Perception of Risk and Knowledge of Risk Factors in Women at High Risk for Stroke

Jennifer L. Dearborn, BA; Louise D. McCullough, MD, PhD

Background and Purpose—Women face a higher mortality after stroke and have different risk factors than men. Despite educational campaigns, women continue to underestimate their own risk for stroke. We present a theoretical model to understand risk perception in high-risk women.

Methods—Eight hundred five women, ages 50 to 70 years, were selected from the University of Connecticut Cardiology Center with at least one risk factor for stroke. A 5-part questionnaire addressed stroke knowledge, risk perception, risk factors, access to health care, and demographics. Two hundred fifteen women responded by mail (28% response rate) and deidentified data were entered in SPSS. Descriptive, bivariate, and multivariate techniques assessed the proposed model.

Results—The cohort was predominantly white (91.5%), higher income (33.1% of the population earned >$75,000), and well-educated (28.6% attended graduate or professional school). Only 2 of the 37 (5.4%) women with atrial fibrillation and 11 of the 71 women with heart disease (15.5%) identified their health condition as a risk factor for stroke. Predictors of risk perception included: other women’s risk (B=0.336, P<0.001), worrying about stroke (B=0.734, P<0.001), having hypertension (B=0.686, P=0.037), and having diabetes (B=0.893, P=0.004). Only 63.9% of women with atrial fibrillation (n=23) reported taking warfarin.

Conclusions—Women were often unable to identify their health condition as a risk factor for stroke. In addition, many women were not undertaking primary prevention behaviors. Risk perception was low, and high-risk women perceived their risk of stroke to be the same as their peers. Educational strategies must advocate for and target high-risk women. (Stroke. 2009;40:1181-1186.)

Key Words: stroke knowledge ■ risk perception ■ stroke warning signs ■ health belief model ■ women and stroke

Stroke is the third leading cause of morbidity and mortality in both men and women behind heart disease and cancer. The incidence of stroke is approximately the same in men and women; however, after the age of 75 years, the incidence of stroke is much greater in women. The lifetime risk of stroke is greater in women, which may be explained in part by women’s increased life expectancy. The 2-year recurrence rate for stroke was significantly higher in women in a high-risk population with symptomatic intracranial arterial stenosis. Although there has been a decline in mortality rates for stroke in men, this advance is not as evident in women explaining the alarming statistic that >67% of stroke deaths now occur in women.

Disability and functional outcomes also appear worse in women because they more likely to require institutional care after a stroke compared with age-matched men, adding significantly to the economic burden of stroke. In addition, differences in the acute management of patients with stroke have been documented with women experiencing greater emergency department wait times and less diagnostic testing.

The risk profiles for stroke for men and women also differ with men being much more likely to have the risk factors of heart disease and smoking and women more likely to be hypertensive and have atrial fibrillation. It is uncertain whether the varying risk factor profiles are more reflective of biological differences or of lifestyle differences between the 2 groups.

Recently, investigators documented a midlife stroke surge in women ages 45 to 54, an age group traditionally at low risk for stroke. This difference was attributed to an increase in risk factors related to metabolic syndrome such as increased abdominal girth and diabetes. These results suggest that there is a need for targeted primary prevention in the perimenopausal age group. The factors of estrogen and pregnancy are modulators of vasculature. Because of recent publicity about hormone replacement therapy and heart disease and stroke, this group may be particularly receptive to education initiatives.

The objective of the current study was to integrate theory from social science research to understand knowledge of...
stroke risk factors and warning signs as well as risk perception of stroke in middle-aged women with at least one risk factor for stroke.

Methods

Research Model

A model was developed to show predicted relationships between studied variables (Figure 1). The key independent variables were personal risk factors and knowledge of risk factors. Perception of risk was the major dependent variable.

Participants

The University of Connecticut and the Hartford Hospital Institutional Review Board approved the study. Eight hundred five female patients, ages 50 to 70 years, from the University of Connecticut Cardiology Center (ages 50 to 70 years) were selected from the following International Classification of Diseases, 9th Revision billing codes: 250.0, 272.4, 401.1, 401.9, 410.4, 411.1, 413.9, 414.0, 414.9, 427.31, 436.0, 440.21, and 443.9. The women received appropriate care and billing codes: 250.0, 272.4, 401.1, 401.9, 410.1, 410.4, 411.1, 413.9, 414.0, 414.9, 427.31, 436.0, 440.21, and 443.9. The women received the survey in 2 separate mailings with 37 envelopes returned for incorrect addresses. One hundred twenty-nine women responded to the first mailing and an additional 86 responded to the second mailing, for a total of 215 returned (28% response rate).

Questionnaire

A 36-item, 5-part questionnaire was developed using elements from prior surveys about knowledge, warning signs, and risk perception. Section 1 asked about knowledge of warning signs and risk factors for stroke. Section 2 addressed risk perception and Section 3 asked about personal risk factors. Section 4 addressed indicators for access to health care and Section 5 inquired about sociodemographic factors.

Figure 1. Research model. We hypothesized that a woman's risk factors for stroke and risk perception as well as her access to medical care would mediate the success of primary prevention measures. We also predicted that health literacy measures such as education and knowledge of stroke warning signs/risk factors would predict perceived risk.

Figure 2. A, Warning signs of stroke and (B) identification of personal risk factors. A, Shown is the percentage of women who identified a particular warning sign for stroke. Subjects were asked to list up to 5 warning signs. Only the responses shown were coded. B, RF indicates risk factor; HBP, high blood pressure; Chol, high cholesterol; Tob, lifetime tobacco use; DM, diabetes mellitus; HD/MI, heart disease or myocardial infarction; CS, carotid stenosis; A Fib, atrial fibrillation; Total, number of women responding. The dark gray bar identifies the number of women who had the particular risk factor and identified it as a risk factor for stroke. The light gray bar is the number of women with the particular risk factor. The difference between the 2 bars is the number of women with a particular risk factor who did not identify it as a risk factor for stroke.

Analog scale. Subjects rated their perceived personal risk and that of other women. Women were asked how often they worried about stroke. In addition, subjects answered questions about personal health conditions and risk factors, access to medical care, and demographic information.

Surveys were returned in provided envelopes and did not contain any identifying personal information. Deidentified data were entered in SPSS. Warning signs and risk factors were coded as nominal responses, whereas risk perception remained a scale variable. Descriptive such as frequencies and means were examined to interpret results. Bivariate correlations were assessed with risk perception and length of time since a primary care office visit as dependent variables. Relationships that were significant at the P<0.05 level were included as independent variables in multivariate analysis. Linear regression was performed using the ENTER method; independent variables were added as a group to the model and analyzed using standard multiple regression. In this technique, a variable is assessed to determine what it adds to the prediction of the dependent variable that is different from the predictability afforded by other independent variables. This is in contrast to sequential (or hierarchical) and stepwise regression techniques, in which the order of entry of variables is determined by the researcher and subject to interpretation. In standard multiple regression, it is possible for an independent variable to appear unimportant to the solution when it is actually highly correlated. For this reason, the full correlation and the semipartial correlation (Table 3B) were considered. In the semipartial correlation, the contribution of other independent variables is
taken out of the independent variable of interest so that only this variable’s contribution is assessed. The semipartial correlation is related to the change in $R^2$ when a variable is added to an equation so that the higher the number, the more important the variable’s contribution is to the correlation coefficient.

The B value reflects the slope of the regression line as determined by the contributions of each significant independent variable. A $B > 0$ represents a positive correlation, with a larger number indicating a more robust relationship. A $B < 0$ indicates an inverse relationship, with a more negative number indicating a more robust relationship. The $P$ value evaluates the unique variance that an independent variable adds to the regression coefficient, and thus an important independent variable that shares variance with another independent variable may be insignificant in the analysis. The 95% CIs for the $B$ value were also included (Table 3B) to show that the slope did not cross zero.

### Results

#### Sample Characteristics

Women ranged in age from 50 to 73 years with a mean age of 63.0 years (S.D. 7.2). The majority of the sample was white (91.5%; Table 1). A total of 33.1% of the population earned more than $75,000 annually and 28.6% of the population had attended graduate or professional school.

#### Stroke Knowledge and Risk Factors

Women identified an average of 2.7 (S.D. 1.6) out of 6 possible warning signs (Figure 2A). Although 71.2% of women identified weakness or numbness as a warning sign, approximately one third of respondents named vision changes (34.1%), dizziness or balance problems (33.6%), headache (32.2%), or confusion (26%) as a warning sign. A total of 69.3% of women identified trouble speaking as a warning sign.

Patients’ risk factors for stroke are shown in Table 2A. Women also were asked to identify any risk factors for stroke (Table 2B). An average of 3.9 (S.D. 1.8) out of 11 coded modifiable risk factors were identified. Only 3.3% of women (n=7) identified atrial fibrillation as a risk factor for stroke. Heart disease was identified as a risk factor 16.3% of the time (n=35). Women often did not identify their own risk factors as placing them at risk for stroke (Figure 2B). For example, only 2 of the 37 (5.4%) women with atrial fibrillation and 11 of the 71 women with heart disease (15.5%) identified their own health condition as a risk factor.

Stroke knowledge, measured by number of stroke warning signs and risk factors identified, did not correlate with worrying about stroke or risk perception in bivariate analysis.

#### Perception of Risk

Mean perception of risk was 5.7 (S.D. 2.3; 10-point scale) and perception of other women’s risk was rated as 5.5 (S.D. 1.7; 10-point scale; Table 3A). Women saw their risk as similar to that of their peers. A majority of women worry about stroke rarely or never, whereas one third of women worry about stroke sometimes or frequently. A total of 64.6% of women perceived their health as good or excellent.

Predictors of risk perception in multivariate analysis included: other women’s risk of stroke ($B = 0.336, P < 0.001$), worrying about stroke ($B = 0.734, P < 0.001$), and having

<table>
<thead>
<tr>
<th>A, Have Risk Factor</th>
<th>N</th>
<th>Percent</th>
<th>B, Identified Risk Factor</th>
<th>N</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypertension</td>
<td>162</td>
<td>76.4</td>
<td>Hypertension</td>
<td>154</td>
<td>71.6</td>
</tr>
<tr>
<td>High cholesterol</td>
<td>157</td>
<td>77.3</td>
<td>Smoking</td>
<td>135</td>
<td>62.8</td>
</tr>
<tr>
<td>Smoke ever</td>
<td>111</td>
<td>52.4</td>
<td>Overweight</td>
<td>122</td>
<td>56.7</td>
</tr>
<tr>
<td>Diabetes</td>
<td>68</td>
<td>32.5</td>
<td>High cholesterol</td>
<td>116</td>
<td>54</td>
</tr>
<tr>
<td>Angina/coronary artery disease</td>
<td>55</td>
<td>27</td>
<td>Lack of exercise</td>
<td>102</td>
<td>47.4</td>
</tr>
<tr>
<td>Atrial fibrillation</td>
<td>37</td>
<td>17.8</td>
<td>Diabetes</td>
<td>78</td>
<td>36.3</td>
</tr>
<tr>
<td>Carotid stenosis</td>
<td>37</td>
<td>17.9</td>
<td>Poor diet</td>
<td>74</td>
<td>34.4</td>
</tr>
<tr>
<td>Prior heart attack</td>
<td>36</td>
<td>17.1</td>
<td>Increased stress</td>
<td>46</td>
<td>21.5</td>
</tr>
<tr>
<td>Prior stroke/transient ischemic attack</td>
<td>23</td>
<td>11.1</td>
<td>Heart disease/coronary artery disease</td>
<td>35</td>
<td>16.3</td>
</tr>
<tr>
<td>Smoke currently</td>
<td>15</td>
<td>7.1</td>
<td>Carotid stenosis/atherosclerosis</td>
<td>16</td>
<td>7.9</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Atrial fibrillation</td>
<td>7</td>
<td>3.3</td>
</tr>
</tbody>
</table>
Primary Prevention

Several aspects of primary prevention were addressed in this survey. A total of 86.6% (n=136) of patients with hypertension (B=0.686, P=0.037) and diabetes (B=0.893, P=0.004) reported good control with blood pressures <140/90 mm Hg. Over half of women (52.4% [n=111]) had smoked >100 cigarettes in their lifetime, but only 7.1% of women (n=15) still smoked. A total of 62.1% (n=41) of diabetics reported having an A1C <6.5%. Only 63.9% of women with atrial fibrillation (n=23) reported taking warfarin. Cholesterol control was defined as a low-density lipoprotein of <100, and 68.3% (n=97) patients reported obtaining this goal. A total of 62.6% (n=132) of subjects reported taking daily aspirin, whereas 22.2% (n=46) had a medical condition that made taking aspirin unsafe.

Access to Health Care

The majority of the sample had health insurance, prescription coverage, and a primary care doctor. However, even in this population, 9.9% of women (n=21) reported being unable to attend a medical appointment because of cost, and 17.8% of women (n=37) reported being unable to take a medication because of cost. Women had seen their primary care physician an average of 7.5 months prior with a range from 0 to 84 months. The average office copay was $16.97 (SD, $31.90) and the average spent per month on prescriptions was $97.49 (SD, $157.24).

In multivariate analysis, having prescription coverage (B=-41.803, P<0.001) and a primary care provider (B=-10.391, P=0.017) was inversely related to the length of time since an office visit. Statistically significant in bivariate correlations but not in the model were: having health insurance, being unable to see doctor of cost (in the past 12 months), and amount of office visit copay. Those who lack prescription coverage and a primary care provider are more likely to have increased time in between office visits. There was no significant relationship for number of health conditions and length of time since seeing a physician.

Primary Prevention

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Discussion

This survey analysis found that a group of high-risk women have low perception of their personal risk for stroke and that they do not perceive their risk to be different from other women. In light of recent data that show a stroke surge in women ages 45 to 54 years, this may be the group who most serves to gain from primary prevention efforts. The lack of knowledge and risk perception in this population is a strong call to action to make stroke education a priority for women of all racial/ethnic and socioeconomic backgrounds.

Stroke Knowledge of Warning Signs and Risk Factors

Health literacy was measured in our model (Figure 1) by stroke knowledge of warning signs and risk factors as well as correctly identifying personal health conditions as stroke risk factors. Low knowledge of risk factors and warning signs for stroke has been documented in large-scale surveys. People are generally able to name risk factors such as stress, high blood pressure, diet, and smoking as causes of stroke, but do not identify health conditions such as atrial fibrillation

<p>| Table 3. Perception of Risk (A) and Multivariate Analysis (B): Predictors of Risk Perception* |
|---------------------------------|-----------------|---------------|---|</p>
<table>
<thead>
<tr>
<th>A.</th>
<th>Mean±SD</th>
<th>N</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean risk perception, scale 1 to 10</td>
<td>5.7±2.3</td>
<td>136</td>
<td>64.6</td>
</tr>
<tr>
<td>Perception of other women’s risk, scale 1 to 10</td>
<td>5.5±1.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Worry about stroke</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Never/rarely</td>
<td>147</td>
<td>71.0</td>
<td></td>
</tr>
<tr>
<td>Sometimes/frequently</td>
<td>60</td>
<td>29.0</td>
<td></td>
</tr>
<tr>
<td>Perceived health</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poor/fair</td>
<td>74</td>
<td>35.4</td>
<td></td>
</tr>
<tr>
<td>Good/excellent</td>
<td>135</td>
<td>64.6</td>
<td></td>
</tr>
<tr>
<td>Other women’s risk of stroke</td>
<td>0.336</td>
<td>&lt;0.001</td>
<td>0.175 to 0.498</td>
</tr>
<tr>
<td>Worry about stroke</td>
<td>0.734</td>
<td>&lt;0.001</td>
<td>0.422 to 1.045</td>
</tr>
<tr>
<td>Have hypertension</td>
<td>0.686</td>
<td>0.037</td>
<td>0.043 to 1.330</td>
</tr>
<tr>
<td>Have diabetes</td>
<td>0.893</td>
<td>0.004</td>
<td>0.298 to 1.489</td>
</tr>
</tbody>
</table>

*ENTER method. Perception of risk was the dependent variable. Variables included in model but with B values not significant include: perceived health, prior stroke, prior transient ischemic attack, carotid artery stenosis, smoking (100 lifetime), and HMO coverage. As can be seen, worrying about stroke was the most significant predictor of risk perception, followed by perceiving that other women are at risk for stroke. A woman having either hypertension or diabetes contributed moderately to the dependent variable. Notable omissions in the model include sociodemographic characteristics and stroke knowledge of warning signs and risk factors, which were not significant under bivariate correlations.
or diabetes. Our data supported these findings. Knowledge of
warning signs is still lacking in many at-risk populations,
which may directly affect emergency room arrival times.16
Many women listed warning signs such as chest pain or arm
pain, suggesting that confusion remains about the difference
between a stroke and a heart attack.

In one study, knowledge of a risk factor was shown to be
superior in those affected by it.19 Our results suggest that this
is not the case in our population. Surprisingly, persons with
atrial fibrillation or carotid stenosis often did not identify
these conditions as a risk factor for stroke, although they are
known to dramatically increase risk. Stroke knowledge has
been shown to be poorest in groups at highest risk,9,10 and
these groups represent missed opportunities for primary
prevention.

Perception of Risk
Risk perception, as suggested by the Health Belief Model, is
a key element in understanding how persons become moti-
vated to change health behaviors.20 Many factors such as
education, presence of disease-specific symptoms, media
campaigns, physician or peer recommendations, socioeconomic
variables, or cultural beliefs can influence the likelihood
of behavioral change. This model can be used to study
the primary prevention of stroke in that individual risk
perception may modulate primary prevention measures such as
blood pressure control, medication adherence, or behav-
ioral and lifestyle changes. In assessment of our model, stroke
knowledge of risk factors or warning signs did not predict
perception of risk. The number of risk factors also did not correlate with risk perception. This suggests that risk perception
is a subjective measure, which is not entirely modulated
by stroke knowledge or actual risk.

Breast cancer campaigns targeted at women such as “Race
for the Cure”21 and the pink ribbon campaign are examples of
a successful education and outreach initiative that has in-
creased risk perception. Women perceive breast cancer to be
one of the largest health concerns they face today despite the
fact that 6 times more women die of stroke and heart disease.1
Patients’ perception of high self-risk has been shown to be a
reliable predictor of mammography screening rates.22 Most
women do not perceive stroke or heart disease to be a major
health concern and report that they are not well informed
about their risk.15 The American Heart Association’s recent
campaign “Go Red for Heart Disease” may serve as a vehicle
to increase risk perception about heart disease and stroke.

Access to Health Care
The patient population studied had increased access consid-
ering that they had received specialty care within the past year
at a cardiology practice. However, even in this select popu-
lation, there were barriers to optimal care. A proportion of
women reported being unable to see a physician for a scheduled
appointment in the past year because of cost. Whether this was
a primary care visit or specialty visit was not reported. An
even greater percentage was unable to take a medication
because of cost in the past year. Efforts in education and
increasing risk perception are undermined if high-risk pop-
ulations are unable to obtain the advice or the medications that
are essential to reducing their stroke risk factors. Surpris-
ingly, perception of risk was not related to access to a
physician or length of time since follow-up. This suggests
that specialty physicians, treating conditions such as hyper-
tension, diabetes, and heart disease, are not emphasizing
patients’ stroke risk in clinical encounters.

Primary Prevention
Primary prevention is the goal and the final step in our model,
which is intrinsically dependent on access to care and
adherence to treatment. In women, it has been shown that a
healthy lifestyle, consisting of low body mass index, abstin-
ence from smoking, moderate consumption of alcohol, and
a healthy diet and regular exercise were associated with a
lower incidence of ischemic and total stroke.1 This survey did
not address health outcomes, but even in this patient popu-
lation who seeks regular specialty care, there were still women
smoking, not taking aspirin with no contraindication to do
so, and with poorly controlled hypertension and cholesterol.
Most surprisingly, more than one third of our sample with
atrial fibrillation reported not taking warfarin. This popula-
tion may represent a mix of women with true contraindica-
tions to warfarin use as well as reflect patients for whom
physicians are averse to prescribing anticoagulation therapy.
This is despite evidence in that patients with a stroke and a
history of atrial fibrillation, the majority are subtherapeutic
or not taking warfarin at the time of their event.23 In addition,
women with atrial fibrillation have higher rates of off-
warfarin thromboembolic risk compared with men,24 placing
them at higher risk.

There are several limitations of this study. Like in all
survey studies, there was a selection bias for women who
returned the survey. Women were predominately white and
living in a suburban area, and whether these results can be
extended to a more urban, ethnically diverse population is
unknown. It would be expected that barriers to primary
prevention would be greater in such populations. In addition,
all women were asked to identify warning signs and risk
factors without any prompting, which would tend to under-
report what women actually know. The benefit of this method
is that there is a sense of relationships that women have
between health and behavior without cues. It is also possible
that women do not identify medical terms such as “atrial
fibrillation” unless they themselves have the condition.

Public Health Significance
Perimenopausal women have an increasing level of risk
factors related to metabolic syndrome and increased stroke
rates compared with men.8 To reduce stroke risk, this popu-
lation must be motivated to produce behavioral change. Risk
perception is a parameter that is separate from stroke knowl-
edge and presence of personal risk factors. This parameter
may predict the likelihood of behavioral change for primary
prevention efforts for reducing stroke risk such as obtaining
blood pressure goals, maintaining A1C below an acceptable
level, quitting smoking, or increasing exercise. Our study
shows that risk perception for stroke is generally low and that
women often do not identify their personal health conditions
placing them at increased risk. Future education campaigns
should target risk perception as an outcome measure to move toward reducing the burden that stroke places on all communities.

Acknowledgments
We acknowledge the contributions of William White, MD, who facilitated the use of the patient population, and Nancy Petry, PhD, who provided consultation on methodology and research methods. Ilene Staff, PhD, Senior Scientist, Research Program at Hartford Hospital provided consultation on statistical methods.

Sources of Funding
This project has been funded by the Northeast Cerebrovascular Consortium and the National Institutes of Health RO1 NS050505 and NS055215.

Disclosures
None.

References
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Stroke. 2009;40:1181-1186; originally published online February 10, 2009;
doi: 10.1161/STROKEAHA.108.543272
Stroke is published by the American Heart Association, 7272 Greenville Avenue, Dallas, TX 75231
Copyright © 2009 American Heart Association, Inc. All rights reserved.
Print ISSN: 0039-2499. Online ISSN: 1524-4628

The online version of this article, along with updated information and services, is located on the
World Wide Web at:
http://stroke.ahajournals.org/content/40/4/1181

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