Perception of risk and knowledge of risk factors in women at high risk for stroke

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Abstract

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—805 women, ages 50 to 70, were selected from the University of Connecticut Cardiology Center with at least one risk factor for stroke. A five-part questionnaire addressed stroke knowledge, risk perception, risk factors, access to health care and demographics. 215 women responded by mail (28% response rate) and de-identified data was 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 7 of the 37 (18.9%) women with atrial fibrillation and 11 out 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=.336, p<.001), worrying about stroke (B=.734, p<.001), having hypertension (B=.686, p=.037) and diabetes (B=.893, p=.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.

Keywords

Organized Stroke Care; Prevention; Psych & Behavior; Public Policy; Women & Minorities; Risk Perception

Stroke is the third leading cause of morbidity and mortality in both men and women, behind heart disease and cancer[1]. The incidence of stroke is approximately the same in men and women; however, after the age of 75, the incidence of stroke is much greater in women[1–3]. The lifetime risk of stroke is greater in women, which may be explained in part by women's increased life expectancy[4]. The two-year recurrence rate for stroke was significantly higher in women in a high-risk population with symptomatic intracranial arterial stenosis[5]. Although there has been a decline in mortality rates for stroke in men, this advance is not as evident in

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women explaining the alarming statistic that over 67% of stroke deaths now occur in women[1,2].

Disability and functional outcomes also appear worse in women as they more likely to require institutional care after a stroke compared to age-matched men[3], adding significantly to the economic burden of stroke. In addition differences in the acute management of stroke patients have been documented, with women experiencing greater emergency department wait times and less diagnostic testing[6]. The risk profiles for men and women for stroke also differ, with men being much more likely to have the risk factors of heart disease and smoking, with women more likely to be hypertensive and have atrial fibrillation[7]. It is uncertain whether the varying risk factor profiles are more reflective of biological differences, or of lifestyle differences between the two groups.

Recently, investigators documented a midlife stroke surge in women ages 45 to 54[8], an age group traditionally at low risk for stroke. This difference was attributed to an increase in risk factors related to the metabolic syndrome such as increased in abdominal girth and diabetes. These results suggest that there is a need for targeted primary prevention in the peri-menopausal 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-age 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 or 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. 805 female patients, ages 50 to 70, from the University of Connecticut Cardiology Center (ages 50 to 70) were selected from the following ICD-9 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 two separate mailings, with 37 envelope returned for incorrect addresses. 129 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, five-part questionnaire was developed using elements from prior surveys about knowledge, warning signs[9–11] and risk perception[12–14]. Section one asked about knowledge of warning signs and risk factors for stroke. Section two addressed risk perception and section three asked about personal risk factors. Section four addressed indicators for access to health care and section five inquired about socio-demographic factors.

Women were asked to list up to five warning signs for stroke, for which coded answers included: weakness or numbness, vision changes loss of balance or dizziness, headache, confusion and speech problems (Figure 2A). Women were asked to identify up to seven modifiable risk factors for stroke, of which there were eleven coded responses (Table 2B).

Coded responses were determined after analyzing frequencies of responses and identifying reasonable groupings. Personal risk factors were identified, including: hypertension, high cholesterol, atrial fibrillation, heart disease, diabetes, stroke or transient ischemic event (TIA), carotid artery stenosis and smoking (current and former). Perception of risk was asked on a 10-point visual analogue 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. De-identified data was entered in Statistical Program for the Social Sciences (SPSS). Warning signs and risk factors were coded as nominal responses, while risk perception remained a scale variable. Descriptives, 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<. 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, where 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 semipartal 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 value greater than zero represents a positive correlation, with a larger number indicating a more robust relationship. A B value less than zero indicates and 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% confidence intervals for the B value were also included (Table 3B) to show that the slope did not cross zero.

Results

Sample Characteristics (Table 1)

Women ranged in age from 50 to 73, with a mean age of 63.0 years (SD7.2). The majority of the sample was white (91.5%). 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 (SD 1.6) out of 6 possible warning signs (Figure 2A). While 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. 69.3% of women identified trouble speaking as a warning sign.

Patient's 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 (SD 1.8) out of eleven 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 7 of the 37 (18.9%) women with atrial fibrillation and 11 out 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 (SD 2.3, 10-point scale) and perception of other women's risk was rated as 5.5 (SD 1.7, 10-point scale) (Table 3A). Women saw their risk to be similar to that of their peers. A majority of women worry about stroke rarely or never, while one-third of women worry about stroke sometimes or frequently. 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=.336, p<.001), worrying about stroke (B=.734, p<.001) and having hypertension (B=.686, p=.037) and diabetes (B=.893, p=.004). Variables included in the model showed a significant correlation with bivariate analysis. The following variables were not significant in the model: perceived health; prior stroke; prior TIA; carotid artery stenosis; smoking (at least 100 lifetime cigarettes); and HMO coverage (Table 3B).

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 co-pay 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<.001) and a primary care provider (B=−10.391, p=.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 co-pay. 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

Several aspects of primary prevention were addressed in this survey. 86.6% (n=136) of hypertensive patients reported good control, with blood pressures less than 140/90. Over half of women (52.4%, n=111) had smoked over 100 cigarettes in their lifetime, but only 7.1% of women (n=15) still smoked. 62.1% (n=41) of diabetics reported having an A1C less than 6.5%. Only 63.9% of women with atrial fibrillation (n=23) reported taking warfarin. Cholesterol control was defined as an LDL of less than 100, and 68.3% (n=97) patients reported obtaining this goal. 62.6% (n=132) of subjects reported taking daily aspirin, while 22.2% (n=46) had a medical condition that made taking aspirin unsafe.

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 shows a stroke surge in women ages 45 to 54[8], 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 socio-economic 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[9,15–18]. People are generally able to name risk factors such as stress, high blood pressure, diet and smoking as a cause of stroke, but do not identify health conditions such as atrial fibrillation 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, even though 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 is suggested by the Health Belief Model (HBM), is a key element in understanding how persons become motivated to change health behaviors[20]. Many factors such as: education, presence of disease specific symptoms, media campaigns, physician or peer recommendations, socio-economic 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 behavioral 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 an example of a successful education and outreach initiative that has increased risk perception. Women perceive breast cancer to be one of the largest health concerns they face today, despite the fact that six times more women die of stroke and heart disease[1]. Patient's 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 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, considering that they had received specialty care within the past year at a Cardiology practice. However, even in this select

population, 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 populations are unable to obtain the advice, or the medications that are essential to reducing their stroke risk factors. Surprisingly, 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 hypertension, diabetes and heart disease, are not emphasizing patient's 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, abstinence from smoking, moderate consumption of alcohol and health 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 population who seeks regular specialty care, there were still women smoking, not taking aspirin with no contraindication not to do so, and with poorly controlled hypertension and cholesterol. Most surprisingly, more than a third of our sample with atrial fibrillation reported not taking warfarin. This population may represent a mix of women with true contraindications to warfarin use as well as reflect patients for whom physicians are averse to prescribing anticoagulation therapy. This is despite evidence that patients with a stroke and a history of atrial fibrillation, the majority are sub-therapeutic 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 to men[24], placing them at higher risk.

There are several limitations of this study. As in all survey studies, there was a selection bias for women that 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 underreport 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

Peri-menopausal women have an increasing level of risk factors related to the metabolic syndrome and increased stroke rates, compared to men[8]. To reduce stroke risk, this population must be motivated to produce behavioral change. Risk perception is a parameter that is separate from stroke knowledge 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.

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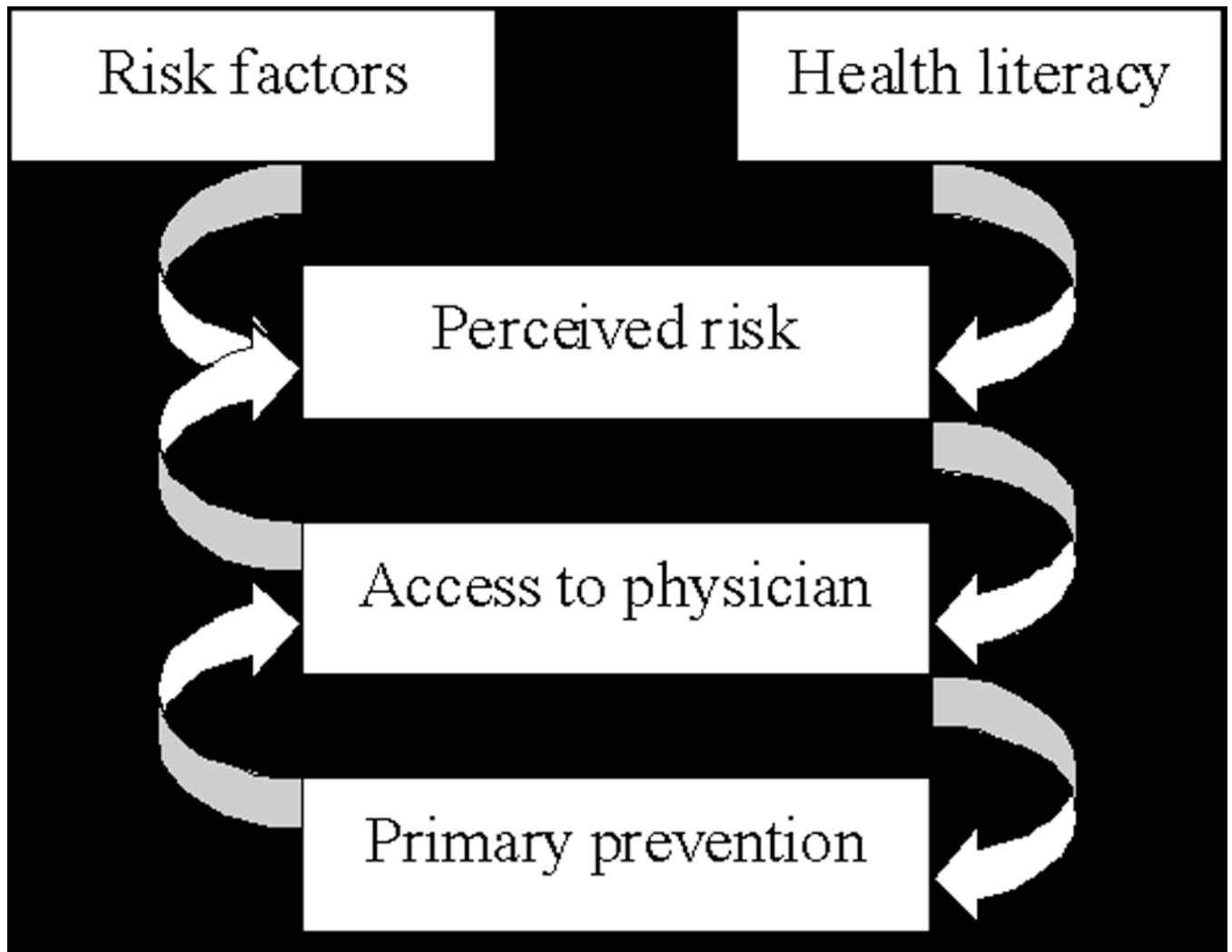
Figure 1. Research model
We hypothesized that a woman's risk factors for stroke and risk perception, as well as her access to medical care, would mediate the success of primary prevention measures. We also predicted that health literacy measures, such as education and knowledge of stroke warning signs/risk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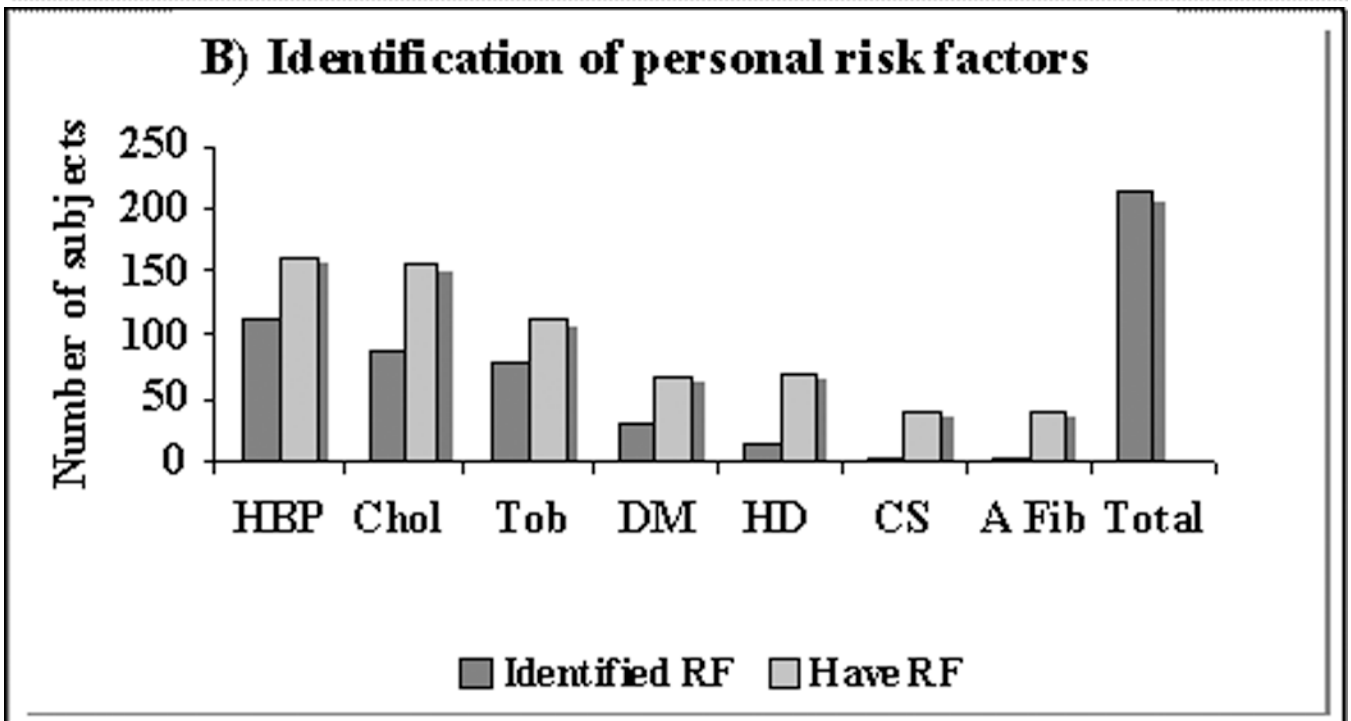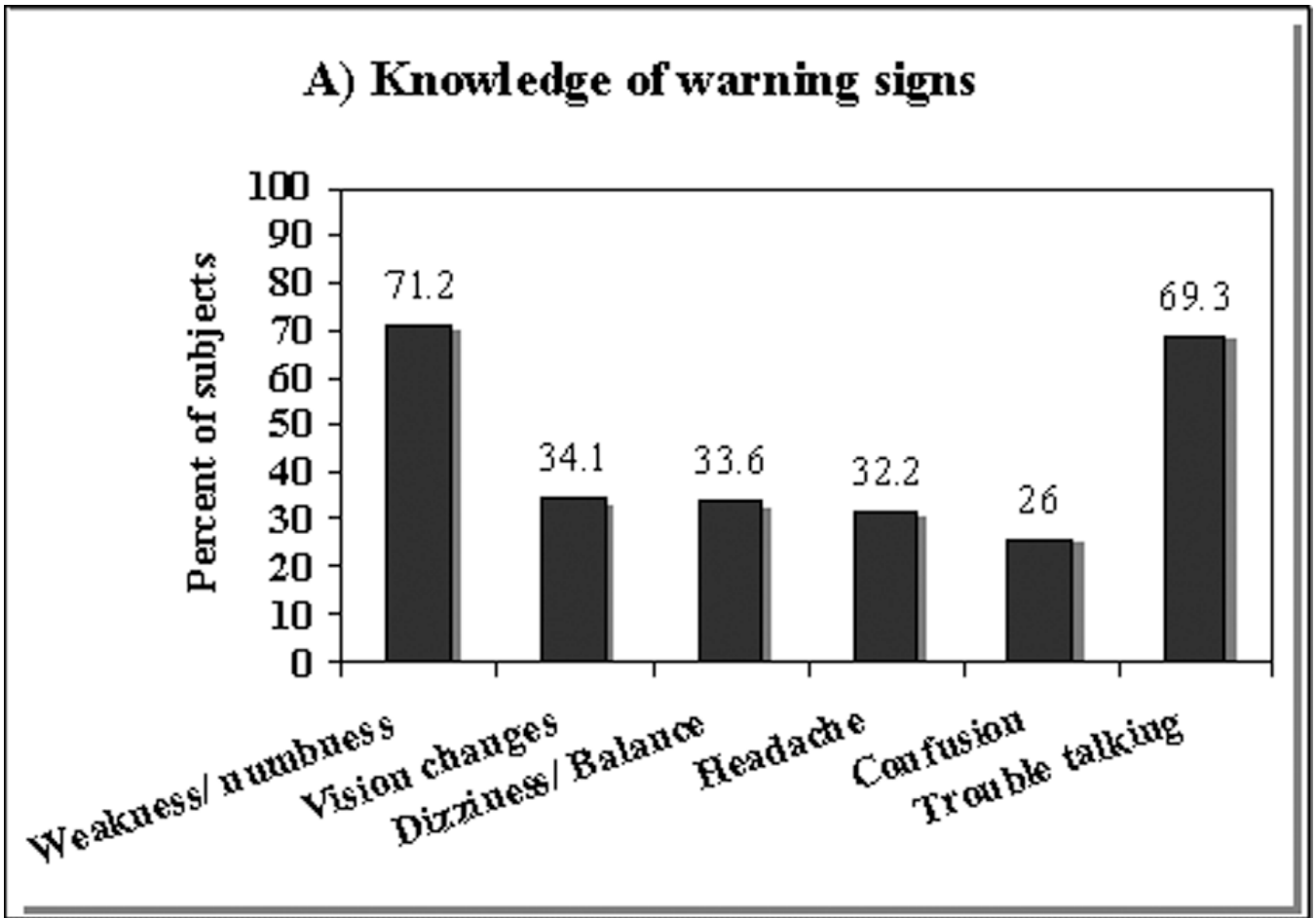
A) Knowledge of warning signs

B) Identification of personal risk factors

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 five warning signs. Only the above responses were coded.
B) RF=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= # women responding
The dark grey bar identifies the number of women who had the particular risk factor and
identified it as a risk factor for stroke. The light grey bar is the number of women responding
to the question. The difference between the two bars is the number of women with a particular
risk factor who did not identify it as a risk factor for stroke.

Table 1

Sample characteristics

Sample Characteristics	N	%
Mean age (years)	63.0 +/− 7.2	
Race		
White	194	91.5
Black	12	5.6
Other	6	2.9
Marital Status		
Married	124	57.9
Divorced/Separated	44	21.5
Widowed	24	11.2
Never Married	22	10.3
Income		
<$25,000	42	21.6
$25,000 to 34,999	22	11.3
$35,000 to 49,999	22	11.3
$50,000 to 74,999	44	22.7
$75,000+	64	33.1
Education		
Some high school or less	17	8
High school diploma or GED	43	20.2
Some college or trade school	47	22.1
College degree	45	21.1
Graduate or professional school	61	28.6

Table 2

A) Presence of risk factors and B) Identification of risk factors

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

Table 3

A) Perception of risk and B) Multivariate analysis: Predictors of Risk Perception *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 TIA; 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 socio-demographic characteristics, stroke knowledge of warning signs and risk factors, which was not significant under bivariate correlations.

A)	Mean +/− SD	N	%
Mean risk perception	5.7 +/− 2.3		
(scale 1 to 10)			
Perception of other women's risk (scale 1 to 10)	5.5+/−1.7		
Worry about stroke			
Never/rarely		147	71.0
Sometimes/frequently		60	29.0
Perceived Health			
Poor/fair		74	35.4
Good/excellent		135	64.6

B)	B	p	Confidence Interval	Semipartial Correlation
Other women's risk of stroke	.336	<.001	.175 to .498	.249
Worry about stroke	.734	<.001	.422 to 1.045	.282
Have hypertension	.686	.037	.043 to 1.330	.128
Have diabetes	.893	.004	.298 to 1.489	.090