# Self-perceived and Actual Risk of Further Stroke in Patients with Recurrent Stroke or Recurrent Transient Ischemic Attack in Thailand

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*Background*: The correct perception in patients of their future risk of recurrent stroke may lead to changes in behavior and to successful secondary prevention of stroke. The primary aim was to compare patients' perceived risk with the actual risk of further stroke. *Methods*: This cross-sectional study was carried out in 2 tertiary hospitals in northeast Thailand. Self-perceived risk of further stroke was assessed by validated questionnaire and categorized as low, medium, or high. Actual risk was calculated using Stroke Prognosis Instrument II which classified patients into 3 risk groups: low, medium, and high. The level of agreement between perceived and actual risk was analyzed using the kappa statistic. *Results*: One hundred forty patients with recurrent stroke or recurrent transient ischemic attack were enrolled (age 65.6 ± 11.3 years, mean ± standard deviation). Most patients wrongly estimated their risk of further stroke: 43.6% of patients underestimated and nearly one fifth (17.1%) overestimated their risk; the kappa coefficient was .08. Patients with hypertension and diabetes were more likely to underestimate their risk of recurrent stroke. The only characteristic found to be significantly associated with perceived high risk was the level of independence in activities of daily living: patients with Barthel index less than or equal to 60 were more likely to perceive themselves as having high risk for recurrent stroke. *Conclusions*: Most patients underestimated their risk for further stroke. Implementation of a comprehensive care program to communicate to patients their future risk of stroke and to modify their risk factors is warranted in Thailand.

**Key Words:** Stroke—Perception—Risk—Recurrent stroke—Knowledge



## Introduction

Stroke is a major cause of death and disability worldwide.[1,2] It is expected that by 2030 there will be almost 70 million stroke survivors globally,[2] with the stroke survivor tending to be younger,[2] and have a longer life expectancy because of advances in therapeutic methods.

After first stroke, the risk of further stroke increases dramatically.[3] Recurrent strokes are likely to be more disabling and are more likely to be fatal than first strokes.[4,5] One of the aims in stroke treatment is to lessen the chance of recurrent stroke; however, nearly 40% of patients experience recurrent stroke within 5 years.[6] Methods to prevent recurrent stroke are crucial to delay further disability and morbidity in these patients.

Risks of stroke recurrence are attributable to both nonmodifiable risk factors such as male gender or history of stroke, and modifiable risk factors such as hypertension, diabetes mellitus, dyslipidemia, statin therapy, and alcohol consumption.[5,7,8] Additionally, it was shown that 80% of recurrent strokes can be prevented by lifestyle

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modification and medical management.[9] It is clear that knowledge about stroke, correct perception of one's own health risk, and appropriate health behavior are important to modify the risk factors for recurrent stroke.

To adopt changes in health-relevant behavior, accurate perception of one's own health risk and knowledge about disease is important.[10] In term of knowledge, inadequate knowledge about stroke and stroke risk factors may lead to wrong understanding of the risk.[11] In regard to self-perception of risk of disease, underestimation of risk or "optimism" (eg, "recurrent stroke should not happen to me") may be barriers in the adoption of preventive health behaviors,[12] thus patients may disregard disease information or not adhere to lifestyle modification programs. Pessimists who overestimate their own risks, on the other hand, may develop high levels of worry and anxiety.[13]

The aim of this study was 2-fold: to compare patients' own perception of their risk of further stroke with the actual risk; and to determine the association between self-perceived risk and stroke knowledge.

## Methods

This cross-sectional study was done in 140 patients who were diagnosed with recurrent stroke or recurrent transient ischemic attack (TIA) in Srinagarind Hospital and Khon Kaen Hospital, which are tertiary hospitals in the northeast of Thailand, from April to July 2014. The study protocol was approved by the institutional review board (ref. HE571111). This study was a further analysis from existing stroke knowledge data[14] to determine the perception of risk of stroke in this group of patients. All patients provided verbal/written informed consent prior to participation.

Patient inclusion criteria were: (1) a diagnosis of recurrent stroke or recurrent TIA, (2) age more than 18 years, (3) sufficient cognitive and communicative ability, and (4) willingness to participate in the study. The exclusion criteria were: (1) severe aphasia limiting comprehension, (2) medical history of dementia, and (3) inability to give informed consent.

### *Measures*

Demographic and clinical variables such as stroke type and side were obtained from medical records. Data on stroke knowledge were collected by face-to-face interview by trained registered nurses. The questionnaire used in this study was developed in 2011 and was validated in first-ever stroke patients.[15] This comprised both opened-ended and closed-ended questions involving stroke knowledge, risk factors, stroke warning signs, treatment and acute management of stroke. The analyses in the present article focused on the overall knowledge score obtained from closed-ended questions (total of 37 scores, Supplementary material A). Perceived risk of recurrent stroke was categorized as low, moderate, and high.

The actual risk of recurrent stroke risk was calculated using Stroke Prognosis Instrument II (SPI-II) which classified patients into 3 risk groups: low, medium, and high. The risk of recurrent stroke was determined by the total score of the combination of 7 factors: congestive heart failure (3 points), diabetes (3 points), prior stroke (3 points), age more than 70 years (2 points), stroke for the indexed event (not TIA, 2 points), hypertension (1 point), and coronary artery disease (1 point). Risk groups I (low risk), II (medium risk), and III (high risk) comprised patients with 0-3, 4-7, and 8-15 points, respectively.[16] In the present study, subjects with systolic/diastolic blood pressure of 140/90 mm Hg or more or who were taking antihypertensive medications were classified as hypertensive.

### *Statistical Analysis*

Demographic data and questionnaire responses are presented as frequencies and percentages for categorical variables. Means and standard deviations are presented for continuous variables. Perceived and actual recurrent stroke risk is shown in a cross-tabulation and the kappa statistic was used to analyze the level of agreement between them. The agreement between perceived risk and actual risk was classified as: correspondence (perceived recurrent stroke risk agrees with actual risk), underestimation (perceived to have lower risk than actual risk), and overestimation (perceived to have lower risk than actual risk). The association between patients' characteristics and their perceived risk and the association between patients' characteristics and the agreement of perceived risk and actual risk was analyzed using the chi-squared test. Fisher's exact test was used when the number in each cell of the table was less than 5. The percentage values shown in brackets in Tables 2 and 4 represent the proportion for each corresponding category. Differences between knowledge score at each perceived-risk level were analyzed using analysis of variance. For overall $P < .05$, Bonferroni post hoc multiple comparison corrections were applied to examine differences between each paired data set. Statistical analysis was performed using SPSS (Version 20.0, IBM Corp., Armonk, NY).

## Results

### *General*

One hundred forty patients with recurrent stroke or recurrent TIA were enrolled. Their age was 65.6 ± 11.3 years. Most patients had low education level (Table 1). Additional descriptive data are reported in a previous study.[14] The knowledge score was 32.2 ± 4.5 from 37 points.

### *Perceived Risk and Actual Risk Computed from SPI-II*

Approximately one third of patients estimated their future stroke risk to be high (35.7% high, 30.7% low, and

**Table 1.** *Characteristics and demographic data of patients (*n = *140)*[14]

| Characteristic | *N* (%) |
|---|---|
| Age (years) | 65.6 ± 11.3 (range 26-87) |
| Male sex, *n* (%) | 78 (55.7) |
| *Education, n* (%) | |
| Less than or equal to secondary school | 110 (78.6) |
| Higher than secondary school | 30 (21.4) |
| *Comorbidities, n* (%) | |
| Hypertension | 56 (40.0) |
| Diabetes mellitus | 56 (40.0) |
| Dyslipidemia | 34 (24.3) |

Abbreviations: *n*, number; SD, standard deviation; TIA, transient ischemic attack.
Values are mean ± SD unless otherwise indicated.

33.6% medium). Analysis of patients' characteristics and the self-perceived risk of recurrent stroke showed that patients with Barthel index less than or equal to 60 were more likely to perceive themselves as having higher risk for recurrent stroke compared with patients whose Barthel index was more than 60 (Table 2). There was a moderate level of evidence that males perceived themselves as having low risk for recurrent stroke ($P = .08$).

Actual risk of recurrent stroke calculated from SPI-II showed that 50.7% of patients had high risk, 42.9% had moderate risk, and 6.4% had low risk of recurrent stroke. The agreement between perceived and actual risk was poor with a kappa value of .08 (Table 3).

Most patients wrongly estimated their risk of recurrent stroke: nearly half of patients (43.6%) underestimated the risk and nearly one fifth (17.1%) overestimated the risk. Patients with hypertension and diabetes were more likely to underestimate their risk of recurrent stroke. There was a moderate level of evidence that the older age group was less likely to overestimate the risk ($P = .08$). Other

**Table 2.** *Bivariate analysis examining associations between self-perceived risk of recurrent stroke and participants characteristics (*n = *140)*

| Variables | Low risk *n* (%) | Medium risk *n* (%) | High risk *n* (%) | Total *n* (%) | *P* value |
|---|---|---|---|---|---|
| *Age* | | | | | |
| Age ≤ 60 years | 10 (26.3) | 14 (36.8) | 14 (36.8) | 38 (100) | .77 |
| Age > 60 years | 33 (32.4) | 33 (32.4) | 36 (35.3) | 102 (100) | |
| *Gender* | | | | | |
| Female | 13 (21.0) | 23 (37.1) | 26 (41.9) | 78 (100) | .08 |
| Male | 30 (38.5) | 24 (30.8) | 24 (30.8) | 62 (100) | |
| *Education* | | | | | |
| Lower than college | 32 (29.1) | 37 (33.6) | 41 (37.3) | 110 (100) | .67 |
| College or higher | 11 (36.7) | 10 (33.3) | 9 (30.0) | 30 (100) | |
| *Barthel index score* | | | | | |
| ≤60 | 6 (20.7) | 10 (34.5) | 13 (44.8) | 29 (100) | .02 |
| >60 | 33 (45.2) | 25 (34.2) | 15 (20.5) | 73 (100) | |
| *Hypertension* | | | | | |
| No | 16 (35.6) | 15 (33.3) | 14 (31.1) | 45 (100) | .64 |
| Yes | 27 (28.4) | 32 (33.7) | 36 (37.9) | 95 (100) | |
| *Diabetes* | | | | | |
| No | 25 (29.8) | 31 (36.9) | 38 (33.3) | 84 (100) | .58 |
| Yes | 18 (32.1) | 16 (28.6) | 22 (39.3) | 56 (100) | |
| *Dyslipidemia* | | | | | |
| No | 33 (31.4) | 38 (36.2) | 34 (32.4) | 105 (100) | .42 |
| Yes | 10 (29.4) | 9 (26.5) | 15 (44.1) | 34 (100) | |
| *Heart disease** | | | | | |
| No | 38 (31.1) | 42 (34.4) | 42 (34.4) | 122 (100) | .70 |
| Yes | 5 (27.8) | 5 (27.8) | 8 (44.4) | 18 (100) | |
| *Family history** | | | | | |
| No | 37 (31.1) | 42 (35.3) | 40 (33.6) | 119 (100) | .65 |
| Yes | 5 (31.3) | 4 (25.0) | 7 (43.8) | 16 (100) | |

*Fisher's exact test.

**Table 3.** *Agreement of perceived risk and actual risk of recurrent stroke in patients with recurrent stroke or recurrent TIA (*n = *140)*

| | Actual risk, *n* (%) | | | |
|---|---|---|---|---|
| Perceived risk, *n* | Low | Medium | High | Total |
| Low | 5 (3.6) | 18 (12.9) | 20 (14.3) | 43 (30.8) |
| Medium | 3 (2.1) | 22 (15.7) | 23 (16.4) | 47 (34.2) |
| High | 1 (.7) | 20 (14.3) | 28 (20.0) | 50 (35.0) |
| Total | 9 (6.4) | 60 (42.9) | 71 (50.7) | 140 (100) |

Calculated recurrent stroke risk was estimated using the SPI-II, kappa = .08.

variables such as level of education, gender, dyslipidemia, heart disease, or family history of stroke did not associate with the level of agreement of risk of recurrent stroke (underestimate, correspondence, or overestimate; Table 4).

### *Association between Perceived Risk of Recurrent Stroke and Stroke Knowledge*

No statistically significant differences in total knowledge scores and any subitems were found among groups of different self-perception of risk for recurrent stroke (Table 5).

### *Association between Level of Agreement of Risk of Recurrent Stroke (Perceived Risk VS Actual Risk) and Stroke Knowledge*

Patients who underestimated their risk of stroke had average total knowledge score of 31.0, whereas the average score in patients who correctly estimated or overestimated their risk of recurrent stroke had average total knowledge score of 32.7 and 32.1, respectively. Patients who underestimated their risk had statistically significantly lower score in the part relating to prevention of stroke compared with those who correctly estimated or overestimated their risks (Table 6).

## Discussion

This study aimed to compare patients' own perception of their risk of further stroke with the actual risk, and to determine the effect of perceived risk of recurrent stroke on stroke knowledge. We found that roughly equal numbers of patients estimated their future stroke risk to be high, medium, and low, that is to say, approximately one third of patients fell into each of these categories. There was poor agreement between self-perceived and actual risk. Most patients wrongly estimated their risk of recurrent stroke: nearly half of patients underestimated the risk and nearly one fifth overestimated the risk.

Regarding patients' characteristics and their perceived risk of recurrent stroke, the level of disability in activities of daily living was the only characteristic found to be significantly associated with perceived high risk. This may reflect that physical disability is the main factor that influences perceived vulnerability to recurrent stroke in patients' perception.

We found that a significantly higher proportion of patients with hypertension and diabetes mellitus underestimated their risk. These findings may be explained by low awareness among patients of their own risk factors for recurrent stroke: in our previous article, we found that, using an opened-ended questionnaire, only one quarter of patients with diabetes and approximately half of patients with hypertension recognized their own underlying diseases as being associated with their risk of stroke.[14] This implies that patients may not adequately account for their personal risk factors when estimating their stroke risk.[13]

Owing to the lack of recognition of risk of stroke, it may not be surprising that most patients with recurrent stroke underestimated their risk of further stroke. The 40% underestimation and 20% overestimation are comparable to the general population when they were asked to rate their own cardiovascular risk.[17,18] Our findings are different from the study of Boden-Albala et al which interviewed patients with different ethnic backgrounds (Black, White, and Hispanic) after their first stroke or TIA in acute care settings and found that 70% of patients overestimated their risk and only 10% of patients underestimated the risk.[19] This may be explained by 2 factors. First, differences in time of interview: Boden-Albala et al interviewed patients in the acute setting. Patients who are interviewed early after stroke may be prone to overestimate the risk because at this stage they may be hypervigilant or have anxiety in relation to potential further stroke.[19] In our study, we interviewed in both the acute and chronic phases after stroke. We found 18.8% of patients who were interviewed within 7 days after recurrent stroke overestimated the risk while only 12.8% of patients who were interviewed later than 7 days overestimated the risk. Second, this may reflect the differences in social and cultural factors and in specific health beliefs.

We did not find differences in stroke knowledge scores among groups of different self-perceived risk of recurrent stroke. Thus, claiming that more stroke knowledge may lead to better self-perception or that higher perceived risk may lead to better knowledge of stroke cannot be claimed. This finding is similar to a previous study.[19] This may be because there are complex factors influencing how

**Table 4.** *Bivariate analysis examining associations between agreement of risk of recurrent stroke between perceived risk and actual risk and participants characteristics* (n = *140)*

| Variables | Underestimation *n* (%) | Correspondence *n* (%) | Overestimation *n* (%) | Total *n* (%) | *P* value |
|---|---|---|---|---|---|
| *Age* | | | | | |
| Age ≤ 60 years | 14 (36.8) | 13 (34.2) | 11(28.9) | 38 (100) | .08 |
| Age > 60 years | 47 (46.1) | 42 (41.2) | 13 (12.7) | 102 (100) | |
| *Gender* | | | | | |
| Female | 22 (35.5) | 28 (45.1) | 12 (19.4) | 62 (100) | .23 |
| Male | 39 (50.0) | 27 (34.6) | 12 (15.4) | 78 (100) | |
| *Education level* | | | | | |
| Lower than college | 49 (44.5) | 43 (39.1) | 18 (16.4) | 110 (100) | .86 |
| College or higher | 12 (40.0) | 12 (40.0) | 6(20.0) | 30 (100) | |
| *Barthel index score* | | | | | |
| ≤60 | 11 (37.9) | 12 (41.4) | 6 (20.7) | 29 (100) | .44 |
| >60 | 38 (52.1) | 23 (31.5) | 12 (16.4) | 73 (100) | |
| *Hypertension* | | | | | |
| No | 13 (28.9) | 21 (46.7) | 11 (24.4) | 45 (100) | .04 |
| Yes | 48 (50.5) | 34 (35.8) | 13 (13.7) | 95 (100) | |
| *Diabetes** | | | | | |
| No | 29 (34.5) | 32 (38.1) | 23 (27.4) | 84 (100) | .0002 |
| Yes | 32 (57.1) | 23 (41.1) | 1 (1.8) | 56 (100) | |
| *Dyslipidemia** | | | | | |
| No | 45 (42.9) | 41 (39.0) | 19 (18.1) | 105 (100) | .69 |
| Yes | 16 (47.1) | 14 (41.2) | 4 (11.8) | 34 (100) | |
| *Heart disease** | | | | | |
| No | 56 (44.8) | 48 (38.4) | 21 (16.8) | 122 (100) | .70 |
| Yes | 6 (33.3) | 7 (46.7) | 3 (20.0) | 18 (100) | |
| *Family history** | | | | | |
| No | 50 (42.0) | 48 (40.3) | 21 (17.6) | 119 (100) | .50 |
| Yes | 8 (50.0) | 7 (43.8) | 1 (6.2) | 16 (100) | |
| *Time to interview* | | | | | |
| Within 7 days of recurrent stroke | 46 (45.5) | 36 (35.6) | 19 (18.8) | 101 (100) | .34 |
| After 7 days of recurrent stroke | 15 (38.5) | 19 (48.7) | 5 (12.8) | 39 (100) | |

*Fisher's exact test.

**Table 5.** *Self-perceived risk of recurrent stroke and stroke knowledge score*

| Knowledge of stroke | Low (43) | Medium (47) | High (50) | *P* value |
|---|---|---|---|---|
| Definition of stroke (5) | 4.3 ± 0.9 | 4.5 ± 1.4 | 4.5 ± 0.7 | .68 |
| Risk of stroke (5) | 4.8 ± 0.5 | 4.6 ± 0.9 | 4.4 ±1.2 | .12 |
| Warning signs of stroke (7) | 5.5 ± 1.5 | 6.1 ± 1.5 | 6.1 ± 1.6 | .13 |
| Signs and symptoms of stroke (5) | 4.4 ± 0.9 | 4.5 ± 0.9 | 4.5 ± 1.0 | .91 |
| Treatment of stroke (4) | 3.5 ± 0.9 | 3.6 ± 1.0 | 3.5 ± 0.9 | .96 |
| Prevention of stroke (4) | 4.0 ± 0.2 | 3.9 ± 0.3 | 3.9 ± 0.4 | .20 |
| Management of stroke (7) | 5.5 ± 1.5 | 5.5 ± 1.3 | 5.1 ± 2.0 | .56 |
| Total score (37) | 32.0 ± 4.1 | 32.6 ± 4.7 | 32.0 ± 4.8 | .80 |

**Table 6.** *Agreement of risk of recurrent stroke between perceived risk and actual risk and stroke knowledge score*

| Knowledge of stroke | Underestimation (61) | Congruence (55) | Overestimation (24) | *P* value |
|---|---|---|---|---|
| Definition of stroke (5) | 4.5 ± 1.2 | 4.5 ± 1.0 | 4.7 ± 0.8 | .35 |
| Risk of stroke (5) | 4.7 ± 0.8 | 4.5 ± 1.0 | 4.5 ± 1.2 | .34 |
| Warning signs of stroke (7) | 5.7 ± 1.6 | 6.1 ± 1.3 | 6.0 ± 1.8 | .35 |
| Signs and symptoms of stroke (5) | 4.4 ± 1.1 | 4.6 ± 0.8 | 4.4 ± 0.9 | .57 |
| Treatment of stroke (4) | 3.4 ± 1.0 | 3.6 ± 0.8 | 3.5 ± 0.9 | .59 |
| Prevention of stroke (4) | 3.8 ± 0.5*,† | 4.0 ± 0.1* | 3.9 ± 0.3† | .01 |
| Management of stroke (7) | 5.0 ± 1.9 | 5.4 ± 1.6 | 5.4 ± 1.6 | .54 |
| Total score (37) | 31.0 ± 5.6 | 32.7 ± 3.5 | 32.1 ± 4.6 | .51 |

*$P < .01$ between underestimation and congruence.
†$P < .05$ between underestimation and overestimation.

individuals understand information and how that information leads to decision-making behavior such as risk perception or behavioral modification.[11] For example, it was demonstrated that inaccurate estimation of risk of recurrent stroke was significantly associated with factors other than knowledge, such as reported worry about stroke.[19]

Interestingly, when looking at the level of agreement of risk of recurrent stroke (underestimate, correspondence, or overestimate) and stroke knowledge scores, we found that patients who underestimated their risk of recurrent stroke had a lower score in the part relating to prevention of stroke. This may partly reflect that patients who are optimistic about their condition may be less likely to be concerned about the prevention of further stroke. This issue may need further clarification in a future study.

Patient awareness regarding the risk of recurrent disease and lifestyle modifications do not rely solely on the patients themselves: healthcare professionals should play a greater role in educating patients. It was found that doctors, for example, general practitioners, are likely to underestimate patient risk resulting in missed opportunities to educate patients.[11] It was suggested that the doctor's accuracy of understanding of disease risk should be improved and they need to be better educated about effective methods to communicate risk to their patients.[11] Furthermore, recent evidence showed that focusing on only patient education was not enough to succeed in secondary intervention after stroke. Multifaceted and multidomain interventions (organizational interventions) were associated with more demonstrable success in modifying risk-factor outcomes.[20,21] These organizational interventions include, for example, increased nurse or pharmacist medical roles, multidisciplinary teams, and organized systems of care delivery including screening, education, treatment, and monitoring.[21] Implementation in stroke patient care would include regular patient appointments, review of multiple stroke risk factors and feedback to the patient if risk factors deviate from targets.[22-24]

The major strengths of this study include focusing on patients with recurrent stroke or recurrent TIA who are at greatest risk of having another stroke and investigating factors associated with the agreement between perceived and actual risk. However, this study has some limitations. The specific inclusion and exclusion criteria may limit the generalizability of the results. The participants were Thai, thus the results may be influenced by social and cultural factors and by specific health beliefs. The SPI-II tool used to objectively estimate the risk of recurrent stroke was developed to predict risk of recurrent stroke from patients with first-ever stroke or TIA, thus the actual risk of recurrent stroke that was calculated may still be underestimated in recurrent stroke patients. However, we consider that the SPI-II is the most appropriate tool because we included both patients with TIA and stroke and the development of SPI-II included both groups of patients. Additionally, the SPI-II can be used to evaluate short-term risk of recurrent events[25] and to predict long-term risk of

stroke recurrence.[26] Furthermore, the SPI-II was shown to have a marginally superior performance in a prospective study to validate prognostic scores compared to Oxford TIA (Hankey Score), Essen Stroke Risk Score, and Life Long After Cerebral ischemia trial.[27] However, the SPI-II, like other models to predict recurrent stroke, performed only modestly at best (area under the Receiver Operating Characteristic curve values = .62).[28]

## Conclusions

There was poor agreement between self-perceived and actual risk of recurrent stroke. Most patients after recurrent stroke or recurrent TIA underestimated their risk for further stroke. Implementation of a comprehensive care program to communicate to patients their future risk of stroke and to modify their risk factors is warranted in Thailand.

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## Supplementary materials

Supplementary material associated with this article can be found in the online version at doi:10.1016/j.jstrokecerebrovasdis.2018.11.001.

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