

# Determinants of length of stay in an inpatient stroke rehabilitation unit in Saudi Arabia

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## ABSTRACT

**الأهداف:** تحديد وتحليل أثر العمر، الجنس، والعرق في مدة الإقامة (LoS) لدى المرضى في أقسام إعادة التأهيل بعد السكتة الدماغية.

**الطريقة:** لقد تم اختيار جميع المرضى الذين أكملوا برنامج إعادة تأهيل السكتة الدماغية مدينة سلطان بن عبد العزيز للخدمات الإنسانية – الرياض – المملكة العربية السعودية خلال الفترة من 1 يناير 2005 إلى 15 أكتوبر 2008 لهذه الدراسة حسب سجلات الدخول. واشتملت هذه الدراسة عدد 823 مريض (551 ذكر – 272 أنثى) تم تحديدهم بفئات عمرية ( $62.87 \pm 0.54$  عام). تم تحليل تغير مدة الإقامة، والجنس، والعرق. واستبعد المرضى الذين أعمارهم أقل من أو مساوي لـ 19 عام والذين أعمارهم أكبر من أو مساوي 91 عام من الدراسة لصغر حجم العينات.

**النتائج:** لقد كان معامل مدة إقامة LoS إعادة التأهيل للسكتة الدماغية المستخدم هو 1.56-45 يوم. لقد أظهرت النتائج تكرار أعلى للسكتة الدماغية بين الفئات العمرية 51-60، 61-70 و71-80 بينما كانت منخفضة في الفئات 20-30 و31-40. كان طول مدة الإقامة LoS أكثر عند الذكور من الإناث في كل الفئات العمرية حيث لوحظت نتائج إحصائية مميزة للفئات العمرية 51-60 ( $p=0.0084$ ) و61-70 ( $p=0.0042$ ) و71-80 ( $p=0.037$ ) مقارنة بمثيلاتها عند الإناث. كما أظهرت الدراسة أيضاً أن طول مدة الإقامة LoS عند المرضى السعوديين كان أطول من المدة عند المرضى غير السعوديين ( $p=0.0009$ ).

**خاتمة:** تقترح نتائج الدراسة أن اختلاف الجنس، العمر، والعرق هي عوامل مجازفة لطول مدة الإقامة LoS لمرضى السكتة الدماغية.

**Objectives:** To determine and analyze the influence of age, gender, and ethnicity in the length of stay (LoS) of inpatient rehabilitation unit patients after stroke.

**Methods:** All patients who completed the stroke rehabilitation program at Sultan Bin Abdulaziz Humanitarian City, Riyadh, Kingdom of Saudi Arabia from 1st January 2005 to 15th October 2008 were selected for the study. Admission records of

823 (male; 551, female; 272) patients with a mean age of  $62.87 \pm 0.54$  years were included in this study. Patients aged  $\leq 19$  and  $\geq 91$  years were excluded due to small sample size. Age, gender, and ethnic differences of LoS were analyzed.

**Results:** The mean LoS on the stroke rehabilitation program of the study population was  $45 \pm 1.56$  days. Results showed that the frequency of the stroke was higher in the 51-60, 61-70, and 71-80 age groups, and lower in the 20-30 and 31-40 age groups. The LoS of males were longer than females in all age groups, and statistically significant results were observed in the 51-60 ( $p=0.0084$ ), 61-70 ( $p=0.0042$ ), and 71-80 ( $p=0.037$ ) age groups as compared with females. The study also found that the LoS of Saudi patients were higher when compared with non-Saudis ( $p=0.0009$ ).

**Conclusion:** The results of the study suggest that gender, age, and ethnic differences were risk factors of LoS of stroke patients.

*Saudi Med J 2010; Vol. 31 (2): 189-192*

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*Received 26th October 2009. Accepted 22nd December 2009.*

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Stroke is the most common cause of disability and a leading cause of mortality world wide,<sup>1</sup> although the incidence is falling in the West, but is probably rising in Asia.<sup>2</sup> According to the World Health Organization (WHO) estimates, 15 million people each year suffer strokes, and 5 million are left permanently disabled. Stroke burden is projected to rise from approximately 38 million disability adjusted life years (DALYs) globally in 1990, to 61 million DALYs in 2020.<sup>3</sup>

Established risk factors, such as arterial hypertension, diabetes mellitus, cigarette smoking, hyper-lipidemia, micro-vascular rupture, age, and observed comorbidity, such as sickle cell disease, human immunodeficiency virus/acquired immune deficiency syndrome infection, and cerebral malaria are increasingly being encountered in the tropics.<sup>4,5</sup> Stroke is second only to ischemic heart disease as a cause of death, and over a third of stroke deaths occur in developing countries.<sup>4,5</sup> Arab countries constitute populations with a similar lifestyle and diet that may influence stroke risk, type, and survival after stroke, as well as other characteristics in comparison with Western and Oriental populations.<sup>4</sup> In the Kingdom of Saudi Arabia (KSA), stroke is a rapidly growing problem and a major cause of illness and deaths. Studies reported that the overall incidence and prevalence of stroke in KSA appeared to be lower than the rates in Western countries, but falls within the range observed among Asian populations.<sup>6,7</sup> The major cause of mortality, hospitalization, and chronic disability, stroke imposed considerable physical and socioeconomic burden. Economic burden of stroke has direct, indirect, and intangible components. The direct cost of stroke is largely determined by the length of initial hospital stay.<sup>8,9</sup> As the search for solutions to rising health care costs has intensified over the past few years in the public and private sectors, the implications of age, gender, and ethnic variations in the length of stay (LoS) have assumed greater importance for stroke patients. Combining acute and rehabilitation services in a stroke unit may improve patients' functional outcomes and reduce length of hospital stay.<sup>10</sup> The duration of hospital stay depends not only on clinical factors, but also social and economic factors.<sup>11</sup> The evaluation of various factors such as age, gender, and ethnicity are necessary to shorten the duration of hospitalization. The aim of the present study was to determine and analyze the influence of age, gender, and ethnicity in the LoS of inpatient rehabilitation unit patients after stroke.

**Methods.** All patients who completed the stroke rehabilitation program at Sultan Bin Abdulaziz Humanitarian City, Riyadh, Kingdom of Saudi Arabia (KSA) from 1st January 2005 to 15th October 2008 were selected for the analysis. Admission records of 823 patients were identified with the mean age of  $62.87 \pm 0.54$  years were included in this study. The patients were divided into 7 groups based on their age (20-30, 31-40, 41-50, 51-60, 61-70, 71-80, and 81-90 years). Patients aged  $\leq 19$  and  $\geq 91$  years were excluded due to small sample sizes. The study was approved by the Research and Ethical Committee of Sultan Bin Abdulaziz Humanitarian City, Riyadh, KSA.

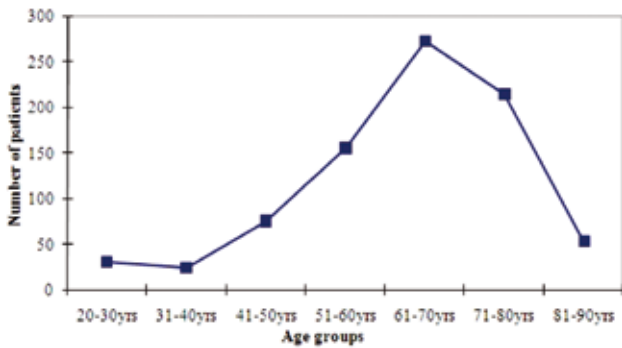
Data analysis was carried out using Microsoft Excel 2002 (Microsoft Corporation, Seattle, WA, USA), and the Statistical Package for Social Sciences version 16 (SPSS Inc., Chicago, IL, USA). Data were presented as mean  $\pm$  standard error of mean. The LoS was analyzed by one-way analysis of variance (ANOVA). Student's *t*-test was used for analyzing the age, gender, and ethnicity differences of LoS. A *p*-value of  $<0.05$  was considered statistically significant.

**Results.** Age, gender, and ethnicity wise distribution of the patients included in the study are shown in Table 1. The mean age of the patients was  $62.87 \pm 0.54$  years, with a median of 66 years (age range: 20-90 years). There were 551 males (67%) with a mean age of  $64.43 \pm 0.67$  years, and 272 females (33%) with a mean age of  $59.21 \pm 0.89$  years. There were 739 (89.8%) Saudi patients and 84 (10.2%) non-Saudi patients. The male to female ratio of the study population was 2:1. The mean LoS on the stroke rehabilitation program of the study population was  $45 \pm 1.56$  days. Figure 1 shows the age wise frequencies of stroke in the study population. Results showed that the higher frequency of stroke was found in the 61-70 age group, and a lower frequency was found in the 20-30 and 31-40 age groups. The influence of age in LoS of the study population is demonstrated in Figure 2. The study found that the LoS increases with age. The LoS of the 20-30 age group was  $36 \pm 2.1$ , and  $53 \pm 1.9$  in the 71-80 age group. However, a slight decrease was found in the 81-90 age ( $50 \pm 2.4$ ) as compared with the 71-80 age group. The changes of LoS within gender are shown in Figure 3. The results showed that the LoS of males were longer than the females in all age groups. A statistically significant results were observed in the male age groups; 51-60 ( $p=0.0084$ ), 61-70 ( $p=0.0042$ ) and 71-80 ( $p=0.037$ ) when compared to the female patients. The difference of the LoS in ethnicity is demonstrated in Figure 4. The results showed that there was a significant difference observed in the LoS of Saudis as compared to non-Saudi patients ( $p=0.0009$ ).

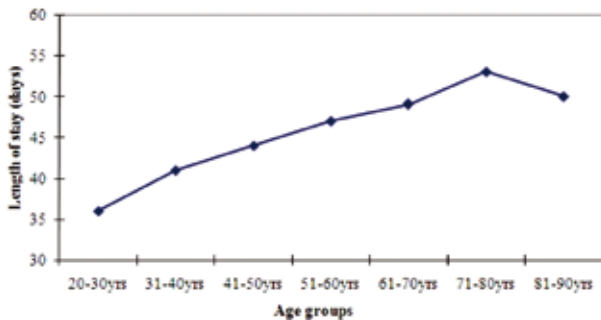
**Table 1** - Age, gender, and ethnicity wise distribution of the patients.

Age groups	mean $\pm$ SEM	Gender		Nationality	
		Male	Female	Saudi	Non-Saudi
20-30	$23.8 \pm 1.15$	15	15	21	9
31-40	$36.9 \pm 0.50$	11	13	23	1
41-50	$45.8 \pm 0.36$	49	26	68	7
51-60	$55.8 \pm 0.23$	102	53	134	21
61-70	$65.8 \pm 0.16$	175	97	247	25
71-80	$74.7 \pm 0.18$	154	60	195	19
81-90	$84.5 \pm 0.39$	45	8	51	2
All groups	$62.8 \pm 0.54$	551	272	739	84

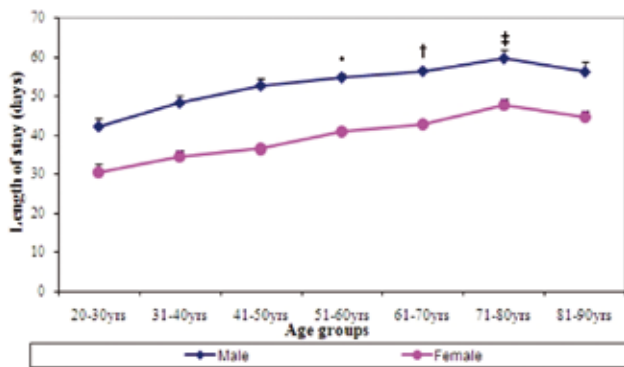
SEM - standard error of mean



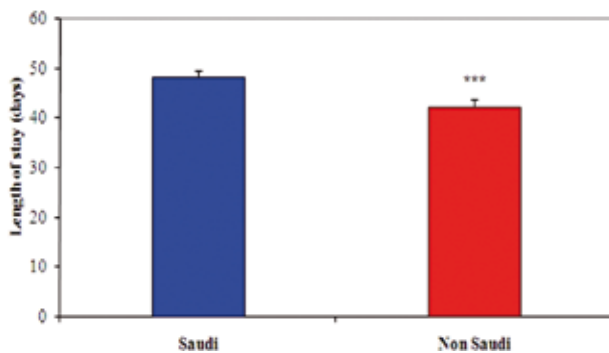
**Figure 1** - The age wise frequencies of stroke in the study population.



**Figure 2** - The influence of age in the length of stay (LoS) of the study population.



**Figure 3** - The changes of length of stay (LoS) within gender. Values are mean  $\pm$  standard error of mean. \* $p=0.0084$ , † $p=0.0042$ , ‡ $p=0.037$



**Figure 4** - The difference of the length of stay in ethnicity. Values are mean  $\pm$  standard error of mean. \*\*\* $p=0.0009$

**Discussion.** Studies reported that age, gender, race, and medical complications of stroke can increase the length of hospital stay. Furthermore, the presence of hypertension, diabetes, or heart disease all may adversely affect the functional outcome and LoS of stroke patients.<sup>12,13</sup> Many of these studies have reported conflicting statistics because the populations studied were often different. Also, stroke severity is a strong and reliable predictor of LoS.<sup>12,13</sup> However, prolonged hospital stay is associated with nosocomial infections, immobility, pressure sores, deep vein thrombosis, and deconditioning.<sup>14</sup> The present study analyzes the influence of age, gender, and ethnicity differences of the LoS of inpatient rehabilitation unit patients after stroke.

The results reported in the study revealed that age was an important risk factor for LoS of stroke patients. We found that the frequencies of the stroke were higher in the 51-60, 61-70, and 71-80 age groups, and lower in the 20-30 and 31-40 years age groups. Our findings were in agreement with the results from previous studies showing that the prevalence of stroke increases with age and higher life expectancy, and it will likely rise in the next decade.<sup>15,16</sup> Furthermore, the WHO report states that stroke is uncommon in people under 40 years.<sup>3</sup> Our study also found that frequencies of the stroke were lower in the <40 years age group. Age influence the severity of stroke, the deficits seen initially, or the functional ability of stroke patients. Conversely, age had an influence on the pattern of care given to patients, in that older patients were likely to stay in the hospital longer than younger patients.<sup>15,17</sup> In addition, younger stroke patients benefitted more by stroke unit rehabilitation compared with older patients.<sup>18</sup> However, a study reported that age is not a significant associate of prolonged LoS.<sup>19</sup> However, we observed that the LoS of the 20-30 years age group was  $36 \pm 2.1$  days, and it increases with age up to the 71-80 age group.

Gender was demonstrated as a significant risk factor of the functional outcome and LoS of stroke patients.<sup>20-22</sup> The results of this study indicated higher LoS among males. Studies reported that male stroke sufferers have poorer survival prospects than female counterparts,<sup>21</sup> and males appear to be more vulnerable to infections, injury, and stress.<sup>23</sup> On other hand, stroke severity, age, stroke subtype, and cardiovascular risk factors found that females had an overall lower risk compared to males.<sup>20-22</sup>

In this study, we observed that the LoS of Saudis (48 days) were higher than the non-Saudi (42 days). This observation is in accordance with the earlier study results that differences in functional independence at admission to post-stroke rehabilitation and the average daily improvement in function is related in part, to

patients' race/ethnicity.<sup>24</sup> It should be noted here that LoS in hospitals is a major contributor of direct stroke care cost. In efforts to contain health care costs, providers have attempted to decrease patients' average LoS in hospital. The assumption was that reducing LoS yields large cost savings.<sup>25</sup> Reducing LoS by as much as one full day reduces the total cost of care on average by 3% or less.<sup>25</sup>

The major limitation of this retrospective study was the limited number of risk factors examined. In conclusion, the results of this study indicate that the gender, age, and ethnicity were the significant risk factors of LoS in stroke patients. However, further studies are required in different clinical settings to provide a more comprehensive picture of LoS in stroke patients.

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