdo da Costa¹, Diana Lidice Araujo da Silva², Vera Maria da Rocha³

ABSTRACT

The objective of this study was to have a multidisciplinary team investigate the neurological state and cognitive performance of patients after a stroke, through a cross-sectional study with 45 patients in rehabilitation after having an acute stroke. The data collection instruments used were an assessment sheet, the Mini Mental-MEEM, and the National International Health Stroke Scale-NIHSS. The sample consisted mostly of women (55.6%), Ischemic Stroke (86.7%), right hemisphere of the brain (60%) and Educated (68.8%). The mean MEEM for educated and illiterate patients was 19.3 ± 5.0 and 15.92 ± 3.7 , respectively. The overall mean of the neurological state was 13.0 ± 4.8 . A significant difference was found between the cognitive means of patients in terms of education (p value = 0.017), and there was a significant relationship between the neurological state and cognitive performance ($r = -0.44$ p value = 0.002). It appears to be a direct relationship between the neurological state and cognition performance of patients after an acute stroke, which evinces the need for greater attention to the cognitive issue involved early in rehabilitation.

DESCRIPTORS

Stroke
Cognition
Evaluation
Rehabilitation

RESUMO

Objetivou-se investigar por meio de uma equipe multidisciplinar o estado neurológico e o desempenho cognitivo de pacientes pós-AVC mediante um estudo transversal com 45 pacientes em processo de reabilitação após um AVC agudo. Utilizaram-se como instrumentos de coleta de dados uma ficha de avaliação, o Mini Mental-MEEM e o National International Health Stroke Scale-NIHSS. Amostra predominantemente feminina (55,6%), AVC Isquêmico (86,7%), Hemisfério cerebral direito (60%) e Escolarizados (68,8%). A média do MEEM para escolarizados e analfabetos foi de $19,3 \pm 5,0$ e $15,92 \pm 3,7$ respectivamente. A média geral do estado neurológico encontrado foi $13,0 \pm 4,8$. Houve diferença significativa entre as médias cognitivas dos pacientes quanto à escolaridade (p valor = 0,017) e relação significativa entre o estado neurológico e o desempenho cognitivo ($r = -0,44$ p valor = 0,002). O estado neurológico e o nível cognitivo de pacientes pós-AVC agudo parecem estar diretamente relacionados, o que evidencia a necessidade de maior atenção à questão cognitiva envolvida no início do processo de reabilitação.

DESCRIPTORES

Acidente cerebral vascular
Cognição
Avaliação
Reabilitação

RESUMEN

Se objetivó investigar mediante equipo multidisciplinario el estado neurológico y el desempeño cognitivo de pacientes post-ACV. Estudio transversal con 45 pacientes post-ACV agudo en proceso de rehabilitación. Se utilizaron para recolección de datos una ficha de evaluación; el Mini Mental-MEEM y el National International Health Stroke Scale-NIHSS. Muestra predominantemente femenina (55,6%), ACV Isquémico (86,7%), Hemisferio cerebral derecho (60%) y Escolarizados (68,8%). La media de MEEM para escolarizados y analfabetos fue $19,3 \pm 5,0$ y $15,92 \pm 3,7$ respectivamente. La media general del estado neurológico encontrado fue $13,0 \pm 4,8$. Existió diferencia significativa entre las medias cognitivas de pacientes respecto de escolaridad (p valor=0,017), y relación significativa entre el estado neurológico y el desempeño cognitivo ($r=0,44$ p valor=0,002). El estado neurológico y el nivel cognitivo de pacientes post-ACV agudo parecen estar directamente relacionados, lo que evidencia la necesidad de mayor atención a la cuestión cognitiva involucrada en el inicio del proceso de rehabilitación.

DESCRIPTORES

Accidente cerebrovascular
Cognición
Evaluación
Rehabilitación

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INTRODUCTION

Cerebrovascular Accident (CVA) is defined by the World Health Organization (WHO) as an acute neurological dysfunction of vascular origin followed by the sudden or rapid occurrence of signs and symptoms related to compromised focal areas in the brain⁽¹⁾.

The incidence of CVA has grown due to increased life expectancy, causing changes in the population's lifestyle⁽²⁾. CVA is the cause of 9% of deaths around the world, ranking second after ischemic heart diseases⁽³⁾.

The proportion of deaths from CVA is 10-12% in Western countries, while 12% of these deaths occur in people younger than 65 years old⁽³⁾. In Brazil, the distribution of deaths caused by diseases in the circulatory system have increased in significance among young adults older than 20 years of age and has become the main cause of death among those in the 40 years old age range, and predominating in the subsequent age groups⁽⁴⁻⁵⁾.

CVA is a common disease having a great impact on world public health because it is the main cause of neurological impairment and important motor and cognitive dysfunctions⁽²⁾. Those surviving a CVA generally face residual impairment such as paralysis of muscles, stiffness of the affected body parts, loss of joint mobility, diffuse pain, memory problems, difficulties in oral and written communication, and sensory disabilities^(2,4).

The growth of the elderly population has increased the risk for the onset of cognitive impairment since the risk for CVA occurrence also increases⁽⁶⁾. Cognitive dysfunctions are the main causes of impairment in people older than 65 years of age in industrialized countries. Taking into account that Brazil is considered a developing country whose classification for elderly individuals includes those around 60 years of age, such information is even more relevant^(1,6).

Reports in the literature indicate that 5% to 10% of the elderly population presents some cognitive decline. Since CVA is one of the main causes of this type of impairment, the incidence of cognitive disorders in the population surviving a CVA varies from 12% to 56%⁽⁶⁻⁷⁾. CVA can be considered the main cause of cognitive impairment in elderly individuals, affecting about 50% of patients, both in the acute and chronic phases⁽⁷⁻⁸⁾.

Cognitive impairment is very common after a CVA and can affect attention, memory and the association of these two skills. Such a fact reduces the organization of thoughts, leading to a disorganized language process, including problems related to speech and the sequential production of words, compromising one's ability to understand written and spoken information⁽⁹⁾.

Individuals with sequelae resulting from a CVA frequently need to take part in a rehabilitation program. Rehabilitation is a set of actions aimed to reestablish and maintain one's physical functions; educate the patient and family; and reinsert the patient into the family's and social circle^(1,5). The ability of patients to succeed in rehabilitation depends on their motivation, social-family support, and, most importantly, their cognitive condition⁽¹⁰⁾.

The presence of cognitive disorders is an important predictor of recovery, directly affecting the patients' rehabilitation and recovery process⁽¹¹⁾. Many studies suggest that a patient's cognitive state can influence the results of treatment, given the fact that the techniques used in the process require some cognitive skills such as the evocation and execution of instructions⁽¹⁰⁾.

These patients are required to learn new skills to perform exercises and recall instructions during the rehabilitation process. Thus, an individual's compromised memory, for instance, can affect the success of a rehabilitation program⁽¹²⁾.

In this context, an early diagnosis, jointly with the prognosis of the patient's cognitive potential, can be very important to determining the best strategy to implement for these patients, since interventions designed to recover from and/or compensate for cognitive impairment can be initiated during the acute phase of CVA, which is an important factor in treatment effectiveness⁽⁸⁾.

However, even though there is mention in the literature of cognitive impairment after a brain damage, most studies addressing cognitive functioning after a CVA have focused on the development of dementia⁽¹³⁾.

Data concerning the relationship between the patients' neurological states at the time they begin physical therapy and their cognitive performance is limited.

Therefore, therapeutic procedures are limited since there are few studies guiding the implementation of a therapeutic program focused on patients' cognitive needs.

This study reports the neurological state and cognitive performance of post-CVA patients that are part of a physical therapeutic rehabilitation program, investigated by a multi-disciplinary team (Physical Therapists, Occupational therapists and speech and hearing therapists).

METHOD

This is a cross-sectional analytical study. The population was composed of patients with CVA who received physical therapy from the five largest public services in the city of Natal, RN, Brazil (the physical therapy units at the Onofre Lopes University Hospital, Potiguar University, Asa Norte Clinical Center, José Carlos Passos Clinical Cen-

The ability of patients to succeed in rehabilitation depends on their motivation, social-family support, and, most importantly, their cognitive condition.

ter, and Adult Rehabilitation Center) between May 2007 and May 2008.

The contingency sample was composed of 45 individuals selected according to the following inclusion criteria: (a) having a CVA diagnosis confirmed by complementary exam (CT or MRI); (b) having been cared for by the physical therapy service in one of the chosen institutions in the research period; (c) being 40 to 90 years old; (d) time of CVA less than three months prior at the time of assessment; and (e) CVA had to be unilateral and non-recurrent.

Exclusion criterion was the presence of associated pathologies that could cause cognitive sequelae beside those caused by CVA, such as Parkinson and Alzheimer's disease. Patients with severe aphasia and visual impairments were also avoided.

Data collection instrument

A physical therapy form was used to collect general information about patients, such as identification, clinical condition, history of current disease, pathological and family antecedents, lifestyle, medication and physical assessment (palpation and inspection) according to the model used by the Physical Therapy Service at the Onofre Lopes University Hospital (HUOL-UFRN).

The Mini Mental State Examination (MMSE) was used to evaluate the cognitive condition of patients. This instrument identifies evidence of cognitive impairment in patients⁽¹⁴⁾ and is divided into seven dimensions including: time and spatial orientation, immediate memory, attention and calculus, evocation, language and visual construction. Its total score varies from 0 to 30. This instrument was validated for Brazil and takes into account the age and educational level of the interviewed individuals⁽¹⁵⁾.

The Stroke Scale by the National Institute of Health (NIHSS), the validity and reliability of which is well documented both in Brazilian and international literature, was used to quantitatively assess the neurological state of patients⁽¹⁶⁻¹⁸⁾. This scale is composed of 11 items that include: level of consciousness, eye movements, visual fields, facial palsy, motor function and limb ataxia, sensory, language, dysarthria, and spatial neglect⁽¹⁸⁾. In this scale, the higher the patient's score, the more severe is his/her neurological state. Scores below 5 at the time of admittance suggest mild clinical severity; scores between 6 and 13 indicates moderate severity; and scores equal to or greater than 14 indicate a more advanced level of clinical severity⁽¹⁶⁾.

Data collection procedures

The research project was initially submitted to the Research Ethics Committee guiding research with human

subjects at the Federal University of Rio Grande do Norte (UFRN). After its approval, in accordance with resolution 196/96 protocol No. 12/2007 CEP/UFRN, the researchers were trained to collect data in order to standardize the procedures. Before the application of the protocol, each participant was informed of the study's objectives and limitations and signed a free and informed consent form confirming their voluntary participation. The instruments were applied only once at the beginning of the physical therapy.

The data obtained were tabulated and statistically analyzed through SPSS version 13.0. According to the Kolmogorov-Smirnov normality test and a level of significance fixed at 5%, a normal distribution of data was assumed in this study.

Descriptive statistics (frequency, averages and standard deviation) are presented to characterize the investigated sample. Inferential statistics was applied to the remaining analyses. To verify the existence of significant differences between the cognitive averages concerning education, the Student *t* test was initially used in independent samples and Pearson's correlation test was applied to check for the existence of a correlation between cognitive performance and the neurological state of patients.

RESULTS

The studied sample was characterized in terms of personal aspects (gender, marital status, age and schooling) and clinical aspects (etiology of CVA, affected brain hemisphere, manual motor dominance). The results indicated a sample of 45 predominantly female (55.6%) and married patients (57.8%). The average age of the individuals was 65.6 years old (± 10.6). The majority had attended primary school ($n=21$, 46.6%), followed by illiterate individuals ($n=14$, 31.1%).

In relation to clinical characteristics, the most prevalent CVA etiology was Ischemic CVA (86.7%) and the right brain hemisphere was the most affected (60%). In relation to laterality, 86.7% of the patients were right-handed.

In relation to the patients' neurological condition, the average score obtained by patients in the NIHSS in relation to their clinical severity was 13.0 ± 4.8 . In relation to their cognitive performance, the average obtained in the MMSE by illiterate patients was 15.92 ± 3.75 and by educated patients was 19.32 ± 5.0 . A statistically significant difference was found in the cognitive averages of patients in relation to schooling (p value = 0.017) (Table 1).

Table 1 – Characterization of patients in relation to personal and clinical aspects – Natal, RN, Brazil 2008

Variables	Patients(n = 45)
Gender	
Female	25 (55.6%)
Male	20 (44.4%)
Marital Status	
Divorced	03 (3.7%)
Single	03 (3.7%)
Widowed	13 (28.9%)
Married	26 (57.8%)
Education	
Illiterate	14 (31.1%)
Primary School	21 (46.6%)
Secondary School	9 (20%)
Bachelor's Degree	1 (2.2%)
Manual motor dominance	
Right	39 (86.7%)
Left	6 (13.3%)
CVA etiology	
Ischemic	39 (86.7%)
Hemorrhagic	6 (13.3%)
CVA brain hemisphere	
Right	27 (60%)
Left	18 (40%)
Age - assessment	65.6 anos \pm 10.6anos
NIHSS	13.0 \pm 4.8
MMSE*	
Illiterate	15.92 \pm 3.75 p valor* = 0,017
Educated	19.32 \pm 5.0

Source: study's data.

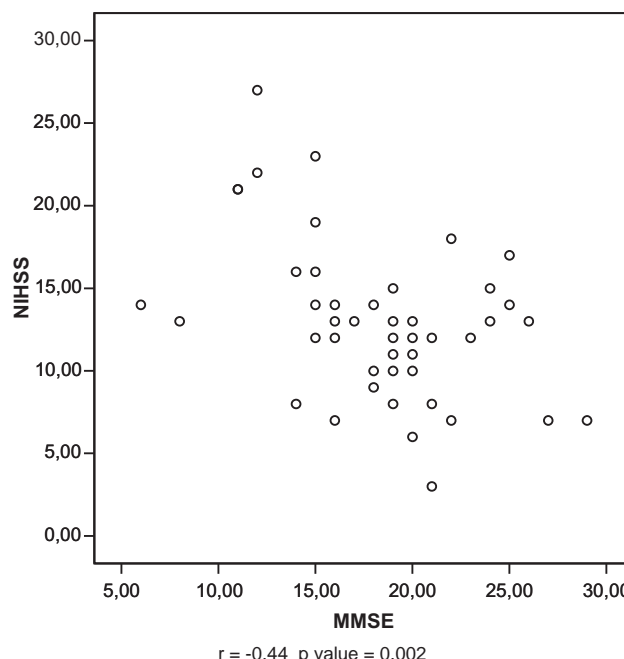
*CVA – Cerebrovascular accident; NIHSS – NIH Stroke Scale; MMSE – Mini Mental State Examination.

Finally, when analyzing the existence of a relationship between the patients' neurological state and cognitive performance, we verified the presence of a negative and significant relationship ($r = -0.34$ p-value = 0.002), which shows that the greater the neurological severity, the worse the cognitive performance of patients (Figure 1).

DISCUSSION

Current rehabilitation programs directed to post-CVA patients neglect the cognitive dimension of these patients, which seems to hinder the success of their treatment. Appropriate treatment may favor recovery in patients who are cognitively compromised when admitted into a rehabilitation unit in the initial phase of CVA⁽⁶⁾. With this in mind, this study was conducted to investigate, using a multi-disciplinary team, the neurological state and cognitive performance of post-CVA patients with up to three months of brain damage at the time they were ad-

mitted into the public physical therapy services in the city of Natal, RN, Brazil.



Source: study's data.

*NIHSS - National Institute of Health Stroke Scale; MMSE – Mini Mental State Examination.

Figure 1 – Correlation between the post-CVA patients' neurological condition and cognitive performance - Natal, RN, Brazil - 2008

The results revealed a sample of patients with an average age of 65 years old, a fact consistent with the literature that reveals a greater concentration of individuals older than 60 years of age with cardiovascular diseases^(1,4). Additionally, the initial assessment showed a moderate neurological state (average of NIHSS 13 ± 4.8), which indicates the need to understand the cognitive level of these patients to implement a more effective treatment.

Some authors report that the final score obtained by patients in the NIHSS at the time of their admittance into the therapy service can help plan the recovery of patients by predicting the care required in the long term⁽¹⁶⁾. According to these authors, more than 80% of patients scoring less than 5 points at the time of admittance are discharged quickly without major intercurrents. Those scoring between 6 and 13, however, usually require a more elaborate rehabilitation program. Finally, those scoring 14 or more, frequently require more intensive rehabilitation care and for a more prolonged period⁽¹⁶⁾.

The cognitive dimension is evident in the case of patients with severe levels of neurological impairment because the severity of CVA seems to be related to a tendency for individuals to present cognitive dysfunction. Such a dimension stands out when one acknowledges the need for cognitive integrity to experience therapeutic success.

The effect of the patients' cognitive condition in the CVA rehabilitation process presents a different context⁽¹⁰⁾.

It occurs because the effect of cognition on the rehabilitation process is a matter of great controversy and has led the scientific community to much debate⁽¹¹⁻¹²⁾. Researchers have reported that patients with cognitive impairment can improve their functioning when attending a rehabilitation program⁽¹⁰⁾.

In this context, various studies have tried to identify the relation between the success of rehabilitation and the degree of cognitive impairment, leading researchers to suggest that a cognitive assessment should be part of the rehabilitation process⁽¹⁰⁻¹²⁾. Studies with post-CVA patients have shown that individuals with some cognitive deficit present unsatisfactory results in the rehabilitation process. This may occur in patients with sensory or attention deficit, or compromised learning and comprehension skills⁽¹¹⁻¹²⁾.

In agreement with this rationale, some researchers suggest that an individual's cognitive state can influence the results of treatment because the techniques used in this process require certain cognitive skills, such as evocation and performance of instructions, and these skills are generally compromised in these patients⁽¹⁰⁾.

In this study, the cognitive assessment of patients was performed using the MMSE. The results indicated that the averages obtained by patients in this instrument were below the cutoff points proposed for the Brazilian population in the MMSE validation⁽¹⁵⁾, both for educated and illiterate patients, suggesting this population presented some level of cognitive impairment.

A study using the MMSE and addressing the diagnosis of dementia in Brazil proposed cutoff points of 23 and 24 for educated elderly individuals and 19 and 20 for illiterate individuals, highlighting the influence of patients' educational level on their cognitive performance⁽¹⁵⁾. Such findings are corroborated by those obtained in this study in which educated patients presented cognitive averages greater than that of illiterate patients; the difference was statistically significant (p value=0.017).

Finally, we investigated whether the neurological state of patients at the time they were admitted into the physical therapy service was related to their cognitive performance. A negative and very significant relation

was found, which was evidence that the more severe the neurological state of patients, the worse was their cognitive performance.

Such a fact is highly relevant for the implementation of a rehabilitation program. The cognitive-motor influence is of considerable clinical importance, since the performance of exercises requires simultaneous motor and cognitive skills⁽¹⁹⁾. Therefore, cognitive domains affected by neurological impairment should be identified so that more coherent treatment planning is devised and, consequently, patients achieve improved recovery from neurological and cognitive damage⁽¹⁹⁻²⁰⁾.

An early diagnosis jointly with the prognosis of potential cognitive recovery can be very important in the determination of better interventions to be implemented for these patients, since interventions intended to recover from and/or compensate for cognitive impairment could be initiated in the CVA acute phase, which is important for treatment effectiveness⁽⁸⁾.

CONCLUSION

According to the findings of this study, we conclude that the level of neurological severity found in the initial assessment of patients at the time they were admitted into the physical therapy service was moderate and the cognitive performance was below the Brazilian cutoff points. Additionally, the study indicated that these two variables seem to be directly related, which shows the need to pay more attention to the cognitive dimension involved at the beginning of the rehabilitation process of these patients.

Despite the relevance of the findings, this study presents a certain limitation since potential influences of how extensive the damage was and the topography of damage on the cognitive state of the studied patients were not considered. However, since the NIHSS was applied and this instrument evaluated the severity of an individual's neurological condition, we believe this limitation has little significance for this study. Hence, we expect that its findings will contribute to future studies addressing the cognitive level of post-CVA patients, aiming to develop therapeutic interventions consistent with this clinical situation.

REFERENCES

1. World Health Organization (WHO). Cerebrovascular disorders. Geneva: WHO; 1978.
2. Andrade LM, Costa MFM, Caetano JA, Soares E, Beserra EP. A problemática do cuidador familiar do portador de acidente vascular cerebral. *Rev Esc Enferm USP*. 2009;43(1):37-43.
3. Donnan GA, Fisher M, Macleod M, Davis SM. Stroke. *Lancet*. 2008;371(9624):1612-23.
4. Falcão IV, Carvalho EMF, Barreto KML, Lessa FJD, LeiteVMM. Acidente vascular cerebral precoce: implicações para adultos em idade produtiva atendidos pelo Sistema Único de Saúde. *Rev Bras Saúde Mater Infant*. 2004;4(1):95-102.
5. Caetano JA, Damasceno MMC, Soares E, Fialho AVM. Rehabilitation process experience after a cerebral vascular accident: a qualitative study. *Online Braz J Nurs [Internet]*. 2007 [cited 2010 Jan 12];6(2). Available from: <http://www.objnursing.uff.br/index.php/nursing/article/view/j.1676-4285.2007.801>

6. Rabadi MH, Rabadi FM, Edelstein L, Peterson M. Cognitively impaired stroke patients do benefit from admission to an acute rehabilitation unit. *Arch Phys Med Rehabil.* 2008;89(3):441-8.
7. Glymour MM, Weuve J, Fay ME, Glass T, Berkman LF. Social ties and cognitive recovery after stroke: does social integration promote cognitive resilience? *Neuroepidemiology.* 2008;31(1):10-20.
8. Nys GM, Van Zandvoort MJ, De Kort PL, Jansen BP, Van Der Worp HB, Kappelle LJ, et al. Domain-specific cognitive recovery after first-ever stroke: a follow-up study of 111 cases. *J Int Neuropsychol Soc.* 2005;11(7):795-806.
9. Vukovic M, Vuksanovic J, Vukovic I. Comparison of the recovery patterns of language and cognitive functions in patients with post-traumatic language processing deficits and in patients with aphasia following a stroke. *J Commun Disord.* 2008;41(6):531-52.
10. HersHKovitz A, Brill S. The association between patients' cognitive status and rehabilitation outcome in geriatric day hospital. *Disabil Rehabil.* 2007;29(4):333-7.
11. Zinn S, Dudley TK, Bosworth HB, Hoening HM, Duncan PW, Horner RD. The effect of poststroke cognitive impairment on rehabilitation process and functional outcome. *Arch Phys Med Rehabil.* 2004;85(7):1084-90.
12. Luk JK, Chin PK, Chu LW. Rehabilitation of older Chinese patients with different cognitive functions: how did they differ in outcome? *Arch Phys Med Rehabil.* 2008;89(9):1714-9.
13. Rasquin SM, Verhey FR, Lousberg R, Lodder J. Cognitive performance after the first ever stroke related to progression of vascular brain damage: a 2 year follow up CT scan study. *J Neurol Neurosurg Psychiatry.* 2005;76(8):1075-9.
14. Folstein MF, Folstein SE, McHugh PR. Mini-Mental State: a practical method for grading the cognitive state of patients for the clinician. *J Psychiatr Res.* 1975;12(3):189-98.
15. Almeida OP. Mini Exame do Estado Mental e o diagnóstico de demência no Brasil. *Arq Neuropsiquiatr.* 1998;56(3B):605-12.
16. Schlegel D, Kolb SJ, Luciano JM, Tovar JM, Cucchiara BL, Liebeskind DS, et al. Utility of the NIH Stroke Scale as a predictor of hospital disposition. *Stroke.* 2003;34(1):134-7.
17. Cincura C, Pontes-Neto O, Neville L, Mendes H, Menezes D, Mariano D, et al. Validation of the National Institutes of Health Stroke Scale, modified Rankin Scale and Barthel Index in Brazil: the role of cultural adaptation and structured interviewing. *Cerebrovasc Dis.* 2009; 27(2):119-22.
18. Caneda M, Fernandes J, Almeida A, Mugnol F. Confiabilidade de Escalas de Comprometimento Neurológico em pacientes com acidente vascular cerebral. *Arq Neuropsiquiatr.* 2006;64(3-A):690-7.
19. Haggard P, Cockburn J, Cock J, Fordham C, Wade D. Interference between gait and cognitive tasks in a rehabilitating neurological population. *J Neurol Neurosurg Psychiatry.* 2000;69(4):479-86.
20. Plummer-D'Amato P, Altmann LJ, Saracino D, Fox E, Behrman AL, Marsiske M. Interactions between cognitive tasks and gain after stroke: a dual task study. *Gait Posture.* 2008;27(4):683-8.