



## Gender-based differences in mortality and complementary therapies for patients with stroke in Taiwan



Chun-Ting Liu<sup>a,1</sup>, Bei-Yu Wu<sup>a,1</sup>, Wen-Long Hu<sup>a,b,c</sup>, Yu-Chiang Hung<sup>a,d,\*</sup>

<sup>a</sup> Department of Chinese Medicine, Kaohsiung Chang Gung Memorial Hospital and Chang Gung University College of Medicine, Kaohsiung, Taiwan

<sup>b</sup> Kaohsiung Medical University College of Medicine, Kaohsiung, Taiwan

<sup>c</sup> Fooyin University College of Nursing, Kaohsiung, Taiwan

<sup>d</sup> School of Chinese Medicine for Post Baccalaureate, I-Shou University, Kaohsiung, Taiwan

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### ABSTRACT

**Background:** Stroke is a leading cause of death worldwide. In this retrospective study, we investigated the different effects of gender on medical behavior, medical service, medical cost, and death from stroke in Taiwan.

**Methods:** We collected data on the stroke-associated mortality rate according to gender and age group for the period between 2009 and 2013 from the official registry of Ministry of Health and Welfare, Taiwan. We analyzed the data related to stroke-associated medical care and costs in 2013 from the National Health Insurance Research Database (NHIRD).

**Results:** The mortality rate due to stroke was higher in men than in women, despite more inpatient or outpatient medical treatment and higher medical costs, especially in patients aged <50 years. Married women showed a significantly lower stroke-associated mortality compared to married men. Women were significantly more likely to accept Western medicine combined with traditional Chinese medicine (TCM) treatment than men (81.51% of women and 74.27% of men). They had lower medical expenditure and lower mortality from stroke than men did. Combined use of integrative Chinese and Western medicine also was associated with lower mortality from stroke than use of conventional Western medicine alone. **Conclusions:** In Taiwan, stroke-associated mortality is higher in men. Marriage or female sex hormone may have protective effect against stroke in women. Women also more tended to seek TCM complementary therapies combined with Western medicine. Integrated Chinese and Western medicine could thus be a potential treatment for stroke.

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## 1. Background

Stroke is a cerebrovascular accident that results in brain ischemia due to poor blood flow or hemorrhage. It is a major cause of mortality and disability worldwide. Two recently published systematic reviews<sup>1,2</sup> showed that the global burden of stroke has increased over the past two decades. Some studies have reported that gender-based differences exist in the etiology, presentation,

treatment, and outcome of stroke.<sup>3–6</sup> Epidemiological studies and analysis of stroke registry data<sup>7–11</sup> have indicated that the incidence or prevalence of stroke is higher among men than among women, although women tend to have poor outcomes. However, some studies have reported no differences in mortality or disability based on gender;<sup>12–15</sup> others have even shown that women have a better survival rate than men.<sup>16,17</sup>

Thus, gender-based differences in mortality rate and other parameters related to stroke are controversial. Few studies have investigated these differences, which were published over 20 years ago in Taiwan<sup>18–20</sup>. They showed that the mortality rate for women was lower than that for men and increased exponentially with age for cerebral infarction and hemorrhage. However, gender differences in relation to TCM complementary medicines have not been previously examined. Therefore, in this study, we used data from the database of the government registry and the National Health Insurance (NHI) program to investigate the gender-based differ-

**Abbreviations:** NHI, National Health Insurance; NHIRD, National Health Insurance Research Database; NTD, New Taiwan Dollar; SDR, standardized death rate; TCM, traditional Chinese medicine.

\* Corresponding author at: Department of Chinese Medicine Kaohsiung Chang Gung Memorial Hospital No. 123, Dapi Rd., Niasong Dist., Kaohsiung City 833, Taiwan.

E-mail address: [hungyuchiang@gmail.com](mailto:hungyuchiang@gmail.com) (Y.-C. Hung).

<sup>1</sup> These authors contributed equally to this work.

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ences in stroke-related mortality rate, medical care behavior, and outcomes.

## 2. Materials and methods

### 2.1. Data sources

This study was approved by the Human Ethics Committee of our hospital (Chang Gung Medical Foundation Institutional Review Board No. 104-5420B). Stroke (ICD-9-CM code: 430-438) mortality was retrospectively collected by gender and age group, for the period between January 2009 and December 2013 from the official registry of the Ministry of Health and Welfare, Taiwan. The data included the standardized death rate (SDR), which is the death rate of a population adjusted to the standard age distribution. It is calculated as a weighted average (based on the age distribution) of the age-specific death rates of a given population. In addition, we downloaded and analyzed the data on stroke-related medical care and the associated costs in 2013 from the National Health Insurance Research Database (NHIRD).

### 2.2. Study subjects

In Taiwan, stroke patients may seek treatment with Western medicine or traditional Chinese medicine (TCM), or a combination of the two. In order to understand the gender-based differences in stroke-related mortality rate, medical care, and associated costs between patients receiving TCM and those receiving Western medicine, we conducted a population-based study on stroke patients among one million subjects randomly selected from the NHI scheme of Taiwan.

### 2.3. Statistical analysis

All statistical analyses were performed using SPSS statistics 17.0. Chi-square test, ANOVA test, hierarchical loglinear analysis, and odds ratio (OR) were carried out to compare gender-based differences for each factor.  $P < 0.05$  was considered statistically significant.

## 3. Results

### 3.1. Gender differences in mortality

For the period from 2009 to 2013, stroke was the third leading cause of death in Taiwan for men; for women it was the third leading cause of death for the period from 2009 to 2011 and the fourth leading cause of death for the period from 2011 to 2013. The number of stroke-related deaths and the SDR for stroke during the period from 2009 to 2013 is shown in [Table 1](#), and the sex ratio is presented in [Fig. 1](#). The number of stroke patients increased and the SDR decreased over time during this period. The number of deaths and the SDR for stroke was higher among men than among women for the period from 2009 to 2013. Gender-based differences were significant in any single year ( $P < 0.001$ ), but not between years ( $P = 0.424$ ). The sex ratio for stroke-related SDR increased progressively, but the trend was not significantly different from 2009 to 2013.

We collected data on 121,729 inpatients and 617,606 outpatients with stroke in 2013. The total expenditure on inpatient and outpatient care in 2013 was 6,900,809,000 New Taiwan Dollar (NTD) and 7,968,647,000 NTD, respectively. The number, medical costs, and male/female ratio for stroke inpatients and outpatients by age group are presented in [Table 2](#) and [Fig. 2](#). The prevalence of stroke patients was 3.16% (739,335/23,373,517) in 2013. The

prevalence in males was 3.5% (408,457/23,373,517), which was higher than the prevalence in females (2.83%; 330,878/23,373,517). Patients with stroke attacks were among the most frequent hospital admissions for inpatient care in Taiwan. The hospital admission rate was 59.42% (72,337/121,729) for males with stroke, which was higher than the rate of admissions for stroke in females (40.58%; 49,392/121,729). A significantly greater number of men received inpatient or outpatient medical care than women. Further, inpatient or outpatient medical expenses were significantly higher for men than for women. Regardless of sex, patients 50 years of age or older had more medical care and medical cost. Men also had higher odds of stroke-related medical care and medical cost than women did. The OR of men to women increased with age. In spite of this, the mortality rate was higher among men than among women. Male/female ratio for stroke-related deaths significantly decreased with increasing age, especially in patients aged >50 years. However, the OR of mortality still increased with age.

### 3.2. Gender differences in medical behavior

As shown in [Table 2](#), among the patients who died of stroke, 61% (4049/6590) of men and 30% (1423/4707) of women were married. Married women had a significantly lower stroke-related mortality rate compared to that for married men. In contrast, widowed women showed a higher stroke-related mortality rate compared to that for widowed males. Married women also had a lower stroke-related mortality rate than widowed women (30.19% vs 61.96%). In addition, if the OR of married status was 1, the OR of widowed status was 6.62. Out of the randomly sampled one million subjects, a total of 15,896 stroke inpatients were selected for analysis. Of these, 77% (12288/15896) received Western medicine combined with TCM treatment. When analyzed by gender, this percentage was 74.27% (6861/9238) for men and 81.51% (5427/6658) for women. The OR of medical behavior was 1.53. Women were significantly more likely to accept Western medicine combined with TCM treatment than men ([Table 2](#)). In addition, women had lower medical expenditure and lower mortality than men in stroke. Combined treatment with integrative Chinese and Western medicine had lower mortality than conventional Western medicine alone ([Table 3](#)).

## 4. Discussion

In this study, we compared the stroke-related mortality rates, the nature, and associated costs of the medical care received, between men and women in Taiwan for the period between 2009 through 2013. Our results revealed significant differences in these parameters between men and women. Although the percentage of patients receiving inpatient or outpatient medical treatment, and the medical costs, were higher among men than among women, especially in patients aged below 50 years, the overall stroke-related mortality rate was still higher in men than in women. The number of deaths and the SDR for stroke was higher among men than among women for each year. SDR is the death rate of a population adjusted to a standard age distribution. It is calculated as a weighted average of the age-specific death rates of a given population to improve comparability over time and between countries. If the SDR is higher than 1.0, then there is a higher number of deaths than is expected. From 2009–2013, the male/female ratio of SDR increased over time. This implies that men are more vulnerable to life-threatening, and even fatal, illnesses. The decline in male/female ratio among patients who died because of stroke may be due to the longer life expectancy of women. The male/female ratio declined in patients aged above 50 years and markedly declined above 75 years of age. This suggested that premenopausal women had a lower stroke-related mortality than men. This was

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