



## Assessment of nursing care-associated predictors of in-hospital mortality in the patients with acute ischemic stroke

Određivanje prediktora intrahospitalnog mortaliteta povezanih sa negom pruženom od strane medicinskog tehničara kod bolesnika sa akutnim ishemijskim moždanim udarom

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### Abstract

**Background/Aim.** Stroke remains one of the leading causes of death and disability worldwide. The aim of the study was to determine the nursing care-associated predictors of in-hospital mortality in the patients with acute ischemic stroke (AIS) who were hospitalized at the Department of Emergency Neurology. **Methods.** Prospective cohort study included 59 consecutive patients with AIS admitted to the Department of Emergency Neurology, Neurology Clinic, Clinical Center of Serbia, Belgrade. The patients were followed until discharge or death. For exploring a relationship between the outcome of patients with AIS and different groups of factors, the univariate and multivariate Cox proportionate hazard regression models were used. **Results.** There were 32 male and 27 female patients with AIS. The mean age was  $62.5 \pm 15.2$  years. The average duration of hospitalization was  $11.1 \pm 9.6$  days (median 8 days; range 1–54

days). Almost 80% of patients (47/59; 79.7%) were admitted to the stroke unit, while 12 (20.3%) patients were admitted to the intensive care unit. In the univariate Cox regression analysis the significant variables ( $p < 0.05$ ) were the Morse score ( $p = 0.030$ ) and the type of admission unit ( $p = 0.029$ ). The multivariate predictive model revealed that the type of admission unit (stroke unit *vs* conventional unit) [hazard ratio (HR) = 0.16;  $p = 0.032$ ] was the independent predictor of in-hospital mortality in the patients with AIS. **Conclusion.** The results of this study showed an important role of nursing staff in the recovery of the AIS patients, as well as that admission to the stroke units versus the conventional units is the independent predictor of decreased in-hospital mortality.

**Key words:** stroke; mortality; nursing care; nursing; convalescence.

### Apstrakt

**Uvod/Cilj.** Moždani udar i dalje predstavlja jedan od vodećih uzroka umiranja i onesposobljenosti u svetu. Cilj ove studije bio je određivanje prediktora intrahospitalnog mortaliteta povezanih sa negom pruženom od strane medicinskih tehničara kod bolesnika sa akutnim ishemijskim moždanim udarom (AIMU), hospitalizovanih na Odeljenju urgentne neurologije Kliničkog centra Srbije (KCS). **Metode.** Prospektivnom kohortnom studijom obuhvaćeno je 59 konsektivnih bolesnika sa AIMU primljenih na Odeljenje urgentne neurologije, Klinike za neurologiju, KCS u Beogradu. Bolesnici su praćeni do otpusta, odnosno smrtnog ishoda. U ispitivanju povezanosti različitih grupa faktora sa ishodom bolesnika korišćene su univari-

jantna i multivarijantna Koksova proporcionalna hazardna regresiona analiza. **Rezultati.** Uzorak je činilo 32 muškaraca i 27 žena sa AIMU. Prosečan uzrast bio je  $62,5 \pm 15,2$  godina. Prosečna dužina hospitalizacije iznosila je  $11,1 \pm 9,6$  dana (medijana 8 dana; opseg 1–54 dana). Blizu 80% bolesnika (47/59; 79,7%) bilo je primljeno u Jedinicu za moždani udar, dok je 12 (20,3%) bilo primljeno u Jedinicu intenzivne nege. Univarijantnom regresionom analizom kao značajne varijable ( $p < 0,05$ ) izdvojile su se Morse skor ( $p = 0,030$ ) i jedinica prijema ( $p = 0,029$ ). Multivarijantni model pokazao je da tip jedinice prijema (Jedinica za moždani udar prema Jedinici konvencionalne nege – [hazard ratio (HR) = 0,16;  $p = 0,032$ ] predstavlja nezavisni prediktor intrahospitalnog mortaliteta kod osoba sa AIMU. **Zaključak.** Rezultati studije pokazali su značajnu ulogu

medicinskog kadra tokom oporavka bolesnika sa AIMU, kao i da je prijem u Jedinicu za moždani udar prema Jedinici konvencionalne nege, nezavisni prediktor sniženog intrahospitalnog mortaliteta.

## Introduction

Stroke remains one of the leading causes of death and disability worldwide<sup>1</sup>. Recently, it has been shown that in Serbia, during the period 1992–2013, a proportion of deaths due to stroke in overall mortality was 16%<sup>2</sup>. Despite the fact that overall mortality rates decreased, stroke is still the second leading cause of premature death in our country with 314,000 (18.8%) years of life lost (YLL) during the period 1990–2010<sup>3</sup>.

Approximately 4 out of 5 persons with the stroke have the acute ischemic stroke (AIS) subtype<sup>1</sup>. According to the Global Burden of Disease (GBD) 2013 study<sup>4</sup>, the worldwide age-standardized mortality rates from AIS have decreased from 1990 to 2013 by 19.6%. In Serbia, the age-standardized mortality rates per 100,000 persons from this stroke subtype, initially decreased from 2.5 in 1990 to 2.2 in 2003 and afterward slightly increased to 2.3 in 2013<sup>2</sup>.

Although many patient-related predictors of the AIS outcome are well-established, some studies showed that some factors associated with healthcare can influence recovery following AIS as well<sup>5,6</sup>. There is the emerging evidence that higher level of organized stroke care is associated with the improved outcome<sup>7</sup>. Keeping in mind the fact that the stroke-related mortality differ significantly between health care units, this rate is assumed as one of the most prominent indicators of the stroke-care quality level<sup>8</sup>.

The aim of this study was to determine the nursing care-associated predictors of in-hospital mortality in the patients with AIS, at the Department of Emergency Neurology, Neurology Clinic, Clinical Center of Serbia, Belgrade.

## Methods

### *Study design*

The prospective cohort study included 59 consecutive patients with AIS admitted to the Department of Emergency Neurology, Neurology Clinic, Clinical Center of Serbia in Belgrade during June and July 2015. The patients were followed until discharge or death. The study was approved by the Institutional Review Board.

### *Data collection*

Data on demographic characteristics, personal and family history, with special emphasis on vascular risk factors, were documented. Information on blood sample analyses and neurological examinations were obtained from medical records. Data on in-hospital complications were also collected. The National Institute of Health Stroke Scale (NIHSS) was

## **Ključne reči:**

**mozak, infarkt; mortalitet; nega bolesnika; medicinski tehničari; oporavak.**

used for assessment of stroke severity<sup>9</sup>. Functional dependency was assessed using the modified Rankin Scale (mRS) and the Barthel Index (BI) during first 24 hours after the admission<sup>10</sup>. The Glasgow Coma Scale (GCS) was used for the determination of conscious level<sup>11</sup>. The health care quality level was estimated by the Braden and Morse scales for the assessment of a risk for development of decubital ulcer and a risk of falls, respectively<sup>12,13</sup>.

### *Statistical analysis*

The baseline characteristics of the study sample were presented using descriptive statistics (mean, standard deviation, percentages). Furthermore, for exploring the relationship between the outcome of patients with AIS and different groups of factors, the univariate and the multivariate Cox proportionate hazard regression models were used. In these analyses, the AIS-related death was considered as the dependent variable. The independent variables were separated into two models. The first model (“Scale scores at admission”) comprised the baseline scores of NIHSS, BI and mRS, GCS, Morse and Braden scales. The second model (“Nursing factors”) comprised the type of admission unit, presence of nasogastric tube, presence of endotracheal tube, mechanical ventilation, presence of urinary tract infection (UTI) and diarrhea during hospitalization. All variables that appeared to be associated ( $p < 0.05$ ) with the endpoint in the univariate analysis were put together to the multivariate Cox proportionate hazard regression analysis in order to determine the independent predictors of in-hospital mortality in the patients with AIS. All analyses were done using the SPSS (Statistical Package for Social Sciences), version 17.0. Probability level of  $< 0.05$  was considered statistically significant.

## **Results**

A total of 59 patients with AIS were enrolled in the study. In 47 (79.7%) patients, it was the first AIS, while 12 (20.3%) patients had the recurrent AIS. The average duration of hospitalization was  $11.1 \pm 9.6$  days (median 8 days, range 1–54 days). Almost 80% of patients [47/59 (79.7%)] were admitted to the stroke unit, while 12 (20.3%) patients were admitted to the conventional unit. The basic demographic characteristics of participants are presented in Table 1. There were 32 male and 27 female patients with AIS. The mean age was  $62.5 \pm 15.2$  years; the youngest patient was 27 years old and the oldest one was 85. A vast majority of patients (61%) had secondary school level. In terms of marital status, more than a half (55.2%) was married. Furthermore, 32.8% of patients were employed.

**Table 1**  
**Demographic characteristics of patients with acute ischemic stroke**

Variable	Number (%)
Gender	
male	32 (54.2)
female	27 (45.8)
Age (years)	62.5 ± 15.2*
Education level	
no education	2 (3.4)
primary school	7 (11.9)
secondary school	36 (61.0)
university	14 (23.7)
Working status	
employed	19 (32.8)
unemployed	15 (25.9)
retired	24 (41.4)
Marital status	
married	32 (55.2)
singled	9 (15.5)
divorced	5 (8.6)
widowed	12 (20.7)

\*value is presented as mean ± SD.

The data on different parameters of the patients at admission are shown in Table 2. The systolic blood pressure values ranged from 104 to 232 mm Hg, while the diastolic blood pressure ranged from 61 to 120 mm Hg. The average value of glycemia was 8.0 ± 4.0 mmol/L. In terms of stroke severity, 33 (55.9%) patients had a mild stroke (NIHSS 0-7), 13 (22.0%) patients had a moderate stroke (NIHSS 8-15), and the same proportion of the patients (22.0%) had a severe stroke (NIHSS > 15). Further, the mean GCS was 13.3 ± 2.9. Functional dependency at admission, measured by mRS and BI was 3.3 ± 1.5 and 47.8 ± 36.5, respectively. The risk of fall (Morse score) at admission was 41.3 ± 15.9. Finally, the risk for decubital ulcer development (Braden score) was 15.4 ± 4.6.

During hospitalization, 6 out of 59 (10.2%) patients died (case-fatality ratio 10.2%). The same proportion (37.3%) of the AIS patients was either discharged or sent to another hospital, while 15.3% was sent to the rehabilitation center. The results of the univariate and multivariate Cox proportionate hazardous regression models are presented in Tables 3 and 4. In the univariate Cox regression analysis, the

significant variables ( $p < 0.05$ ) were the Morse score ( $p = 0.030$ ) in the "Scale scores at admission" model and type of admission unit ( $p = 0.029$ ) in the "Nursing care-associated factors" model. The multivariate predictive model revealed that the type of admission unit [stroke unit vs. conventional (HR) = 0.16,  $p = 0.032$ ] was the independent predictor of in-hospital mortality in the patients with AIS.

**Table 2**

**Clinical characteristics of patients at admission**

Variable	Mean ± SD
Systolic blood pressure (mm Hg)	151.6 ± 24.0
Diastolic blood pressure (mm Hg)	89.2 ± 13.7
Temperature (°C)	36.5 ± 0.3
Pulse rate (/min)	85 ± 19
Oxygen saturation (%)	97 ± 2
Glycemia (mmol/L)	8.0 ± 4.0
Platelets (×10 <sup>6</sup> /mL)	219 ± 61
PTT (s)	23.6 ± 4.2
INR	1.2 ± 0.5
NIHSS	9.5 ± 8.8
BI	47.8 ± 36.5
mRS	3.3 ± 1.5
GCS	13.3 ± 2.9
Morse fall scale	41.3 ± 15.9
Braden scale	15.4 ± 4.6

PTT – Partial Thromboplastin Time; INR – International Standardized Ratio; NIHSS – National Institute of Health Stroke Scale; BI – Barthel Index; mRS – modified Rankin Scale; GCS – Glasgow Coma Scale; SD – standard deviation.

**Table 3**

**Univariate Cox proportionate hazard regression model of scale scores at admission**

Variable	HR	<i>p</i> -value
NIHSS	2.47	0.075
Barthel Index	1.20	0.263
mRS	1.04	0.995
GCS	7.28	0.115
Morse fall scale	1.28	0.030
Braden scale	0.04	0.086

HR – hazard ratio; NIHSS – National Institute of Health Stroke Scale; mRS – Modified Rankin Scale; GCS – Glasgow Coma Scale.

**Table 4**

**Univariate Cox proportional hazard regression of nursing care-associated factors**

Variable	HR	<i>p</i> -value
Admission unit (stroke unit vs. conventional unit)	0.05	0.031
Nasogastric tube (yes vs. no)	6.67	0.250
Endotracheal tube (yes vs. no)	0.14	0.371
Mechanical ventilation (yes vs. no)	7.60	0.247
UTI during hospitalization (yes vs. no)	1.90	0.718
Diarrhea during hospitalization (yes vs. no)	6.26	0.250

HR – hazard ratio; UTI – urinary tract infection.

## Discussion

A numerous studies conducted so far have revealed that the AIS patients admitted to the stroke unit have better survival probabilities, a higher post-stroke level of independency and greater chance to be discharged, compared to the AIS patients admitted to the general wards<sup>14, 15</sup>. There are several potential reasons for such differences which include the 24-hour monitoring, multidisciplinary health care provider teams, involvement of family members, etc. Recently published results of an observational study from Australia revealed that besides all patient-related benefits, the stroke units are also cost-effective<sup>16</sup>. Namely, the authors analyzed data on the patients with a stroke treated before and after establishing the stroke unit in this country, and concluded that although one day of stay in the stroke unit was more expensive compared to the general ward, total costs are lower due to a shorter stay and reduced needs for certain examinations because of their availability in the stroke unit<sup>16</sup>. However, some studies reported different results, i.e., they did not find any differences in the outcome of the AIS patients treated in the stroke unit vs. conventional unit<sup>17</sup>. One of the explanations is a difference in the applied methodological approach. Namely, in clinical trials, the results often showed that the stroke unit was more effective compared to the conventional unit, while in some observational studies, results were contradictory. Consequently, these disparities between the results obtained in the observational and intervention studies could be explained by the artificial conditions seen in clinical trials.

The results of our study also showed that admission to the stroke unit is independent protective factor for the outcome in the AIS patients. The first stroke unit in Serbia was established in 2005 at the Department of Emergency Neurology, Neurology Clinic, Clinical Center of Serbia in Belgrade<sup>18, 19</sup>. The aim was to provide the diagnostic and therapeutic protocols for the stroke patients according to the internationally accepted standards. It comprises six beds and it is equipped with six monitors necessary for the continuous monitoring of electrocardiography (ECG) and vital functions. Furthermore, extracranial color Doppler, transcranial Doppler machine and computed tomography as well as blood analyses and consultative examinations of different specialists are available 24 hours. Also, all-day presence and the work of physiotherapists and speech therapists as well as extended stay of the family with the patient facilitate their rapid recovery. It is worthwhile to mention that the AIS patients treated with intravenous thrombolysis in this stroke unit are included in the prospective, multicenter, observational Serbian Experience with Thrombolysis in Ischemic Stroke Registry (SETIS)<sup>18, 20</sup>.

From the time of admission to the stroke unit until discharge, nurses have one of the key functions as health care providers. Well-coordinated stroke care management can result in better outcome of the AIS patients, shorter hospitalization, and reduced costs<sup>21</sup>. One of the most important tasks is monitoring of patients' vital parameters (such as blood pressure, glucose level, heart rate, breathing pattern, temperature) through the regular examinations, bearing in mind

that timely response on changes in those parameters can improve patient's outcome<sup>21</sup>. Furthermore, nursing staff have a pivotal role in decreasing a probability of complications occurrence<sup>21</sup>. A prospective cohort study conducted at the Belgrade stroke institutions revealed that the most frequent infections among the AIS patients were urinary tract, infections (UTI) (17.7%) and chest infections (9.7%)<sup>22</sup>. It is well known that complications are associated with worse outcome in those patients<sup>23</sup>. Further, in Korea, the nurses are included in the Stroke Alerts Teams (SAT) organized with the aim to accelerate time to thrombolysis in the patients with AIS<sup>24</sup>. In London, where 8 hyper-acute stroke units were established in 2010, the nursing staff is involved in thrombolysis treatment in terms of the patients' fulfillment of criteria for receiving this therapy, providing accommodation and adequate care<sup>25</sup>. A recent study which compared the stroke care teams in 11 Veterans Affairs medical centers in the USA, concluded that the advanced practice professionals (nurse practitioners and physician assistants) can represent coordinators in a process of stroke care<sup>26</sup>. Beside mentioned duties, early mobilization and education of patients and their families how to prevent recurrence of AIS are the scope of nursing commitments as well<sup>21</sup>. According to the American Stroke Association (ASA) Guideline for the early management of patients with acute ischemic stroke, the nursing staff represent one of pivotal members of stroke management team including the Emergency Department nurses and inpatient nurses and should be included in all phases of care of stroke patients<sup>27</sup>. The ASA Guidelines for Adult Stroke Rehabilitation and Recovery put emphasis on a role of nursing care during hospitalization, but also after discharge<sup>28</sup>. For example, the authors pointed out that a great proportion of the AIS patients experience dysphagia immediately after the stroke and thus highlighted contribution of nursing staff in adequate nutrition of patients in order to prevent this problem and its consequences<sup>28</sup>. Further, it was reported that the nursing staff has important role in the early supported discharge and that their key tasks in this process include prevention of skin lesions, urinary and gastrointestinal tract disorders, malnourishment, regular use of therapy etc. Finally, the authors emphasized the function of nursing staff in the prevention and management of post-stroke depression<sup>28</sup>.

Use of different stroke scales can also be helpful in everyday work of the nursing professionals. They are used for the assessment of stroke severity as well as for monitoring of patient's recovery during and after hospitalization. Based on the scale scores, the nurses can make decisions to which special care the patients should be directed<sup>21</sup>. One of these scales especially important for nursing staff is the Morse Fall scale<sup>13</sup>. It is used as a quick tool for the assessing a patient's chance of falling. The North American Nursing Diagnosis Association (NANDA) classified fall risk as a nursing diagnosis<sup>29</sup>. Although the Morse Fall scale score was significant prognostic factor in univariate regression analysis in our study, it was not shown to be an independent predictor of in-hospital mortality among the AIS patients, probably due to a small sample size.

Some limitations of our study have to be mentioned. Firstly, a total of 59 patients with AIS were enrolled in this

study. It is apparent that our research would benefit from the larger sample size, i.e., these results should be interpreted with caution. However, the consecutive sampling design, in the defined period of 2 months, ensures the representativeness of the sample and the generalizability of the results. Further, 33 out of 59 (55.9%) patients had mild AIS, according to the NIHSS score, and 6 patients died during hospitalization (10.2%). These facts could have affected our results.

### Conclusion

The results of this study showed an important role of nursing staff in the recovery of AIS patients, as well as that

admission to the stroke units versus the conventional units is the independent predictor of decreased in-hospital mortality.

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### Conflict of interest

All authors declare that they have no conflict of interest.

## R E F E R E N C E S

- World Heart Federation. Stroke. Available from: <http://www.world-heart-federation.org/cardiovascular-health/stroke/> [accessed 2016 November].
- Dolicanin Z, Bogdanovic D, Lazarevic K. Changes in stroke mortality trends and premature mortality due to stroke in Serbia, 1992–2013. *Int J Public Health* 2016; 61(1): 131–7.
- GBD Profile: Serbia. Global Burden of Diseases, Injuries, and Risk Factors Study 2010. Seattle, WA: Institute for Health Metrics and Evaluation; 2010. Available from: <http://www.healthmetricsandevaluation.org>
- GBD 2013 Mortality and Causes of Death Collaborators. Global, regional, and national age-sex specific all-cause and cause-specific mortality for 240 causes of death, 1990–2013: a systematic analysis for the Global Burden of Disease Study 2013. *Lancet* 2015; 385(9963): 117–71.
- Ingeman A, Andersen G, Hundborg HH, Svendsen ML, Johnsen SP. Processes of care and medical complications in patients with stroke. *Stroke* 2011; 42(1): 167–72.
- Tung YC, Jeng JS, Chang GM, Chung KP. Processes and outcomes of ischemic stroke care: the influence of hospital level of care. *Int J Qual Health Care* 2015; 27(4): 260–6.
- Ingeman A, Pedersen L, Hundborg HH, Petersen P, Zielke S, Mainz J, et al. Quality of care and mortality among patients with stroke: a nationwide follow-up study. *Med Care* 2008; 46(1): 63–9.
- CMS. Hospital compare: timely and effective care. 2014. Available from: <http://www.medicare.gov/hospitalcompare/about/timely-effective-care.html>. [accessed 2016 October].
- Goldstein LB, Bertels C, Davis JN. Interrater reliability of the NIH stroke scale. *Arch Neurol* 1989; 46: 660–2.
- Salter G, Steen C, De Keyser J. Use of the Barthel Index and modified Rankin scale in acute stroke trials. *Stroke* 1999; 30(8): 1538–41.
- Weir CJ, Bradford AP, Lees KR. The prognostic value of the components of the Glasgow coma scale following acute stroke. *QJM* 2003; 96(1): 67–74.
- Bergstrom N, Braden BJ, Laguzza A, Holman V. The Braden Scale for Predicting Pressure Sore Risk. *Nurs Res* 1987; 36(4): 205–10.
- Morse JJ, Morse RM, Tylko SJ. Development of a scale to identify the fall-prone patient. *Can J Aging* 1989; 8(4): 366–77.
- Stroke Unit Trialists' Collaboration. Organised inpatient (stroke unit) care for stroke. *Cochrane Database Syst Rev* 2007; (4): CD000197.
- Seenan P, Long M, Langhorne P. Stroke units in their natural habitat: systematic review of observational studies. *Stroke* 2007; 38(6): 1886–92.
- Zhai S, Gardiner F, Neeman T, Jones B, Gawarikar Y. The Cost-Effectiveness of a Stroke Unit in Providing Enhanced Patient Outcomes in an Australian Teaching Hospital. *J Stroke Cerebrovasc Dis* 2017; 26(10): 2362–8.
- Bokbari FA, Wellwood I, Rudd AG, Langhorne P, Dennis MS, Wolfe CD. Selective admission into stroke unit and patient outcomes: a tale of four cities. *Health Econ Rev* 2014; 4(1): 1.
- Jovanović DR, Beslac-Bumbasirević Lj, Budimkić M, Pekmezović T, Zivković M, Kostić VS. SETIS Investigation Group. Do women benefit more from systemic thrombolysis in acute ischemic stroke? A Serbian experience with thrombolysis in ischemic stroke (SETIS) study. *Clin Neurol Neurosurg* 2009; 111(9): 729–32.
- Stefanović Budimkić M, Pekmezović T, Beslac-Bumbasirević L, Ercegović M, Berisavac I, Stanarčević P, et al. Return to Paid Work after Ischemic Stroke in Patients Treated with Intravenous Thrombolysis. *Neuroepidemiology* 2016; 46(2): 114–7.
- Budimkić MS, Pekmezović T, Beslac-Bumbasirević L, Ercegović M, Berisavac I, Stanarčević P, et al. Long-term medication persistence in stroke patients treated with intravenous thrombolysis. *Clin Neurol Neurosurg* 2016; 141: 19–22.
- Summers D, Leonard A, Wentworth D, Saver JL, Simpson J, Spilker JA, et al. American Heart Association Council on Cardiovascular Nursing and the Stroke Council. Comprehensive overview of nursing and interdisciplinary care of the acute ischemic stroke patient: a scientific statement from the American Heart Association. *Stroke* 2009; 40(8): 2911–44.
- Medić S, Beslac-Bumbasirević L, Kisić-Tepavčević D, Pekmezović T. Short-term and long-term stroke survival: the Belgrade prognostic study. *J Clin Neurol* 2013; 9(1): 14–20.
- Wang P, Wang Y, Zhao X, Du W, Wang A, Liu G, et al. In-hospital medical complications associated with stroke recurrence after initial ischemic stroke: A prospective cohort study from the China National Stroke Registry. *Medicine (Baltimore)* 2016; 95(37): e4929.
- Jeon SB, Ryoo SM, Lee DH, Kwon SU, Jang S, Lee EJ, et al. Multidisciplinary Approach to Decrease In-Hospital Delay for Stroke Thrombolysis. *J Stroke* 2017; 19(2): 196–204.
- Javier Catanguí E, John Roberts C. The lived experiences of nurses in one hyper-acute stroke unit. *Br J Nurs* 2014; 23(3): 143–8.
- Rattray NA, Damush TM, Luckhurst C, Bauer-Martinez CJ, Homoya BJ, Miech EJ. Prime movers: Advanced practice professionals in the role of stroke coordinator. *J Am Assoc Nurse Pract* 2017; 29(7): 392–402.
- Jauch EC, Saver JL, Adams HP Jr, Bruno A, Connors JJ, Demaerschalk BM, et al. American Heart Association Stroke Council; Council on Cardiovascular Nursing; Council on Peripheral Vascular Disease; Council on Clinical Cardiology. Guidelines for the early management of patients with acute ischemic stroke: a guideline for healthcare professionals from the

- American Heart Association/American Stroke Association. *Stroke* 2013; 44(3): 870–947.
28. *Winstein CJ, Stein J, Arena R, Bates B, Cherney LR, Cramer SC, et al.* American Heart Association Stroke Council, Council on Cardiovascular and Stroke Nursing, Council on Clinical Cardiology, and Council on Quality of Care and Outcomes Research. Guidelines for Adult Stroke Rehabilitation and Recovery: A Guideline for Healthcare Professionals from the American Heart Association/American Stroke Association. *Stroke* 2016; 47(6): e98–e169.
29. *Herdman TH, Kamitsuru S.* NANDA International Nursing Diagnoses: Definitions and Classification, 2015–2017. Oxford: Wiley Blackwell; 2014.

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