Background: Stroke is a major health problem in developing countries. In a previous survey, the prevalence rate of stroke in the Nile Valley governorate of Assiut was significantly higher than other Arabic countries. In view of this, we carried out a follow-up study in a second Nile Valley governorate (Qena).

Methods: A community-based, three-phase, door-to-door study with random sampling of 10 areas in Qena governorate (first phase), involving 8027 inhabitants with 4172 males (51.97%) and 3855 females (48.03%). There were 4427 urban residents (55.15%) and 3600 residents (44.85%) from the rural community. In the second phase, participants were screened using the questionnaire for stroke, whereas the third phase involved neurologic evaluation of all suspected cases, with diagnosis of stroke confirmed by evaluation of computed tomography (CT) scans. The Mini Mental State Examination and National Institute of Health Stroke Scale were evaluated for each patient.

Results: Of the 8027 participants, 74 were identified as positive cases with a crude prevalence rate 922 of 100,000, an age-adjusted local prevalence rate of 777 of 100,000 and an age-adjusted prevalence rate of Egyptian population 566.6 of 100,000. The highest age-specific prevalence rates were recorded among subjects 70 years of age or older (8,392 of 100,000). The crude prevalence rate of ischemic stroke was significantly higher than that of hemorrhagic stroke (797 vs 125 of 100,000). Illiterate participants had a significantly higher crude prevalence rate than those who were literate (3567 vs 704 of 100,000). There was no significant difference in the prevalence rate between rural and urban areas or between males and females. Fifty patients (67.57%) had 1 or more risk factors of stroke, with hypertension being the most common (62.16%), followed by diabetes mellitus (36.49%).

Conclusions: The overall prevalence rate of stroke is nearly the same as in other Egyptian governorates and is higher than other Arabic countries.

Key Words: Stroke—prevalence—poststroke dementia—risk factors of stroke—Qena/Egypt—transient ischemic attack (TIA).

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After coronary heart disease and cancer of all types, stroke is the third commonest cause of death worldwide. Stroke remains one of the most devastating of all neurologic conditions, causing an estimated 5.7 million deaths in 2005. Stroke is a major cause of adult disability, both in terms of its initially debilitating symptoms and, in many cases, because of the severe long-term impairment in activities such as walking and speech. Knowledge about the risk factors of stroke is mostly based on North American or European studies, with few data from developing countries.
The highest prevalence rate of stroke (included only door-to-door studies) of 3370 of 100,000 was recorded in European countries mainly in Croatia and the lowest recorded in an Arabic country (Tunisia) 42 of 100,000. According to the data collected by Zhang et al, the incidence of stroke in 5 European countries ranging from 114 cases per 100,000 persons per year in France for first-ever stroke to 350 cases per 100,000 persons per year in Germany for all strokes.

There are few community-based studies from Arabic countries; 3 of them have been performed in Egypt. Such studies are more informative than hospital-based data in countries with a large rural population such as Egypt where people may not be able to come to hospital for treatment. The first study was in Assiut Governorate (Nile valley); where the age-adjusted prevalence rate was 699 of 100,000 whereas in the second study in the Al-Kharga district, New Valley, the crude prevalence rate was 566 per 1000 population, the third one in Al Quseir district with a crude prevalence rate of 655 of 1000.

Because these rates are higher than in neighboring Arab countries, we performed a second survey in a Nile governorate to provide additional confirmatory evidence for the high prevalence rate in Egypt. We hope that estimation of stroke frequency in Egyptian populations in different governorates will provide evidence for formulating a strategy to prevent and control stroke in Egypt.

Subjects and Methods

A cross sectional community-based study was implemented in the south Upper Egypt, Qena governorates. The Nile valley is at its narrowest in Egypt here and the arable land, a green strip only 1 or 2 km on either side of the river, is bordered by barren desert on both sides. The Qena governorate’s total area covers 10,798 km², representing 1.1% of the Republic’s area. Qena is an agricultural and industrial governorate. According to the preliminary results of the 2006 census, the population is about 3 million; 21.4% of them live in urban areas and 78.6% in rural areas. Qena governorate consists of 2 cities and 11 districts. Qena and Nagh Hammadi are considered as urban areas. Qena city is the capital of Qena governorate. It is situated on the east bank of the Nile. It is most famous for its proximity to the ruins of Dendera. The population is 230,392. Nagh Hammadi is located on the west bank of the Nile in Qena governorate. It is an industrial city as sugar, aluminum, and cement are produced there. It has a population of about 30,000. The 11 districts are considered as rural areas, which are distributed around the Nile, where most of the people were farmers.

The sample size was based on an expected prevalence of 4% among adults, with 2 percentage points’ error and a 95% confidence interval, allowing for a 10% refusal to participate. The study was conducted over a 2-year period from September 1, 2011 to August 31, 2013. August 31, 2013 was considered the prevalence day. So, any positive subject fulfilling the diagnostic criteria of stroke before the prevalence day at any time of their lives was considered as a prevalent case, and any subject who gave a history suggestive of stroke developing during the period of the survey was considered an incident case of stroke.

Sampling Methodology

First Stage: Selection of the Study Sites

A simple random sample of 10 study areas was selected randomly from Qena Governorate.

First, according to the geographic location we selected 3 districts randomly of 11 districts, then we selected 2 villages (areas) from each district, that is, Nagada (in the west bank of Nile), Qift (in the east of Nile), Dishenna (in the north bank of the Nile) with a total of 6 villages considered as rural populations. We selected urban areas from each city (Qena city and Nagh Hammadi city), with a total of 4 urban areas using simple random technique and according to local security safety.

Selection of the households: a systematic random sample of households in the 10 areas was then taken by selecting every third household in each of the 10 study sites. If families refused the examination, we replaced them with the family next door.

Second Stage

Initial diagnosis was based on a general two-part screening questionnaire with part I recording sociodemographic details and part II involving a stroke screening questionnaire translated into Arabic as previously discussed in details by Khedr et al. We used this questionnaire for individuals who were interviewed directly unless aphasic or mentally impaired; in such cases, relatives or caregivers answered the questions.

The survey team comprised 10 social workers (education level of at least 10 years) who used the screening questionnaire, headed by 2 neurologists and a psychiatrist (master’s degree with at least 5 years of experience) who confirmed the diagnosis by reusing the screening questionnaire and referring the positive cases to hospital. The team received 3 weeks of training on how to carry out the protocol before starting the study.

Third Stage

This involved neurologic examination of all the positive cases after referral to the Neuropsychiatric Department at Qena University Hospital. In individuals with suspected stroke, the history was obtained, CT of the brain and laboratory investigations were performed as previously done in the survey of Assiut governorate. Each case was scored using the following: (1) Mini Mental State
PREVALENCE OF STROKE IN QENA/EGYPT

Examination (MMSE)\textsuperscript{11} and (2) National Institute of Health Stroke Scale.\textsuperscript{12} The date of the stroke and the presence of recurrent events were recorded.

**Statistical Analysis**

Different scales were reviewed, and open-ended questions were coded and entered using a simple spreadsheet. Analysis followed after data verification and correction. All data were analyzed with the aid of the SPSS version 16 (www.spss.com). The results were expressed as mean $\pm$ standard deviation.

**Results**

A total of 8027 inhabitants (1076 families) were included in the study. The family which refused participation (40 families) was replaced by the next-door family in the survey. Of the study population, 5628 (70\%) were more than 20 years of age. Details of other age and gender specific groups with the prevalence rates are given in Table 1.

In terms of education, 590 (7.3\%) were below age of education, 757 (9.4\%) were illiterate, and 6680 (83.3\%) were literate (ranging from read and write to university level of education).

Of 8,027 participants, 90 were identified as positive on the survey questionnaire; but only 74 confirmed after re-evaluation by clinical examination and neuroimaging (CT or magnetic resonance imaging (MRI) of the brain). Twelve cases were diagnosed as psychogenic, 2 cases had hemi-Parkinson disease, and the other 2 had multiple sclerosis. The crude prevalence rate was 922 of 100,000, an age-adjusted local (Qena 2006 census) prevalence rate of 777 of 100,000 and an age-adjusted prevalence rate to Egyptian population 566.6 of 100,000 and 1221.7 of 100,000 to world population.

In general, the prevalence increased with age for both genders. No cases of stroke were found in subjects less than 20 years of age. The highest age-specific prevalence rates were recorded among subjects 70 years of age or older (8392 of 100,000) and then among those 60-69 years old (6204 of 100,000). There were more males than females in all age groups except among the age group 50-59 years old where females were 2535 and males were 2388.

The crude prevalence rate of ischemic stroke (797 of 100,000) was significantly higher than the crude prevalence rate of hemorrhagic stroke (125 of 100,000). Transient ischemic attack was recorded in 5 cases with crude prevalence rate 62 of 100,000. Eleven cases gave a history suggestive of stroke developing during the period of the survey with a crude incidence of stroke of 137 of 100,000 with 95\% confidence interval 56-218.

The prevalence among males was slightly, but not significantly, higher than for females (1103 of 100,000 vs 726 of 100,000). The crude prevalence rate was higher in rural than in urban areas (1111 vs 768 of 100,000, respectively) but the difference was not significant. Illiterate participants had a significantly higher crude prevalence rate than those who were literate (3567 vs 704 of 100,000; Table 2).

Concerning the demographic and clinical data of studied prevalent cases of stroke, the mean age of our patients was $59.6 \pm 11$ years (range 28-91) with a mean duration of illness of $2.47 \pm 1.05$ years (range 1-7). Among the patients, 32 (43.3\%) had right-sided hemiplegia and 39 (52.7\%) had left-sided hemiplegia, 2 (2.7\%) had vertebro-basilar stroke and 1 patient (1.35\%) had double.

A total of 50 patients (67.57\%) had 1 or more risk factors of stroke, 37.84\% had 2 risks factors and 20.27\% had 3 risk factors, hypertension being the most common risk factor (62.16\%), followed by diabetes mellitus (36.49\%). Ischemic heart disease was recorded in 7 cases (9.46\%) and a history of transient ischemic attack in 5 cases (6.76\%), whereas rheumatic heart in 4 cases (5.4\%) and systemic lupus erythromatosis in 1 patient (1.35\%). Eight cases (10.8\%) had a family history of stroke. There were no significant differences between males and females and between rural and urban areas in frequencies of diabetes mellitus or hypertension, whereas there was significant higher percentage of smoking and ischemic heart disease in males than in females with $P = .0001$ for both.

The National Institutes of Health Stroke Scale (NIHSS) mean $\pm$ standard deviation was 5.2 $\pm$ 4.4 (range 0-21). The mean MMSE score was 26.14 $\pm$ 2.36 (range 20-30) with 5 cases (6.67\%) having dementia (MMSE $\leq 23$ for literate and 21 for illiterate). Two cases were recorded with poststroke Parkinsonism (2.7\%).

**Discussion**

Egypt is a developing country with a large population, most of which live in the Nile valley where they share a common culture and climate. Stroke prevalence data provides the best measure of the total burden of stroke in any population. In the present study, the crude prevalence rate of stroke was 922 of 100,000 with an age-adjusted local prevalence of 777 of 100,000 and an age-adjusted standard world population prevalence of 1221 of 100,000, which is very similar to that reported in a previous study in Assiut/Egypt.\textsuperscript{6} Both of these governorates lie along the Nile and have slightly higher prevalence rates than in 2 other Egypt governorates outside the Nile valley (Al-Kharga Valley [desert governorate] and Al Qusier [governorate along the Red Sea]),\textsuperscript{9,10} which recorded crude prevalence rates of 566 and 655 of 100,000 respectively, but did not report age-adjusted prevalence. Overall, the prevalence of stroke in Egypt is higher than in other Arabic countries (in Tunisia 68 of 100,000 age adjusted for World Health Organization population and 186 of 100,000 for crude prevalence rate in Saudi Arabia).\textsuperscript{6,13} Inaccurate diagnosis, lack of investigatory tools, and lack of stroke awareness among the public may contribute to varying extents of inaccurate information about stroke prevalence.
The incidence of stroke was 137 of 100,000, whereas in other Egyptian studies the age-specific incidence rate was 2.5 and 1.8 of 1000 in a population greater than 20 years of age.9,10

In other African countries, prevalence rate ranged from 114 of 100,000 crude prevalence in Nigeria 14 to 870 of 100,000 age adjusted for WHO population in Sub-Saharan Africa.15

In Europe, the prevalence in Norway 16 age adjusted for the European population was 960 of 100,000 whereas there was a crude prevalence rate for all strokes including transient ischemic attacks of 3.370 of 100,000 in Croatia.5

In Asia, the age-adjusted prevalence rate was 244 of 100,000 for India17 age adjusted to the US population or 545/100,000 for India18 age adjusted to world population.

In South America the age-adjusted prevalence rate was 322 of 100,000 in Bolivia19 and 574 of 100,000 in Peru.20 However, it is difficult to compare estimates between studies because of differences in study design and because many previous studies have estimated the prevalence of first-ever stroke only or all strokes including transient ischemic attacks or subarachnoid hemorrhage. Another difference is the type of estimation, whether crude or age adjusted for local area, or for the WHO population. It is however, important to note that increased prevalence of stroke may not necessarily be because of increasing stroke incidence, but may also be related to better care and survival with decrease in mortality as previously described in Khedr et al.8

Our survey found that the crude prevalence rate of ischemic stroke was significantly higher than that of

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**Table 1. Crude prevalence rate of cerebrovascular stroke with age and sex specific groups in Qena Governorate, Egypt**

<table>
<thead>
<tr>
<th>Age group</th>
<th>Number of cases</th>
<th>Number of inhabitants</th>
<th>Percent of studied population (N = 8027)</th>
<th>CPR/100,000</th>
<th>95% CI</th>
</tr>
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<tbody>
<tr>
<td>Lesser than 20 y</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>0</td>
<td>2399</td>
<td>29.88</td>
<td>0</td>
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<tr>
<td>Male</td>
<td>0</td>
<td>1287</td>
<td>16.03</td>
<td>0</td>
<td>0</td>
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<tr>
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<td>0</td>
<td>1112</td>
<td>13.85</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Age-specific CPR 20 y of age or older</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>74</td>
<td>5628</td>
<td>70.11</td>
<td>1315</td>
<td>1015-1614</td>
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<tr>
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<td>46</td>
<td>2885</td>
<td>35.94</td>
<td>1594</td>
<td>1134-2055</td>
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<tr>
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<td>28</td>
<td>2743</td>
<td>34.17</td>
<td>1021</td>
<td>643-1399</td>
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<td>20-29 y</td>
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<td>28.89</td>
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<tr>
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<td>15.10</td>
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<tr>
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<td>1107</td>
<td>13.79</td>
<td>90</td>
<td>0-267</td>
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<td>16.19</td>
<td>231</td>
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<tr>
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<td>672</td>
<td>8.37</td>
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<tr>
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<td>1</td>
<td>628</td>
<td>7.82</td>
<td>159</td>
<td>0-471</td>
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<tr>
<td>40-49 y</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
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<td>628</td>
<td>7.82</td>
<td>1115</td>
<td>289-1940</td>
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<tr>
<td>Male</td>
<td>5</td>
<td>326</td>
<td>4.06</td>
<td>1334</td>
<td>189-2878</td>
</tr>
<tr>
<td>Female</td>
<td>2</td>
<td>302</td>
<td>3.76</td>
<td>662</td>
<td>0-1580</td>
</tr>
<tr>
<td>50-59 y</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>17</td>
<td>690</td>
<td>8.59</td>
<td>2464</td>
<td>1293-3635</td>
</tr>
<tr>
<td>Male</td>
<td>8</td>
<td>335</td>
<td>4.17</td>
<td>2388</td>
<td>733-4034</td>
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<tr>
<td>Female</td>
<td>9</td>
<td>355</td>
<td>4.42</td>
<td>2535</td>
<td>879-4192</td>
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<td>60-69 y</td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>Total</td>
<td>34</td>
<td>548</td>
<td>6.82</td>
<td>6204</td>
<td>4119-8290</td>
</tr>
<tr>
<td>Male</td>
<td>22</td>
<td>264</td>
<td>3.29</td>
<td>8333</td>
<td>4851-11,816</td>
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<tr>
<td>Female</td>
<td>12</td>
<td>284</td>
<td>3.53</td>
<td>4225</td>
<td>1835-6616</td>
</tr>
<tr>
<td>Above 70 y</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>12</td>
<td>143</td>
<td>1.78</td>
<td>8392*</td>
<td>3644-13,140</td>
</tr>
<tr>
<td>Male</td>
<td>9</td>
<td>76</td>
<td>.95</td>
<td>11,842†</td>
<td>4105-19,579</td>
</tr>
<tr>
<td>Female</td>
<td>3</td>
<td>67</td>
<td>.83</td>
<td>4478‡</td>
<td>0-9545</td>
</tr>
</tbody>
</table>

Abbreviations: CI, confidence interval; CPR, crude prevalence rate.

*The highest age-specific prevalence rate, \( P \leq .0001.  
†The highest specific prevalence rate among male, \( P \leq .0001. 
‡The highest specific prevalence rate among female, \( P \leq .0001.

The incidence of stroke was 137 of 100,000, whereas in other Egyptian studies the age-specific incidence rate was 2.5 and 1.8 of 1000 in a population greater than 20 years of age.9,10

In other African countries, prevalence rate ranged from 114 of 100,000 crude prevalence in Nigeria 14 to 870 of 100,000 age adjusted for WHO population in Sub-Saharan Africa.15

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In Asia, the age-adjusted prevalence rate was 244 of 100,000 for India17 age adjusted to the US population or 545/100,000 for India18 age adjusted to world population.
The prevalence of stroke increases with age in both genders, with the prevalence in males being generally higher than in females of the same age group. This trend is consistent with studies from France, Italy, and Germany. A community-based study in the Pashtun population reported that 30% of all strokes occurred at the age of 45 years or less. In the present study, no cases were found in people less than 20 years of age, and Khedr et al. reported that no case was reported in people 30 years of age or less.

Hypertension was the most common risk factor, followed by diabetes mellitus, which is similar to that reported in studies from Egypt, South Asia, and Iran. The frequency of dementia after cerebrovascular stroke varies between studies, ranging between 21% and 37%. In the present study only 6.75% had dementia. The differences may be related to the differences in assessment of dementia. It is possible that cognitive impairment may result from cerebrovascular stroke and its related vascular risk factors.

There is considerable heterogeneity in the designs of many studies cited previously leading to variability in reported data and conclusions. This article has highlighted that the prevalence of stroke in Qena Governorate is the same reported as by Khedr et al. in the Assiut Governorate, which shares the same geographic criteria. Both have a slightly higher prevalence than that reported by Farhaly et al. in the New Valley/Egypt, which is far away from the Nile and has different geographic, social, economic, and cultural characteristics.

**Conclusion**

Reliable epidemiologic data for stroke are required for proper planning and allocation of health care resources. The prevalence of stroke in Qena Governorate is similar to that estimated in the Assiut Governorate, which shares the same geographic criteria and slightly higher than in 2 other Egyptian studies with different geographic criteria. Overall, the prevalence of stroke in Egypt is higher than in many surrounding countries.

**References**


