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## Stroke outcomes in Croatian and Bulgarian patients measured by modified Rankin scale

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### Abstract

The purpose of the study was to measure functional outcomes of stroke patients undergoing rehabilitation in Croatia and Bulgaria using modified Rankin scale (mRS) as a clinician-reported measure of global disability. Fewer days are allowed for rehabilitation in Bulgaria than in Croatia according to the payers' rules, and the aim of the study was to assess the impact of length of stay to the progress of patients. Data on 50 stroke patients from each of two countries were analyzed that were matched by gender, age at stroke, days from stroke to the onset of rehabilitation, type, side and severity of stroke, co-morbidity and the programme of rehabilitation. Initial and final mRS results and the change (progress) of patients' functional abilities and lengths of stay of both groups were recorded. Both groups presented with lower mRS results at rehabilitation onset ( $4.06 \pm 1.02$  in Croatian and  $3.88 \pm 0.96$  in Bulgarian patients) indicating high dependency and the need for thorough approach and engagement of the whole rehabilitation team. There were significant changes of mRS (improvement) in both groups, but the progress was statistically better in Croatian with change of mRS of  $0.96 \pm 0.67$ , than in Bulgarian patients ( $0.42 \pm 0.50$ ), whereas the length of stay was significantly longer in Croatian patients ( $33 \pm 15$  days) than in Bulgarian ( $8 \pm 2$  days). The change in

one mRS level may represent functionally important progress with significant impact for the patient and his/her carers. Bulgarian patients, although significant in before-after comparison of mRS results, do not reach functional goals as Croatian patients. Therefore, we may suggest that the length of stay of Bulgarian patients ( $8 \pm 2$  days) should be prolonged to, at least, the length of stay present in Croatian patients ( $33 \pm 15$  days) to achieve the same functional improvement measured by the modified Rankin scale.

**Key words:** stroke, outcome, modified Rankin scale.

## **Ishodi moždanog udara u hrvatskih i bugarskih pacijenata mjereni modificiranom Rankinovom ljestvicom**

### **Sažetak**

Cilj rada bio je usporedba funkcijskih ishoda pacijenata s moždanim udarom tijekom rehabilitacije u Hrvatskoj i Bugarskoj s pomoću modificirane Rankinove ljestvice (mRS) kao kliničke mjere opće nesposobnosti. Broj rehabilitacijskih dana u Bugarskoj je, sukladno nacionalnim pravilnicima, manji nego u Hrvatskoj. Stoga je namjera studije bila ocijeniti utjecaj duljine rehabilitacije na napredak pacijenata. Korišteni su podaci 50 pacijenata iz svake od zemalja, koji su bili usklađeni prema spolu dobi u vrijeme udara, proteka vremena od udara do rehabilitacije, tipa udara, zahvaćene strane i težine udara, komorbiditeta i programa rehabilitacije. U obje skupine zabilježeni su početni i završni rezultati mRS-a, promjene (napredak) funkcijskih mogućnosti i duljina boravka na rehabilitaciji. Također su zabilježene niže početne vrijednosti mRS-a ( $4,06 \pm 1,02$  u hrvatskoj i  $3,88 \pm 0,96$  u bugarskoj skupini) što je upućivalo na veliku ovisnost i potrebu temeljitog pristupa i angažmana cijelog rehabilitacijskog tima. Zabilježene su značajne promjene mRS-a (napredaka) u obje skupine, ali je napredak bio statistički bolji u hrvatskoj s promjenom od  $0,96 \pm 0,67$  u odnosu prema bugarskoj skupini u kojoj je bio  $0,42 \pm 0,50$ . Pritom je rehabilitacija pacijenata iz hrvatske skupine trajala mnogo dulje ( $33 \pm 15$  dana) nego bugarskih ( $8 \pm 2$  dana). Promjena u jednoj razini mRS-a može značiti funkcijski važan napredak s velikim utjecajem na pacijenta i njegovu/njezinu okolinu. Bugarski pacijenti, iako su značajno napredovali u odnosu na početne rezultate, nisu postizali funkcijske napretke kao hrvatski pacijenti. Stoga možemo predložiti da rehabilitacija bugarskih pacijenata ( $8 \pm 2$  dana) traje, barem, koliko i hrvatskih ( $33 \pm 15$  dana) kako bi se postigao isti funkcijski napredak mjereno modificiranom Rankinovom ljestvicom.

**ključne riječi:** moždani udar, ishodi, modificirana Rankinova ljestvica

### **Introduction**

Successful functional outcome of stroke patients depends on treatment provided by an interdisciplinary team of experienced professionals (1,2). The aim of rehabilitation is not only to teach patients how to take care of

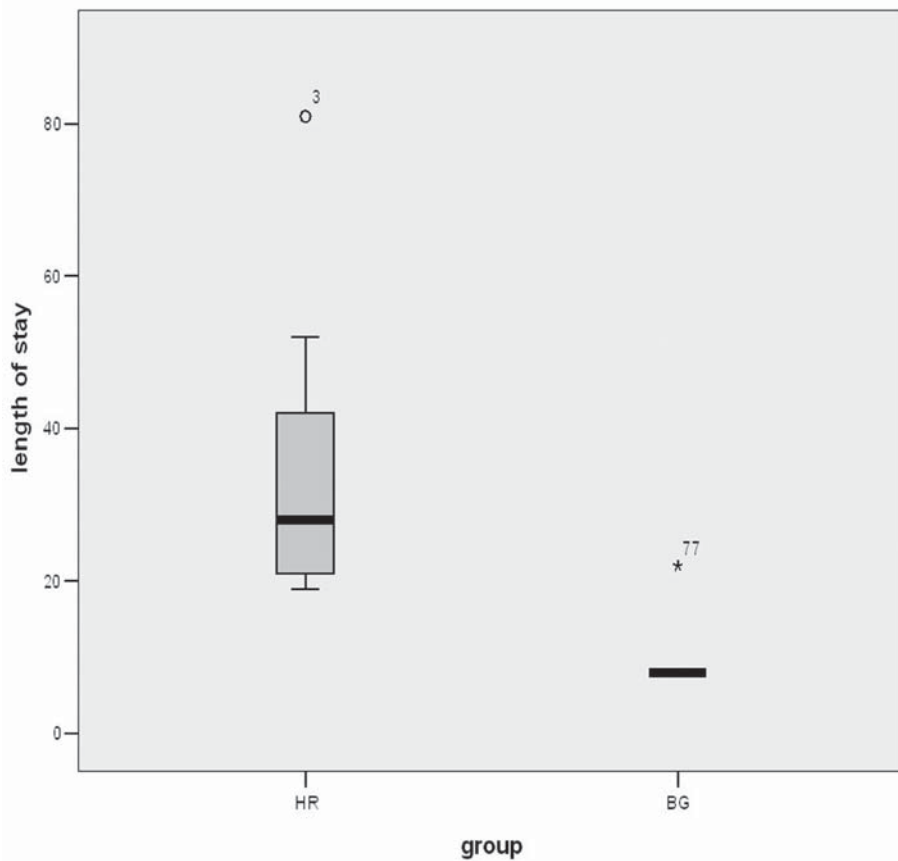
themselves, but to integrate them back into society. In that crucial part of their lives, rehabilitation plays the major role (3). The modified Rankin scale (mRS) is a clinician-reported measure of global disability and widely applied for evaluating stroke patient outcomes (4,5). This scale measures independence rather than performance of specific tasks (Appendix 1). It consists of six grades from 0 to 5 and additional category "6" which means death. According to them, score  $\leq 2$  corresponds to independence. Limitations in the use of mRS include inter-rater variability (6), lack of consensus of the impact of change in mRS rating to the actual performance of the patient (7), or patient's co-morbidities (diabetes, cardiovascular diseases and arthritis) (8) that can influence the physical functioning and cognitive abilities. Croatia and Bulgaria are developing countries with similar protocols for rehabilitation of stroke patients. However, according to the current rules of payers (insurance), rehabilitation in Bulgaria may last shorter (in days) comparing to Croatia. The aim of the study was to compare progress in mRS during rehabilitation between patients of both countries. We expected more beneficial outcomes in Croatian stroke patients, who were allowed to spend more days in rehabilitation programme than in Bulgaria.

## Methods

Data on 50 stroke patients were analyzed in both countries in rehabilitation units in 2011 and 2012. Data were collected in accordance with the ethical standards of the institutions. We recorded data on gender, age at stroke, days from stroke to the onset of rehabilitation, length of stay at rehabilitation, severity of stroke (plegia or paresis), side of stroke (left or right), type of stroke (ischemic or hemorrhagic), mRS (4,5) at the onset and at the end of inpatient rehabilitation, progress (change) in mRS result, type of programme (full - including hydrotherapy or partial - without hydrotherapy but comprising of kinesiotherapy, occupational therapy, speech therapy, massage and various forms of electrotherapy, if indicated) and co-morbidity (hypertension, diabetes, hyperlipidaemia...). Duration of the programme was approximately 3 hours of therapy per working day in both countries. Independent and paired t-tests for equality of means were used to determine if differences existed between the groups and in before-after study. For all analysis, significance was established when  $p < 0.05$ . Descriptive statistics was used and data are presented as means  $\pm$  standard deviation. Distribution was tested with Kolmogorov-Smirnov test. All statistical analysis was performed using SPSS for Windows, version 13.0.

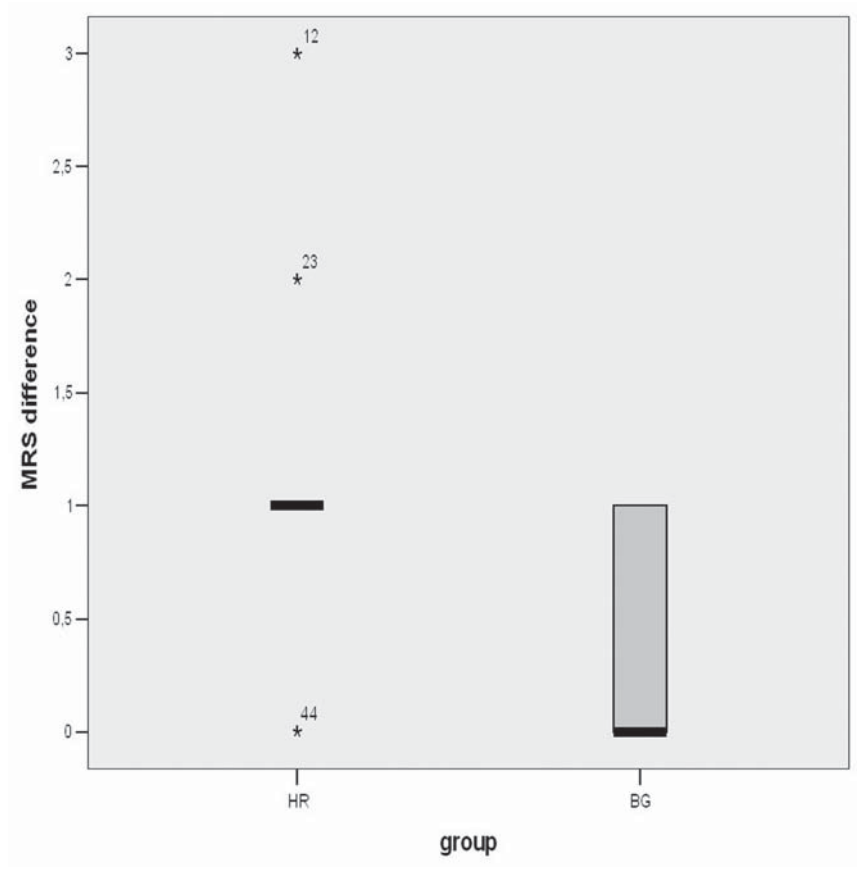
## Results

There were 50 stroke patients in both countries undergoing rehabilitation in 2011 that were included in the study. There were 25 male and 25 female patients in Croatian, while there were 34 male and 16 female patients in Bulgarian sample. Age at stroke was  $69 \pm 12$  (median=70, range=31-85) years in Croatian, while it was  $67 \pm 11$  (median=67, range=29-86) in Bulgarian sample, without difference ( $p=0.589$ ). Croatian patients presented to rehabilitation ward  $29 \pm 23$  (median 21, range 7-120) days following stroke, while Bulgarian at  $35 \pm 31$  (median 28, range 8-170), without difference ( $p=0.268$ ). However, the duration of stay at rehabilitation ward for Croatian patients was  $33 \pm 15$  (median=28, range=19-81) days, while in Bulgarian sample it was  $8 \pm 2$  (median=8, range=8-22) days, with significant difference ( $p<0.001$ ), as shown in Figure 1.



**Figure 1** The duration of stay (in days) at rehabilitation in Croatian (HR) and Bulgarian (BG) patients

In both samples 9 patients presented with plegia and 41 with paresis of affected side. Thirty-six Croatian patients suffered from ischemic stroke as well as 38 in Bulgaria - the rest were hemorrhagic incidents. MRS at rehabilitation onset in Croatia was  $4.06 \pm 1.02$  (median=4, range=1-5), and in Bulgaria  $3.88 \pm 0.96$  (median=4, range=2-5), without difference ( $p=0.366$ ). MRS at the end of rehabilitation in Croatia was  $3.10 \pm 1.13$  (median=3, range=1-5), and in Bulgaria  $3.46 \pm 0.79$  (median=3, range=2-5), without difference ( $p=0.068$ ). There were significant changes (improvements) in mRS at onset and at the end of rehabilitation in both samples ( $p < 0.001$ ). Mean progress (change) in mRS result in Croatian sample was  $0.96 \pm 0.67$  and in Bulgarian sample it was  $0.42 \pm 0.50$ . However, mRS progress in Croatian sample was statistically better than in Bulgarian sample ( $p < 0.001$ ) as shown in Figure 2.



**Figure 2** Modified Rankin scale (mRS) progress (change) in Croatian (HR) and Bulgarian (BG) patients

Full rehabilitation programme was obtained in 44 Croatian and in 40 Bulgarian patients. Co-morbidity was present in majority of patients, 44 in Croatian and 47 in Bulgarian sample; while multiple co-morbidities (more than one) were found in 29 Croatian and 17 Bulgarian patients.

## Discussion

Results of the study demonstrate similarities of age-groups, days from stroke before onset of rehabilitation, type (ischemic or hemorrhagic) and severity of stroke (plegia or paresis), co-morbidities and programmes of rehabilitation in both samples. Although admission to rehabilitation after stroke was in both samples appropriate ( $29\pm 23$  days in Croatian and  $35\pm 31$  days in Bulgarian sample), there were some too early (e.g. 7-8 days) or too late admissions (e.g. 120 or 170 days from stroke). Both groups of patients presented with lower mRS result at rehabilitation onset ( $4.06\pm 1.02$  in Croatian and  $3.88\pm 0.96$  in Bulgarian sample) indicating high dependency and the need for thorough approach and engagement of the whole rehabilitation team, including occupational and speech therapy as well as basic kinesiotherapy (2). Moreover, the presence of comorbidities and risk factors in majority of patients added to the complexity of rehabilitation process. Some patients were restricted from full programme because of contra-indications (e.g. hydrotherapy). Although both groups have made statistically significant progress in the course of rehabilitation, the average mRS change (progress of patients) was statistically better in Croatian patients ( $0.96\pm 0.67$  in Croatian sample and  $0.42\pm 0.50$  in Bulgarian) ( $p < 0.001$ ). This may be attributed to the length of stay of patients which is very much in favour of Croatian group ( $33\pm 15$  days, median=28, range=19-81) compared to Bulgarian group ( $8\pm 2$  days, median=8, range=8-22), since all other data that were monitored (type, side and severity of stroke, gender and age of stroke, co-morbidities and type of rehabilitation programme) were without difference. Stroke patients require calm environment with structured rehabilitation effort of the multidisciplinary team, and length of stay that allows expected variations of their physical, psychological and motivational state, which occur over days and weeks (2,3). The change in one mRS level may represent functionally important progress (e.g. from 4 - unable to walk without assistance to 3 - able to walk without assistance; or from 3 - requiring some help to 2 - able to look after own affairs) with significant impact for the patient and his/her carers. Bulgarian patients have an average of  $0.42\pm 0.50$  of mRS progress indicating that their improvements, although

significant in before-after comparison, do not reach functional goals as in Croatian patients ( $0.96 \pm 0.67$  of mRS progress). Therefore, we may suggest that the length of stay of Bulgarian patients ( $8 \pm 2$  days) should be prolonged to, at least, the duration of stay present in Croatian patients ( $33 \pm 15$  days) to achieve the same functional improvement measured by the modified Rankin scale. Limitation of this multicentre study is possible interobserver variability (6) that might be improved with inclusion of more patients in the study.

### Conflict of interest statement

The authors declare that there is no conflict of interest.

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## Appendix 1.

Provided by the Internet Stroke Center — [www.strokecenter.org](http://www.strokecenter.org)

### **MODIFIED RANKIN SCALE (MRS)**

Patient Name: \_\_\_\_\_

Rater Name: \_\_\_\_\_

Date: \_\_\_\_\_

Score	Description
0	No symptoms at all
1	No significant disability despite symptoms; able to carry out all usual duties and activities
2	Slight disability; unable to carry out all previous activities, but able to look after own affairs without assistance
3	Moderate disability; requiring some help, but able to walk without assistance
4	Moderately severe disability; unable to walk without assistance and unable to attend to own bodily needs without assistance
5	Severe disability; bedridden, incontinent and requiring constant nursing care and attention
6	Dead

TOTAL (0–6): \_\_\_\_\_