Factors associated with knowledge and awareness of stroke among the Lebanese population: A cross-sectional study [version 2; peer review: 2 approved]

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Abstract

Background: Evaluation of the knowledge about stroke in the general population is extremely vital as it prevents stroke development, limits complications, and achieves better quality of life. We assume that the general Lebanese population lacks awareness about stroke and its associated complications. This study aims to evaluate stroke knowledge and determine the factors associated with stroke awareness among the general Lebanese population.

Methods: This cross-sectional study assessed respondents’ sociodemographic characteristics and the identification of risk factors, warning signs, stroke consequences, and early response to stroke symptoms. A total of 551 Lebanese adults without a history of stroke filled in an online self-reported questionnaire publicly shared on social applications. Logistic regression analysis was performed to identify the factors associated with poor knowledge of stroke.

Results: Among the 551 participants enrolled, 403 (74.2%) were
females and 312 (56.7%) were under 30 years of age. Females compared to males and employed compared to unemployed had significantly higher odds of identifying at least one risk factor (OR=4.3 [95%CI=1.1;16.8] and 6 [95%CI=1.2;29.6], respectively). Also, when compared to unemployed, employed participants had significantly higher odds of recognizing at least one of the early stroke symptoms (OR=3.3 [95%CI=1.2;8.9]) and identifying at least one of the stroke consequences (OR=5.3 [95%CI=1.1;25.9]). Reaching a university level of education compared to a school level was associated with significantly higher odds (OR=2.3 [95%CI=1.1;4.8]) of taking a patient to a hospital.

**Conclusion:** Well-educated, employed, and female participants were more knowledgeable about stroke. Tailored interventions focusing on individuals with inadequate stroke literacy are needed. Further studies, more representative of the general Lebanese population with a larger sample size, are necessary to confirm our findings.

**Keywords**
stroke; knowledge; awareness
Introduction

Ischemic stroke is neurologic dysfunction caused by sudden embolic occlusions in the cerebral vessel.\(^1,2\) It accounts for around 87% of all cases of stroke worldwide and is a major contributing cause of mortality and a significant factor of disability in adults.\(^3,4\) In Lebanon, the adjusted prevalence of stroke is 0.5%, and the cumulative mortality rates are 14.1% at one month.\(^5,6\)

Primary prevention against stroke is considered a cornerstone in minimizing stroke development. It is reached through a variety of strategies that focus on identifying related risk factors, implementing preventative measures, and educating patients. Awareness programs should aim to increase community knowledge, which is one of the most effective prevention measures; this raises the need for an accurate assessment of stroke knowledge and its related triggers.\(^7–11\) Moreover, knowledge will not only improve patients’ quality of life but can also prevent health care professionals from being overwhelmed when stroke cases arrive in the hospital at an early stage.\(^12\) This is noteworthy as 80% of stroke cases are preventable if adequate precautions and measures are taken promptly.\(^13\)

Therefore, it is essential to explore features such as lifestyle, behavior,\(^14,15\) educational background, smoking history,\(^15\) and socioeconomic status\(^15,16\) to understand the disparities in stroke knowledge between different sociodemographic groups. Since stroke risk factors (e.g., history of hypertension, diabetes) are identifiable in individuals with low socioeconomic, past medical history is also an important factor to investigate. Educational level, personal history of smoking, and high-income status have been associated with increased stroke knowledge.\(^17\) Concerning gender, there are conflicting results. Some studies reported that females are more likely than males to present non-traditional stroke warning signs, develop stroke, and arrive late to the hospital\(^18–20\); on the contrary, other studies showed that females can identify all the five conventional warning signs of a stroke and quickly call the emergency line.\(^21\)

In Lebanon, various studies were conducted that assessed stroke risk factors, prevalence, adherence to post-discharge medications, and acute hypertension treatment.\(^5,6\) However, no nationwide study has been conducted yet. Only one study assessed the public awareness of stroke but examined a small population, as it was limited to the capital city.\(^22\) In Jordan, a recent nationwide study revealed that educational level, gender, and socioeconomic income are correlated with early identification of stroke.\(^23\) Thus, this study aims to 1) evaluate stroke knowledge (i.e., definition, risk factors, and early warning signs, potential consequences) and 2) determine the factors associated with stroke awareness (i.e., attitude and reaction of people) among the general Lebanese population.

Methods

Ethical approval

The study was conducted based on the declaration of Helsinki and was approved by the ethics committee at the School of Pharmacy of the Lebanese International University (202ORC-035-LIUSOP). Written informed consent was obtained from all participants before inclusion in the study.

Study design and procedure

This descriptive observational cross-sectional study was carried out from September 2020 through January 2021 on the Lebanese population from all Governorates (Beirut, Mount Lebanon, North, South, and Beqaa), using an anonymous online survey. A snowball sampling method was used to abide by the lockdown restrictions enforced by the Lebanese Government. An electronic survey was developed using the Google forms platform and was distributed through different social media platforms (i.e., WhatsApp, LinkedIn, and Facebook). The link to the questionnaire was posted by the authors on each platform and made available to all the users, who are given the right to share. No particular group was targeted. Participation in this survey was voluntary and free of charge. Participants over the age of 18 were eligible, while those with a history of stroke were excluded. The anonymity of the participants was guaranteed during the data collection process.
Sample size calculation

Based on another study, which concluded that around 71.8% of the participants were able to identify at least three out of five stroke risk factors, and in the absence of similar studies in Lebanon, the Epi Info software version 7.2 (population survey; https://www.cdc.gov/epiinfo/index.html) calculated a minimum sample of 312 participants at a confidence level of 95%. The purpose of oversampling is to take into account patients’ refusal.

Questionnaire

The questionnaire was distributed in Arabic, the native language of Lebanon. The questionnaire was structured initially in the English language and then translated by a single bilingual translator, whose native language is Arabic and fluent in English. An expert committee formed by healthcare professionals and a language professional verified the English to Arabic translation in the English language and then translated by a single bilingual translator, whose native language is Arabic and fluent in English. An expert committee formed by healthcare professionals and a language professional verified the Arabic-to-English translation. A backward translation was then performed by a native English speaker translator, fluent in Arabic and unfamiliar with the concepts of stroke. The back-translated English questionnaire was subsequently compared with the original English one, by the expert committee, aiming to discern discrepancies and solve any inconsistencies between the two versions. The process of forward-back translation was repeated until all ambiguities disappeared. It was self-administered and required approximately 20 minutes to be completed.

The second section evaluated the general knowledge related to stroke. Participants responded to whether stroke is a disease that: 1) affects the brain, 2) is an old person disease, 3) is contagious, 4) is hereditary, and 5) and can be prevented. Also, this section assessed awareness of the risk factors of stroke, including old age, hypertension, diabetes mellitus, heart disease, high cholesterol, smoking, alcohol consumption, physical inactivity, obesity, and stress. Furthermore, this section focused on participants’ knowledge of early stroke warning signs including 1) sudden numbness or weakness of the face, arms, or legs, 2) sudden difficulty speaking or understanding speech, 3) sudden blurry vision or visual impairment in one or both eyes, 4) sudden dizziness or loss of balance or coordination, and 5) sudden severe headache. Additionally, participants reported potential consequences of stroke: 1) movement and functional problems (i.e., one-sided paralysis, loss of ability to walk, tiredness, fatigue), 2) Cognitive and memory problems (i.e., loss of ability to speak, write, read, remember or understand), 3) visual problems (i.e., loss of sight or blurred vision), 4) emotional and personality changes (i.e., depression, anger, mood changes), and 5) long-term disabilities. Three questions assessed the attitude and the reaction of people towards a patient experiencing stroke (e.g., willingness to take a patient to hospital care); two others were on the curiosity and self-assessment while the last one was to determine the sources of information of knowledge about stroke. Participants were given one point for each correct response to the above statements (see extended data – date key). Missing answers were not counted. Sometimes, multiple answers were allowed; that is why the total score was higher than the total number of questions.

Statistical analysis

Data collected were analyzed using the Statistical Package for Social Sciences version 25.0 (SPSS; https://www.ibm.com/be-en/products/spss-statistics). A freely accessible software alternative software to run this analysis is RStudio (https://www.rstudio.com/products/rstudio/download/). Continuous variables were presented as mean standard deviation and 95% confidence interval. Categorical and ordinal variables were shown as frequencies (n) and percentages (%). Correlations between risk factors, early symptoms, and consequences of stroke with the socio-demographics and past medical history were determined by the Pearson chi-square or Fisher’s exact test if the cell count was less than five.

Logistic regressions models were used to assess the association between sociodemographic factors, the medical history that showed a P<0.2 in the bivariate analysis and identified a total number of risk factors, identified a total number of early
symptoms, identified a total number of consequences, and willingness to take a patient to a hospital. Potential confounders were eliminated if P>0.2 to protect against residual confounding.

The results were presented in the form of odds ratios (OR) and 95% confidence interval. Statistical tests were two-tailed and indicated statistical significance at P<0.05.

Results
Sample description
Out of the total 551 participants enrolled in the study, 403 (74.2%) were females, 312 (56.7%) were under 30 years of age, and almost half were single and residing in rural areas. The most common concomitant disease was dyslipidemia (17.6%), followed by obesity (16.8%) and peptic ulcer (16.2%). The sociodemographic factors results are displayed in Table 1. Almost all the participants had heard of stroke (93.6%); 69.1% know about stroke if someone around had the disease.

| Variables (N=551) | Categories | Frequency (%) |
|------------------|------------|---------------|
| **Gender**       | Male       | 140 (25.8)    |
|                  | Female     | 403 (74.2)    |
| **Age (years)**  | <30        | 312 (56.7)    |
|                  | 30-49      | 175 (31.8)    |
|                  | >50        | 63 (11.5)     |
| **Residence area** | Urban   | 256 (46.8)    |
|                  | Rural      | 291 (53.2)    |
| **Marital status** | Single   | 274 (50.1)    |
|                  | Married    | 254 (46.4)    |
|                  | Divorced   | 12 (2.2)      |
|                  | Widowed    | 7 (1.3)       |
| **Education (years)** | School   | 53 (9.6)      |
|                  | University | 497 (90.4)    |
| **Employment status** | Unemployed | 246 (44.9)   |
|                  | Employed   | 302 (55.1)    |
| **Income level** | Low (<1,500,000 LL*) | 199 (43.2) |
|                  | Medium (1,500,000-3,000,000 LL*) | 206 (44.7) |
|                  | High (>3,000,000 LL*) | 56 (12.1) |
| **History of smoking (≥1 year)** | Yes | 147 (27.4) |
| **Past medical history** | Hypertension | 64 (12.3) |
|                  | Diabetes mellitus | 37 (7.2) |
|                  | Dyslipidemia | 91 (17.6) |
|                  | Arrhythmia | 81 (15.7) |
|                  | Kidney disease | 22 (4.3) |
|                  | Peptic ulcer | 82 (16.2) |
|                  | Depression | 73 (14.2) |
|                  | Obesity | 87 (16.8) |
| **Familiarity with stroke** | Ever heard of stroke | 511 (93.6) |
|                  | History of stroke in the family | 150 (27.8) |
|                  | Personally know someone with stroke | 378 (69.1) |

*LL, Lebanese Lira.
Figure 1. Percentages (%) of responses regarding stroke' knowledge, risk factors, early symptoms, attitude and reaction toward stroke, consequences, and sources of information.
Stroke knowledge, risk factors, early warning signs, consequences, and sources of information

Our sample revealed a variable level of knowledge about stroke (Figure 1 and Table 2). The majority were aware that stroke is a brain disease and that it can be prevented (80% and 90%, respectively). Approximately half of the participants could identify four out of five correct answers related to stroke knowledge. Furthermore, 90% believed that psychosocial stress was the most common risk factor for stroke, followed by hypertension and dyslipidemia. The most common warning signs were ‘Sudden difficulty in speaking or understanding speech’ and ‘Sudden weakness/numbness of the arms/face/legs’, accounting for 85%. Only 26% identified all the risk factors, 22.7% recognized all the symptoms, and 44% stated all possible stroke consequences. Internet/social media (30%), healthcare professionals (30%), and family/relatives (18.9%) were the main sources of information of knowledge about stroke. It is noteworthy that missing answers were not counted in the analysis.

Table 2. Number of stroke risk factors, early symptoms, and consequences that were identified by the participants.

| Variables (n=551)                  | Categories          | Frequency (%) | Cumulative frequency (%)* |
|-----------------------------------|---------------------|---------------|---------------------------|
| Number of correct answers regarding stroke in the general knowledge | Less than two       | 0 (0)         | 0 (0)                     |
|                                   | Two                 | 7 (1.3)       | 7 (1.3)                   |
|                                   | Three               | 52 (9.6)      | 59 (10.9)                 |
|                                   | Four                | 225 (41.6)    | 284 (52.5)                |
|                                   | Five                | 257 (47.5)    | 541 (100)                 |
| Number of identified risk factors of stroke | Zero               | 12 (2.2)      | 12 (2.2)                  |
|                                   | One                 | 9 (1.7)       | 21 (3.9)                  |
|                                   | Two                 | 11 (2)        | 32 (5.9)                  |
|                                   | Three               | 20 (3.7)      | 52 (9.5)                  |
|                                   | Four                | 34 (6.2)      | 86 (15.8)                 |
|                                   | Five                | 30 (5.5)      | 116 (21.3)                |
|                                   | Six                 | 63 (11.6)     | 179 (32.8)                |
|                                   | Seven               | 68 (12.5)     | 247 (45.3)                |
|                                   | Eight               | 78 (14.3)     | 325 (59.6)                |
|                                   | Nine                | 78 (14.3)     | 403 (73.9)                |
|                                   | Ten                 | 142 (26.1)    | 545 (100)                 |
| Number of identified early symptoms of stroke | Zero               | 22 (4.1)      | 22 (4.1)                  |
|                                   | One                 | 14 (2.6)      | 36 (6.6)                  |
|                                   | Two                 | 13 (2.4)      | 49 (9)                    |
|                                   | Three               | 57 (10.5)     | 106 (19.6)                |
|                                   | Four                | 74 (13.7)     | 180 (33.2)                |
|                                   | Five                | 117 (21.6)    | 297 (54.8)                |
|                                   | Six                 | 122 (22.5)    | 419 (77.3)                |
|                                   | Seven               | 123 (22.7)    | 542 (100)                 |
| Number of identified consequences of stroke | Zero                | 12 (2.2)      | 12 (2.2)                  |
|                                   | One                 | 16 (2.9)      | 28 (5.2)                  |
|                                   | Two                 | 35 (6.4)      | 63 (11.6)                 |
|                                   | Three               | 74 (13.6)     | 137 (25.2)                |
|                                   | Four                | 167 (30.8)    | 304 (56)                  |
|                                   | Five                | 239 (44)      | 543 (100)                 |

*Missing answers were not included in the analysis.
Table 3. Association of risk factors, early symptoms, and consequences of stroke with the socio-demographic characteristics and past medical history.

| Variables (N=551)          | Risk factor(s) identified (≥1) | Early symptom(s) identified (≥1) | Consequence(s) identified (≥1) |
|----------------------------|--------------------------------|----------------------------------|-------------------------------|
|                            | Yes (n=533), n (%)               | No (n=12), n (%)                  | P-value                       | Yes (n=520), n (%)               | No (n=22), n (%)                  | P-value                       |
| Socio-demographic characteristics |                                |                                  |                               |                                |                                  |                               |
| Gender                     |                                 |                                  |                               |                                |                                  |                               |
| Male                       | 132 (25.1)                      | 7 (58.3)                         | 0.016†                       | 129 (25)                       | 8 (40)                           | 0.133                         | 134 (25.6)                      | 6 (50)                           | 0.089                         |
| Female                     | 394 (74.9)                      | 5 (41.7)                         |                               | 386 (75)                       | 12 (60)                          |                               | 390 (74.4)                      | 6 (50)                           |                               |
| Age (years)                |                                 |                                  |                               |                                |                                  |                               |                                |                                  |                               |
| <30                        | 302 (56.7)                      | 6 (50)                           | 0.832                        | 294 (56.5)                      | 12 (54.5)                        | 0.880                         | 300 (56.5)                      | 6 (50)                           | 0.698                         |
| 30-49                      | 169 (31.7)                      | 5 (41.7)                         |                               | 166 (31.9)                      | 8 (36.4)                         |                               | 170 (32)                        | 4 (33.3)^                       |                               |
| > 50                       | 62 (11.6)                       | 1 (8.3)^                         |                               | 60 (11.5)                       | 2 (9.1)^                         |                               | 61 (11.5)                       | 2 (16.7)^                       |                               |
| Residence area             |                                 |                                  |                               |                                |                                  |                               |                                |                                  |                               |
| Urban                      | 245 (46.2)                      | 9 (75)                           | 0.048^                       | 240 (46.4)                      | 14 (63.6)                        | 0.113                         | 246 (46.6)                      | 6 (50)                           | 0.815                         |
| Rural                      | 285 (53.8)                      | 3 (25)                           |                               | 277 (53.6)                      | 8 (36.4)                         |                               | 282 (53.4)                      | 6 (50)                           |                               |
| Marital status             |                                 |                                  |                               |                                |                                  |                               |                                |                                  |                               |
| Single                     | 263 (49.6)                      | 8 (66.7)                         | 0.602                        | 257 (49.7)                      | 12 (54.5)                        | 0.368                         | 261 (49.4)                      | 8 (66.7)                         | 0.602                         |
| Married                    | 248 (46.8)                      | 4 (33.3)^                        |                               | 242 (46.8)                      | 9 (40.9)                         |                               | 248 (47)                        | 4 (33.3)^                       |                               |
| Divorced                   | 12 (2.3)                        | 0 (0)^                           |                               | 12 (2.3)                        | 0 (0)                            |                               | 12 (2.3)                        | 0 (0)^                           |                               |
| Widowed                    | 7 (1.3)                         | 0 (0)^                           |                               | 6 (1.2)                         | 1 (4.5)^                         |                               | 7 (1.3)                         | 0 (0)^                           |                               |
| Educational level          |                                 |                                  |                               |                                |                                  |                               |                                |                                  |                               |
| School                     | 48 (9)                          | 3 (25)                           | 0.093                        | 47 (9)                          | 3 (13.6)                         | 0.445                         | 45 (8.5)                        | 5 (41.7)                         | 0.003^                         |
| University                 | 485 (91)                        | 9 (75)                           |                               | 473 (91)                        | 19 (86.4)                        |                               | 486 (91.5)                      | 7 (58.3)                         |                               |
| Employment status          |                                 |                                  |                               |                                |                                  |                               |                                |                                  |                               |
| Unemployed                 | 233 (96.3)                      | 9 (3.7)                          | 0.032^                       | 223 (93.7)                      | 15 (6.3)                         | 0.020^                        | 230 (96.2)                      | 9 (3.8)                          | 0.030^                         |
| Employed                   | 298 (99)                        | 3 (1)^                           |                               | 295 (97.7)                      | 7 (2.3)                          |                               | 299 (99)                        | 3 (1)^                           |                               |
| Income level               |                                 |                                  |                               |                                |                                  |                               |                                |                                  |                               |
| Low (<1,500,000 LL*)       | 196 (43.4)                      | 2 (28.6)^                        | 0.340                        | 187 (42.6)                      | 7 (41.2)                         | 0.660                         | 194 (43.2)                      | 3 (33.3)^                       | 0.892                         |
| Medium (1,500,000-3,000,000 LL*) | 202 (44.7)                      | 3 (42.9)^                        | 0.300                        | 197 (44.9)                      | 9 (52.9)                         |                               | 201 (44.8)                      | 5 (55.6)                         |                               |
| High (>3,000,000 LL*)      | 54 (11.9)                       | 2 (28.6)^                        |                               | 55 (12.5)                       | 1 (5.9)^                         |                               | 54 (12)                         | 1 (11.1)^                       |                               |
| History of smoking (≥1 year) |                                 |                                  |                               |                                |                                  |                               |                                |                                  |                               |
| No                         | 383 (73)                        | 5 (50)                           | 0.147                        | 374 (73)                        | 14 (70)                          | 0.764                         | 383 (73)                        | 6 (54.5)                         | 0.183                         |
| Yes                        | 142 (27)                        | 5 (50)                           |                               | 138 (27)                        | 6 (30)                           |                               | 142 (27)                        | 5 (45.5)                         |                               |
### Table 3. Continued

| Variables (N=551) | Risk factor(s) identified (≥1) | Early symptom(s) identified (≥1) | Consequence(s) identified (≥1) |
|-------------------|--------------------------------|----------------------------------|-------------------------------|
|                   | Yes (n=533), n (%)             | Yes (n=520), n (%)               | Yes (n= 520), n (%)           |
|                   | No (n=12), n (%)               | No (n=22), n (%)                 | No (n=22), n (%)              |
|                   | P-value                        | P-value                          | P-value                       |
| Past medical history |                               |                                  |                               |
| Hypertension      |                               |                                   |                               |
| No                | 448 (87.8)                     | 435 (87.3)                       | 447 (87.6)                    |
|                    | 8 (80)                         | 19 (95)                          | 10 (90.9)                     |
| Yes               | 62 (12.2)                      | 63 (12.7)                        | 63 (12.4)                     |
|                    | 2 (20)                         | 1 (5)                            | 1 (9.1)                       |
| Diabetes Mellitus |                               |                                   |                               |
| No                | 465 (92.8)                     | 454 (92.7)                       | 464 (92.6)                    |
|                    | 9 (90)                         | 18 (94.7)                        | 11 (100)                      |
| Yes               | 36 (7.2)                       | 36 (7.3)                         | 37 (7.4)                      |
|                    | 1 (10)                         | 1 (5.3)                          | 0 (0)                         |
| Dyslipidemia      |                               |                                   |                               |
| No                | 417 (82.2)                     | 406 (82)                         | 416 (82.1)                    |
|                    | 9 (90)                         | 18 (90)                          | 11 (100)                      |
| Yes               | 90 (17.8)                      | 89 (18)                          | 91 (17.9)                     |
| Arrhythmia        |                               |                                   |                               |
| No                | 424 (84.1)                     | 414 (84.1)                       | 424 (84.1)                    |
|                    | 9 (90)                         | 17 (85)                          | 10 (90.9)                     |
| Yes               | 80 (15.9)                      | 78 (15.9)                        | 80 (15.9)                     |
| Kidney disease    |                               |                                   |                               |
| No                | 475 (95.6)                     | 463 (95.5)                       | 475 (95.6)                    |
|                    | 10 (100)                       | 20 (100)                         | 11 (100)                      |
| Yes               | 22 (4.4)                       | 22 (4.5)                         | 22 (4.4)                      |
| Peptic ulcer      |                               |                                   |                               |
| No                | 416 (83.9)                     | 407 (84.1)                       | 417 (83.9)                    |
|                    | 8 (80)                         | 15 (75)                          | 8 (80)                        |
| Yes               | 80 (16.1)                      | 77 (15.9)                        | 80 (16.1)                     |
| Depression        |                               |                                   |                               |
| No                | 429 (85.5)                     | 422 (86.3)                       | 430 (85.7)                    |
|                    | 10 (100)                       | 16 (80)                          | 10 (90.9)                     |
| Yes               | 73 (14.5)                      | 77 (15.9)                        | 72 (14.3)                     |
| Obesity           |                               |                                   |                               |
| No                | 420 (83)                       | 409 (82.8)                       | 419 (82.8)                    |
|                    | 9 (90)                         | 18 (90)                          | 11 (100)                      |
| Yes               | 86 (17)                        | 85 (17.2)                        | 87 (17.2)                     |

*Fisher’s exact test was used when the cell counts were less than 5.
†Significant P-values.
*LL, Lebanese Lira
## Table 4. Association of taking a patient who is experiencing stroke to the hospital with socio-demographic characteristics, and past medical history.

| Variables (N=551)                        | Taking a patient who is experiencing stroke to the hospital | P-value |
|----------------------------------------|-----------------------------------------------------------|---------|
|                                        | Yes (n=473), n (%) | No (n=74), n (%) |         |
| **Socio-demographic characteristics**   |                                            |         |
| Gender                                 |                                            |         |
| Male                                   | 117 (25)                                   | 23 (31.9)| 0.211  |
| Female                                 | 351 (75)                                   | 49 (68.1)|         |
| Age (years)                            |                                            |         |
| <30                                     | 263 (55.6)                                 | 46 (62.2)| 0.475  |
| 30-49                                   | 153 (32.3)                                 | 22 (29.7)|         |
| >50                                     | 57 (12.1)                                  | 6 (8.1) |         |
| Residence area                         |                                            |         |
| Urban                                  | 214 (45.3)                                 | 41 (56.9)| 0.066† |
| Rural                                  | 258 (54.7)                                 | 31 (43.1)|         |
| Marital status                         |                                            |         |
| Single                                 | 237 (50.3)                                 | 35 (47.9)| 0.567  |
| Married                                | 216 (45.9)                                 | 37 (50.7)|         |
| Divorced                               | 12 (2.5)                                   | 0 (0)  |         |
| Widowed                                | 6 (1.3)                                    | 1 (1.4) |         |
| Educational level                      |                                            |         |
| School                                 | 39 (8.2)                                   | 13 (17.6)| 0.011† |
| University                             | 434 (91.8)                                 | 61 (82.4)|         |
| Employment status                      |                                            |         |
| Unemployed                             | 207 (85.2)                                 | 36 (14.8)| 0.383  |
| Employed                               | 265 (87.7)                                 | 37 (12.3)|         |
| Income level                           |                                            |         |
| Low (<1,500,000 LL*)                   | 174 (43)                                   | 25 (44.6)| 0.932  |
| Medium (1,500,000-3,000,000 LL*)       | 181 (44.7)                                 | 25 (44.6)|         |
| High (>3,000,000 LL*)                  | 50 (12.3)                                  | 6 (10.7) |         |
| History of smoking (≥1 year)           |                                            |         |
| No                                     | 336 (72.4)                                 | 53 (73.6)| 0.832  |
| Yes                                    | 128 (27.6)                                 | 19 (26.4)|         |
| Past medical history                   |                                            |         |
| Hypertension                           |                                            |         |
| No                                     | 400 (87.9)                                 | 57 (86.4)| 0.720  |
| Yes                                    | 55 (12.1)                                  | 9 (13.6) |         |
| Diabetes Mellitus                      |                                            |         |
| No                                     | 414 (92.8)                                 | 61 (92.4)| 0.803  |
| Yes                                    | 32 (7.2)                                   | 5 (7.6) |         |
### Table 4. Continued

| Variables (N=551)          | Taking a patient who is experiencing stroke to the hospital |   |   |
|---------------------------|----------------------------------------------------------|---|---|
|                           | Yes (n=473), n (%) | No (n=74), n (%) | P-value |
| Dyslipidemia              | No 377 (83.8)      | 50 (73.5)       | 0.038†  |
|                           | Yes 73 (16.2)      | 18 (26.5)       |         |
| Arrhythmia                | No 379 (84.6)      | 55 (82.1)       | 0.599   |
|                           | Yes 69 (15.4)      | 12 (17.9)       |         |
| Kidney disease            | No 423 (95.7)      | 63 (95.5)       | 1.000   |
|                           | Yes 19 (4.3)       | 3 (4.5)         |         |
| Peptic ulcer              | No 373 (84)        | 52 (82.5)       | 0.767   |
|                           | Yes 71 (16)        | 11 (17.5)       |         |
| Depression                | No 389 (87.2)      | 51 (76.1)       | 0.015†  |
|                           | Yes 57 (12.8)      | 16 (23.9)       |         |
| Obesity                   | No 374 (82.9)      | 56 (84.8)       | 0.697   |
|                           | Yes 77 (17.1)      | 10 (15.2)       |         |

† Fisher’s exact test was used when the cell counts were less than 5.
Significant p-values.
*LL, Lebanese Lira
Bivariate analysis
A significantly higher percentage of females versus males (74.9% vs. 25.1%), residents of the rural versus urban areas (53.8% vs. 46.2%), and employed versus unemployed (99% vs. 96.3%) correctly identified risk factors. Moreover, a significantly higher percentage of participants who had a job versus unemployed (97.7% vs. 93.7%) recognized at least one warning symptom of stroke. A significantly higher percentage of subjects with university level of education compared to school level (91.5% vs. 8.5%) and those employed versus unemployed (99% vs. 96.2%) correctly identified the consequences emerging from stroke (Table 3).

A significantly higher number of correct answers was associated with university compared to school level of education (91.8% vs. 8.2%), no history of dyslipidemia compared to having dyslipidemia (83.8% vs. 16.2%), and no history of depression versus having depression (87.2% vs. 12.8%) (Table 4).

Multivariable analysis
When considering the identification of at least one risk factor as the dependent variable, our analysis showed that females compared to males and employed compared to unemployed had significantly higher odds (OR 4.3 [95% CI 1.1; 16.8] and 6 [95% CI 1.2; 29.6], respectively).

While when considering the identification of at least one early stroke symptom as the dependent variable, employed compared to unemployed had significantly higher odds (OR 3.3 [95% CI 1.2; 8.9]).

Also, when considering the identification of at least one stroke consequence as the dependent variable, employed compared to unemployed had significantly higher odds (OR 5.3 [95% CI 1.1; 25.9]).

When taking the identification of at least one stroke symptom as the dependent variable, university level compared to school level of education had significantly higher odds (OR 2.3 [95% CI 1.1; 4.8]) (Table 5).

| Variables (N=551) | β (SE) | OR (95% CI) | P-value |
|-------------------|--------|-------------|---------|
| **Risk factor(s) identified (≥1)** | | | |
| Gender (female versus male*) | 1.5 (0.7) | 4.3 (1.1; 16.8) | 0.034† |
| Residence area (rural versus urban*) | 1 (0.7) | 2.8 (0.7; 11.1) | 0.149 |
| Educational level (university versus school*) | 0.3 (0.8) | 1.3 (0.3; 6.9) | 0.729 |
| Employment status (employed versus unemployed*) | 1.8 (0.8) | 6 (1.2; 29.6) | 0.028† |
| History of smoking (≥1 year) (yes versus no*) | -0.6 (0.7) | 0.5 (0.1; 2.1) | 0.366 |
| **Early symptom(s) identified (≥1)** | | | |
| Gender (female versus male*) | 0.8 (0.5) | 2.3 (0.9; 5.8) | 0.086 |
| Residence area (rural versus urban*) | 0.6 (0.5) | 1.7 (0.7; 4.4) | 0.241 |
| Employment status (employed versus unemployed*) | 1.2 (0.5) | 3.3 (1.2; 8.9) | 0.016† |
| **Consequence(s) identified (≥1)** | | | |
| Gender (female versus male*) | 0.8 (0.7) | 2.3 (0.6; 8.4) | 0.214 |
| Educational level (university versus school*) | 1.3 (0.7) | 3.5 (0.9; 13.1) | 0.06 |
| Employment status (employed versus unemployed*) | 1.7 (0.8) | 5.3 (1.1; 25.9) | 0.04† |
| History of smoking (≥1 year) (yes versus no*) | -0.6 (0.7) | 0.6 (0.2; 2.1) | 0.404 |
| **Taking a patient to a hospital** | | | |
| Residence area (rural versus urban*) | 0.4 (0.3) | 1.5 (0.9; 2.6) | 0.136 |
| Educational level (university versus school*) | 0.8 (0.4) | 2.3 (1.1; 4.8) | 0.032† |
| Dyslipidemia (yes versus no*) | -0.4 (0.3) | 0.7 (0.3; 1.3) | 0.244 |
| Depression (yes versus no*) | -0.6 (0.3) | 0.5 (0.3; 1) | 0.067 |

Abbreviations: β, Beta; SE, standard error; OR, odds ratio; CI, confidence interval.
Dependent variables: identification of stroke risk factors, stroke early symptoms, stroke consequences, taking a patient who is experiencing stroke to the hospital.
Independent variables: sociodemographic factors (gender, residence area, educational level, employment status, and smoking status).
†Significant P-values.
*Reference.
Discussion
The current study evaluated factors related to knowledge about stroke risk factors, early symptoms, and consequences in a sample of the general Lebanese population without a history of stroke. The results indicated that the majority of participants identified at least one stroke related risk factor, symptom, and consequence. Our percentages are higher than those reported in the literature, showing that at least one stroke risk factor may be identified by more than half of the sample, probably as most of our participants had a university degree. A Lebanese study among 390 participants showed that 68% could spontaneously recall at least one stroke symptom, and 85.4% spontaneously recalled at least one risk factor. A study done in Spain has found that 60% of the sample identified at least one risk factor, and an Australian study revealed that 76% could name at least one risk factor. However, other studies have demonstrated a low knowledge of stroke risk factors and symptoms in the general population.

Our results revealed that hypertension and psychological stress were the most known risk factors, with a percentage close to 80%. A previous study in Lebanon found that the most recalled risk factor was hypertension (48.2%), followed by stress (43.1%). A study in Morocco among 469 participants has found similar results, with a percentage close to 50%. These findings are in line with those of several surveys conducted in different countries. Although diabetes is a major risk factor for stroke, it was the least reported in our study. Similarly, another study found that more than half of the sample did not recognize diabetes or hypercholesterolemia as risk factors for stroke.

Also, our results showed a higher percentage of participants recalling at least one stroke early symptom compared to those studies in Portugal (74.2%), Norway (70.7%), Oman (68%), Korea (65%), and Jordan (95.5%). Sudden loss of speech was the most frequently reported stroke symptom in our study compared to studies in Jordan (54.7%), Ireland (54%), and Australia (60.1%). However, other studies reported sudden weakening of one side of the body to be the most prevalent symptom, as in the Omani (65%) and Nigerian (55%) populations.

In our study, most of the sample was aware of the importance of going to a hospital emergency as early as possible after a stroke is identified, in agreement with previous findings showing that a high percentage of participants recognized the need for immediate medical care. A study in Oman among 400 participants found that 73% would go immediately to the hospital if they knew they had a stroke. However, the percentage found in international studies was lower, with only 47% claiming they would go to a hospital if they suspected they had a stroke.

The adequate knowledge of stroke risk factors, symptoms, and consequences in our sample could be explained by the young age of the participants and the high level of education, which might be related to better awareness of these aspects of the stroke.

Our results showed that females had better knowledge about stroke risk factors than males, in agreement with other findings. However, some studies did not detect any gender differences in risk factors awareness, and others showed a better knowledge among men. Women tend to be more knowledgeable and might be more interested in health topics than men and take more time to seek related information. In this regard, the country of origin is an essential factor to consider because of cultural gaps in gender distribution, access to education, and information in each country.

Moreover, our results revealed that being employed was significantly associated with better awareness of stroke risk factors, early symptoms, and consequences. Similarly, a study in Spain among 2,411 persons has found that actively employed individuals have a better knowledge of stroke than unemployed. One possible explanation could be that employed people might have the financial capacity to access information or visit their physician more regularly for check-ups. Our results also showed that higher education levels were a significant factor associated with the need for immediate medical intervention and direct transfer to the hospital after warning signs of stroke. Expectedly, the more literate the participants, the more health-related knowledge they have, making them more ready to respond to any stroke condition.

Limitations
This study has several limitations. The results could not be representative of the entire Lebanese population as the majority of participants were females, well-educated with computer literacy and internet access; thus, less-educated people and those who did not have access to a computer or mobile or internet were not assessed. Additionally, its cross-sectional design cannot infer causality. Information bias could also exist as the study questionnaire was online and answers were self-reported. The answers to stroke awareness might be overestimated because the questionnaire used consisted of multiple-choice questions with limited options available; thus, the participants could have guessed the answers. Selection bias might have also occurred since the sample was not randomly selected but rather gathered using the snowball sampling technique. Residual confounding bias is also possible since there might be factors related to stroke awareness that were not measured in this study.
Conclusion
The evaluation of stroke knowledge among the general Lebanese population showed that well-educated, employed, and female participants were more knowledgeable about stroke. Tailored interventions focusing on individuals with inadequate stroke literacy are needed to improve stroke awareness.

Further studies, more representative of the general Lebanese population and with a larger sample size, are necessary to confirm our findings.

Data availability
Underlying data
OSF: Factors Associated with Knowledge and Awareness of Stroke Among the Lebanese Population: A Cross-Sectional Study. https://doi.org/10.17605/OSF.IO/Y2DAP.25

This project contains the following underlying data:

- Anonymous data_Stroke Education Article_Dr Diana Malaeb.sav

Data are available under the terms of the Creative Commons Attribution 4.0 International license (CC-BY 4.0).

Extended data
OSF: Factors Associated with Knowledge and Awareness of Stroke Among the Lebanese Population: A Cross-Sectional Study. https://doi.org/10.17605/OSF.IO/Y2DAP.25

This project contains the following extended data:

- Questionnaire_Stroke Education Article_Dr Diana Malaeb.doc. (English version of the questionnaire).
- Questionnaire_Stroke Education Article_Dr Diana Malaeb.Arabic.doc. (Arabic version of the questionnaire).
- Data key_Stroke Education Article_Dr Diana Malaeb.docx.

Data are available under the terms of the Creative Commons Attribution 4.0 International license (CC-BY 4.0).

Acknowledgments
We thank all the participants for their participation and contribution to this study.

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Version 1

Reviewer Report 01 June 2022

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Ammar ali saleh Jaber
Department of Clinical Pharmacy & Pharmacotherapeutics, Dubai Pharmacy College for Girls, Dubai, United Arab Emirates

This research assesses the knowledge and awareness of the Lebanese population regarding stroke in a cross-sectional study. The methodology is scientifically founded. The article is well-written and raises an interesting question. The results are represented adequately. The study paves the road for awareness campaigns about stroke. This article is of good quality, fit for indexing and citation.

However, I have some minor points for revision before final indexing:

1. State the objectives of the study in a clearer manner.

2. The real questionnaire should be attached as supplement material for reproducibility.

3. Some of the English writing in the intro needs to be revised before submission.

4. In the 4th paragraph of the intro, a very brief comparison of Lebanon people to a neighbouring country might be needed.

Overall, this manuscript will be very interesting after doing the above recommendations and insertion of the recommended citations.

Is the work clearly and accurately presented and does it cite the current literature?
Yes

Is the study design appropriate and is the work technically sound?
Yes

Are sufficient details of methods and analysis provided to allow replication by others?
Yes
If applicable, is the statistical analysis and its interpretation appropriate?
Yes

Are all the source data underlying the results available to ensure full reproducibility?
Yes

Are the conclusions drawn adequately supported by the results?
Yes

**Competing Interests:** No competing interests were disclosed.

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.

---

**Author Response 10 Jun 2022**

**Nada Dia**, Lebanese International University, Beirut, Lebanon

Dear Prof. Ammar ali saleh Jaber,

Thank you for reviewing our article.

Our reply is stated below each question:

1. State the objectives of the study in a clearer manner.
   Thank you for pointing this out. We have stated the objectives clearly, as requested, in the second version.

2. The real questionnaire should be attached as supplement material for reproducibility.
   Thank you for this suggestion. Abiding by the policy of the journal, the questionnaire is accessible online via the link provided in the section on data availability.

3. Some of the English writing in the intro needs to be revised before submission.
   Thank you for pointing this out. English writing was revised and corrected.

4. In the 4th paragraph of the intro, a very brief comparison of Lebanon people to a neighboring country might be needed.
   Thank you for raising an important point here. The introduction was expanded to cover neighboring countries.

We look forward to hearing from you in due time regarding our second version and to respond to any further questions and comments you may have.

Sincerely,

Nada Dia

**Competing Interests:** No competing interests were disclosed.

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**Reviewer Report 22 April 2022**

https://doi.org/10.5256/f1000research.120152.r135286
Mohammad Al-Shorbagy

Department of Pharmacology and Toxicology, Faculty of Pharmacy, Cairo University, Cairo, Egypt

The current cross-sectional study highlights the factors associated with the knowledge and awareness of stroke among a sample of the Lebanese population. Motives to initiate the study in that population seem logical and the stratification of the population groups serves the purpose of the study. Results are coherent and neatly described with appropriate statistical analysis. The conclusions drawn are not overly expressed and are matching with the obtained results and can drive action to population awareness as well as feed future research in that particular setup.

Is the work clearly and accurately presented and does it cite the current literature?
Yes

Is the study design appropriate and is the work technically sound?
Yes

Are sufficient details of methods and analysis provided to allow replication by others?
Yes

If applicable, is the statistical analysis and its interpretation appropriate?
Yes

Are all the source data underlying the results available to ensure full reproducibility?
Yes

Are the conclusions drawn adequately supported by the results?
Yes

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Neuropharmacology

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.

Author Response 10 Jun 2022

Nada Dia, Lebanese International University, Beirut, Lebanon

Dear Prof. Mohammad Al-Shorbagy

Thank you for reviewing our article.
We look forward to hearing from you in due time regarding our second version and to responding to any further questions and comments you may have.

Sincerely,
Nada Dia

**Competing Interests:** No competing interests were disclosed.