Knowledge About Risk Factors for Stroke
A Population-Based Survey With 28 090 Participants

Jacqueline Müller-Nordhorn, MD; Christian H. Nolte, MD; Karin Rossnagel, PhD; Gerhard J. Jungehülsing, MD; Andreas Reich; Stephanie Roll, MSc; Arno Villringer, MD; Stefan N. Willich, MD

Background and Purpose—Increased knowledge of stroke risk factors in the general population may lead to improved prevention of stroke. The objective of the present study was to assess knowledge of stroke risk factors and to determine factors associated with knowledge.

Methods—In a population-based survey, we sent a questionnaire to randomly selected residents in Berlin who were ≥50 years of age enquiring about knowledge of stroke risk factors. Knowledge was assessed in an open-ended question. In addition, we enquired about the source of participants' information. Sociodemographic factors, including age, sex, educational level, and nationality, were also assessed.

Results—A total of 28 090 of 75 720 residents (response rate, 37%) responded to the questionnaire. Of all respondents, 68% were able to name ≥1 correct stroke risk factor, and 13% named 4 correct risk factors. The majority of respondents named mass media as source of information (82%), followed by family/friends (45%) and by general physicians (20%). In multivariable analysis, increased knowledge of stroke risk factors was significantly associated with younger age, a higher educational level, not living alone, a German nationality, and having received any information about stroke during the last year. However, characteristics of respondents using the respective sources of information varied significantly.

Conclusions—Mass media was most frequently named as a source of information about stroke risk factors. Source of information used varied according to population characteristics. Health education programs should take this into account and be adapted accordingly. **(*Stroke*. 2006;37:000-000.)**

Key Words: knowledge ■ population ■ risk factors ■ stroke

Stroke is associated with a considerable burden of disability and loss of quality-adjusted life years.[1] Increased knowledge of stroke risk factors in the population may lead to improved prevention of stroke. For example, perceived risk of disease has been associated with better compliance and risk factor control.[2–4] In population-based surveys, the percentage of participants who were able to name ≥1 correct stroke risk factor ranged from 60% to 76%.[5–8] In patients with an increased risk for stroke, knowledge about stroke risk factors was similar or even lower.[9–11] In most surveys, hypertension was the most frequently mentioned risk factor for stroke, followed by smoking, alcohol, or unhealthy diet.[5,6,8,10,12] In addition, stress is frequently mentioned as a perceived stroke risk factor in both the general population and in high-risk patients.[6–8,10,11]

Different sources of information, such as mass media, friends and family, or medical professionals, are used by people.[5–6,10,12] To our knowledge, characteristics of people using the respective sources of information have not yet been described. Before the development and implementation of effective health education programs about stroke risk factors, it is important to identify people at risk for a lower level of knowledge and to analyze what source of information may be used for knowledge transfer in these people. The objective of our study was, therefore, to assess knowledge of stroke risk factors in the general population, to determine factors associated with knowledge, and to determine characteristics of people using the respective sources of information.

Methods

Design

The study is part of the Berlin Acute Stroke Study (BASS), which first aimed at assessing prehospital and in-hospital delays in patients with an acute cerebrovascular event.[13,14] The second ongoing part aims at reducing both prehospital and in-hospital time delays. The present study is part of the randomized intervention trial to reduce prehospital delays. Briefly, the intervention consisted of an educational letter to inform people of stroke symptoms and warning signs, as well as about appropriate help-seeking behavior. However, the

Received August 1, 2005; final revision received October 22, 2005; accepted November 29, 2005.

From the Institute of Social Medicine, Epidemiology and Health Economics (J. M.-N., K.R., A.R., S.R., S.N.W.) and Department of Neurology (C.H.N., G.J.J., A.V.), Charité University Medical Center, Berlin, Germany.

Correspondence to Jacqueline Müller-Nordhorn, MD, DPH, Institute of Social Medicine, Epidemiology and Health Economics, Charité University Medical Center, Luisenstr 57, D-10117 Berlin, Germany. E-mail jacqueline.mueller-nordhorn@charite.de

Stroke **is available at http://www.strokeaha.org** **DOI: 10.1161/01.STR.0000209332.96513.82**

letter did not contain any information with regard to stroke risk factors. We randomized administrative areas according to postal codes into an intervention (n=24) and control group (n=24). All of the inhabitants in the postal code areas who were ≥50 years of age and who were randomized to the intervention group received the health education material. In addition, we included a standardized questionnaire assessing knowledge of stroke risk factors and source of information. The study was approved by the Ethics Committee of the Charité University Medical Center.

Study Population and Questionnaire

We chose the age of 50 years as the cutoff point, because the risk of stroke is very low for people under the age of 50 years.[15] The vital statistic office provided names and addresses of inhabitants in the postal code areas of the intervention group. A total of 75 720 households in these areas had ≥1 person ≥50 years of age in the household.

Knowledge was assessed in an open-ended question with participants being able to name ≤4 risk factors. In addition, we enquired about the source of participants' information in close-ended questions (mass media, family/friends, and general practitioners) with multiple answers possible. Sociodemographic factors, such as age, sex, educational level, nationality, and whether they were living alone or not, were also assessed. We also enquired about history of prior stroke diagnosed by a physician, family history of stroke and/or myocardial infarction, and stroke symptoms using the stroke symptom questionnaire.[16]

Statistical Analyses

First, we compared baseline sociodemographic variables, history of prior stroke, family history of stroke and/or myocardial infarction, as well as information received between men and women, using the *t* test for the continuous variable age and the χ^2 test for categorical variables. In addition, we compared baseline characteristics of respondents who knew ≥1 risk factor and those who did not know a single risk factor. Odds ratios and 95% CIs for naming the respective "correct" risk factors were calculated comparing women to men with the use of logistic regression analyses. The following risk factors were classified as correct risk factors: older age, male sex, hypertension, smoking, obesity, heart disease, diabetes, family history of stroke, heavy alcohol use, physical inactivity, poor diet/nutrition, and hypercholesterolemia.[17,18]

We used polynomial logistic regression analyses to assess factors associated with increasing knowledge and source of information, respectively. In addition, we performed a logistic regression analysis to assess factors associated with naming "stress" as a risk factor. All of the tests for significance were 2-sided; the significance level was $\alpha=0.05$. Statistical analyses were performed using SPSS, version 11.0 for windows, and SAS, version 8.1 and 9.

Results

Study Population

Of the 75 720 persons, a total of 28 090 persons responded to the questionnaire yielding a response rate of 37%. Table 1 shows

TABLE 1. Baseline Characteristics and Source of Information of Survey Respondents

Characteristic	Total (n=28 090)*	Men (n=12 171)	Women (n=15 822)	OR (women vs men)	95% CI	No Risk Factor (n=8874)	≥1 Risk Factor (n=19 126)	OR (≥1 vs 0)	95% CI
Socioeconomic factors									
Years of age (mean, SD)	64.4±9.7	62.9±8.9	65.5±10.2	1.03 (per year)	1.03 to 1.03	66.0±10.3	63.6±9.4	0.98 (per year)	0.97 to 0.98
Education (>10 y)	8743/25 624 (34%)	4616/11 196 (41%)	4127/14 428 (29%)	0.57	0.54 to 0.60	2281/8017 (29%)	6476/17 656 (37%)	1.46	1.38 to 1.54
Living alone	11 052/27 867 (40%)	3454/12 111 (29%)	7598/15 756 (48%)	2.33	2.22 to 2.46	3915/8782 (45%)	7160/19 134 (37%)	0.74	0.71 to 0.78
Non-German nationality	1124/27 885 (4%)	591/12 121 (5%)	533/15 764 (3%)	0.68	0.61 to 0.77	411/8779 (5%)	717/19 156 (4%)	0.79	0.70 to 0.90
Prior stroke	1309/27 493 (5%)	631/11 956 (5%)	678/15 537 (4%)	0.82	0.73 to 0.92	413/8619 (5%)	896/18 925 (5%)	0.99	0.88 to 1.11
Family history of stroke	10 754/22 296 (48%)	4104/9470 (43%)	6650/12 826 (52%)	1.41	1.34 to 1.49	2938/6856 (43%)	7833/15 482 (51%)	1.37	1.29 to 1.45
Family history of myocardial infarction	8552/20 695 (41%)	3414/8994 (38%)	5138/11 701 (44%)	1.28	1.21 to 1.35	2475/6437 (38%)	6090/14 295 (43%)	1.19	1.12 to 1.26
Information about stroke risk factors†	19 055/27 805 (69%)	7792/12 089 (65%)	11 263/15 716 (72%)	1.40	1.33 to 1.47	60%	73%	1.79	1.70 to 1.89
If any, source of information‡									
GP	3815/19 055 (20%)	1990/7792 (26%)	1825/11 263 (16%)	0.56	0.53 to 0.61	1003/5216 (19%)	2813/13 870 (20%)	1.07	0.99 to 1.16
Media	15 604/19 055 (82%)	6312/7792 (81%)	9292/11 263 (83%)	1.11	1.03 to 1.19	4251/5216 (82%)	11 374/13 870 (82%)	1.03	0.95 to 1.12
Family/friends	8501/19 055 (45%)	3131/7792 (40%)	5370/11 263 (48%)	1.36	1.28 to 1.44	2071/5216 (40%)	6447/13 870 (47%)	1.32	1.24 to 1.41

GP indicates general practitioner; OR, odds ratio.

*For 97 participants, information on sex was missing; †information received during the last year; ‡more than 1 source of information possible.

TABLE 2. Stroke Risk Factors Named in Open-Ended Questions by Survey Respondents

Risk Factors	All (n=28 090)*	Men (n=12 171)	Women (n=15 822)	OR (women vs men)	95% CI
Established risk factors†					
Hypertension	11 937 (43%)	4463 (37%)	7460 (47%)	1.53	1.45 to 1.60
Smoking	10 847 (39%)	5304 (44%)	5530 (35%)	0.75	0.71 to 0.78
Obesity	9549 (34%)	3950 (33%)	5581 (35%)	1.18	1.12 to 1.24
Physical inactivity	5569 (20%)	2854 (23%)	2707 (17%)	0.72	0.68 to 0.76
Alcohol consumption	4602 (16%)	2506 (21%)	2089 (13%)	0.61	0.56 to 0.66
Poor diet/nutrition	3884 (14%)	2067 (17%)	1811 (11%)	0.68	0.64 to 0.73
Hypercholesterolemia	3710 (13%)	1311 (11%)	2395 (15%)	1.48	1.38 to 1.59
Diabetes	2264 (8%)	873 (7%)	1388 (9%)	1.21	1.11 to 1.32
Family history of stroke	894 (3%)	409 (3%)	478 (3%)	0.98	0.86 to 1.13
Heart disease	526 (2%)	193 (2%)	333 (2%)	1.26	1.05 to 1.51
Age	199 (1%)	121 (1%)	78 (1%)	0.53	0.40 to 0.71
Male sex	0%	0%	0%	...	...
Nonestablished risk factors					
Stress	5145 (18%)	2484 (20%)	2653 (17%)	0.87	0.82 to 0.93

OR indicates odds ratio.
*For 97 participants, information on sex was missing; †according to current guidelines.[13,14]

baseline socioeconomic factors, history of prior stroke, family history of stroke or myocardial infarction, and source of information about stroke risk factors, if any. Women respondents were significantly older, had a lower educational level, were more likely to live alone, and were less likely to have a non-German nationality compared with male respondents.

Knowledge of Stroke Risk Factors

Of all respondents, 68% were able to correctly name ≥1 stroke risk factor with 10% naming 1, 20% 2, 25% 3, and 13% the maximum of 4 correct risk factors. Table 2 shows stroke risk factors named in open-ended questions by survey respondents. Men were significantly more likely to name smoking, physical inactivity, alcohol consumption, poor diet/nutrition, age, or stress as a risk factor, whereas women were more likely to name hypertension, obesity, hypercholesterolemia, diabetes, or heart disease as a risk factor.

Factors Associated With Increased Knowledge

In Table 3, factors associated with an increasing number of correct stroke risk factors are shown. In multivariable analyses, the maximum of naming 4 correct risk factors was significantly associated with a higher educational level, a family history of stroke, and having received information about stroke risk factors during the last year. An inverse association was observed for an increasing age, living alone, and a non-German nationality (Table 3).

Table 4 shows factors associated with naming stress as a risk factor (Table 4). A higher educational level, a non-German nationality, a history of prior stroke, and information during the last year by family or friends were positively associated with naming stress as a risk factor, whereas being female, older, living alone before the event, and information by media were associated with a decreased likelihood to name stress as a risk factor.

TABLE 3. Factors Associated With an Increasing No. of Correctly Named Stroke Risk Factors

Correctly Named Risk Factor(s)	1 vs 0 OR* (95% CI)	2 vs 0 OR* (95% CI)	3 vs 0 OR* (95% CI)	4 vs 0 OR* (95% CI)
Age (for 1-y increase)	0.99 (0.99 to 1.00)†	0.98 (0.97 to 0.98)†	0.97 (0.97 to 0.98)†	0.98 (0.97 to 0.98)†
Sex (female vs male)	1.07 (0.96 to 1.19)	1.02 (0.93 to 1.11)	1.04 (0.96 to 1.13)	1.12 (1.02 to 1.24)
Education (>10 vs ≤10 y)	1.06 (0.95 to 1.19)	1.19 (1.08 to 1.29)†	1.32 (1.22 to 1.43)†	1.51 (1.37 to 1.67)†
Living alone	0.98 (0.88 to 1.08)	0.89 (0.82 to 0.97)†	0.78 (0.72 to 0.85)†	0.70 (0.64 to 0.77)†
Non-German nationality	1.18 (0.93 to 1.49)	0.92 (0.75 to 1.13)	0.54 (0.43 to 0.68)†	0.48 (0.35 to 0.65)†
History of stroke	1.48 (1.17 to 1.86)†	1.52 (1.25 to 1.84)†	1.16 (0.96 to 1.42)	1.10 (0.86 to 1.39)
Family history of stroke	1.10 (0.99 to 1.23)	1.08 (0.99 to 1.18)	1.15 (1.05 to 1.25)†	1.16 (1.05 to 1.29)†
Source of information				
GP vs none	1.03 (0.87 to 1.21)	1.13 (0.99 to 1.28)	1.40 (1.24 to 1.56)†	1.45 (1.27 to 1.66)†
Media vs none	0.80 (0.72 to 0.89)†	1.15 (1.06 to 1.26)†	1.54 (1.42 to 1.66)†	2.12 (1.92 to 2.35)†
Family/friends vs none	1.24 (1.10 to 1.40)†	1.35 (1.22 to 1.48)†	1.44 (1.31 to 1.58)†	1.52 (1.36 to 1.69)†

GP indicates general practitioner; OR, odds ratio.
*Adjusted for all other variables in the model; †significant results.

TABLE 4. Facts Associated With Naming "Stress" as Risk Factor for Stroke

Fact	OR*	95% CI
Age (for 1-y increase)	0.95†	0.95 to 0.96†
Sex (female vs male)	0.92†	0.85 to 0.99†
Education (>10 vs ≤10 y)	1.26†	1.17 to 1.36†
Living alone prior event	0.85†	0.78 to 0.92†
Non-German nationality	1.64†	1.39 to 1.94†
History of stroke	1.65†	1.39 to 1.96†
Family history of stroke	0.95	0.88 to 1.03
Source of information		
GP vs none	1.10	0.99 to 1.23
Media vs none	0.89†	0.83 to 0.96†
Family/friends vs none	1.18†	1.08 to 1.29†

GP indicates general practitioner; OR, odds ratio.
*Adjusted for all other variables in the model; †significant results.

Source of Information

Of all respondents, 69% reported having received information about stroke during the last year. With multiple answers possible, the majority of respondents named mass media as source of information (82%), followed by family/friends (45%), and by general physicians (20%; Table 1). Table 5 shows the characteristics of patients using the respective sources of information in multivariable analysis.

Discussion

About two-thirds of the survey respondents were able to name ≥1 established risk factor for stroke. The most frequently named risk factor was hypertension, followed by smoking and obesity. Approximately one-fifth of the respondents, however, named stress, a nonestablished factor, as risk factor for stroke. Mass media was the most frequently cited source of information. The source of information differed according to the respective respondent's socioeconomic profile and medical history.

Knowledge of Risk Factors

Other surveys in both the general population and in patients at an increased risk of stroke reported a similar knowledge of stroke risk factors as observed in our study.[5–8,10–12] In our analyses, factors associated with increased knowledge appear to be inversely related to actual risk of stroke. Respondents with a history of stroke were less likely to name 3 or 4 correct risk factors compared with those without a history of stroke. Others studies including patients at increased risk of stroke, such as older patients, similarly did not report a higher level of knowledge in these patients compared with the general population.[10,11,19] An additional finding is that respondents with a non-German nationality were less likely to name a higher number of established risk factors. This problem may be caused, for example, by language barriers or by a lack of family or friends in a foreign country and is often neglected in the development of health education programs.

Source of Information

Characteristics of participants using the respective sources of information vary significantly. For example, older people, men, and patients with a history of stroke were more likely to receive information by their general practitioner. However, the overall percentage of respondents having received information by general practitioners was low. Similarly to our study, mass media played the key role in transferring knowledge into the population in other studies.[6–8] According to our results, despite the different characteristics of people using different sources of information, the most important fact seems to be to receive any information at all, regardless of the specific source of information. However, in order to transfer knowledge effectively into the population, it is important to develop and adapt health education programs taking into account who is using what in the population.

Perception of Stress as Risk Factor

A high percentage of respondents named stress as a risk factor for stroke in our survey, as observed in other studies as well.[6–8,10,11] However, stress is not included as an established stroke risk factor in current international guidelines.[17,18] There appears to be a gap between public perception and current medical knowledge. Here, either misconceptions are prevalent in the population or, on the other hand, popular beliefs are, in fact, true, but the medical community failed to evaluate certain risk factors sufficiently.

To date, it is unclear whether and how stress is associated with stroke.[20–23] There are a number of reasons for this uncertainty regarding stress and other psychosocial factors. First, stress is an unclear concept for both researchers and patients, often used for different underlying situations or psychological states, for example, stress at work or at home,

TABLE 5. Characteristics of Patients Using the Respective Sources of Information

Source of Information	GP vs None OR* (95% CI)	Media vs None OR* (95% CI)	Family/friends vs None OR* (95% CI)
Age (for 1-y increase)	1.03 (1.02 to 1.03)†	1.01 (1.01 to 1.01)†	1.00 (1.00 to 1.00)
Sex (female vs male)	0.62 (0.57 to 0.68)†	1.35 (1.27 to 1.44)†	1.41 (1.32 to 1.51)†
Education (>10 vs ≤10 y)	1.01 (0.92 to 1.10)	1.52 (1.43 to 1.62)†	1.18 (1.10 to 1.26)†
Living alone prior event	0.92 (0.84 to 1.00)	0.80 (0.76 to 0.85)†	0.79 (0.74 to 0.85)†
Non-German nationality	0.78 (0.61 to 1.00)	0.30 (0.26 to 0.36)†	0.60 (0.49 to 0.73)†
History of stroke	3.71 (3.21 to 4.29)†	0.84 (0.73 to 0.96)†	1.14 (0.98 to 1.34)
Family history of stroke	1.19 (1.09 to 1.29)†	1.28 (1.21 to 1.36)†	6.67 (6.23 to 7.14)†

GP indicates general practitioner; OR, odds ratio.
*Adjusted for all other variables in the model; †significant results.

financial worries, stressful life events, a low locus of control, lack of adequate coping mechanisms, or underlying diseases, such as depression. In addition, there is a lack of studies investigating the role of stress in cerebrovascular disease. Particularly exaggerated systolic reactivity may play a role in the etiology of stroke, as well as adaptive behavior to stressful situations.[20,21] With respect to coronary heart disease, a recently published case-control study by Rosengren et al[24] showed that stress was an independent major risk factor for myocardial infarction. Additional research should focus to clarify the role of stress as a risk factor in the etiology of stroke.

Limitations

One limitation of the study is that, because of the nature of the survey, we have little information about nonresponders. Therefore, we cannot exclude response bias in our survey population. Response bias might have influenced our results, for example, leading to an overestimation of knowledge in the case that responders were more interested in health issues generally and possessed a higher knowledge compared with nonresponders. In official statistics, the age (mean age, 65 years) and sex (57% female) distribution in the intervention postal code areas is similar to those of our respondents.[25] However, there is a higher percentage of inhabitants with a non-German nationality compared with our respondents (11% versus 4%, respectively). Another limitation of our study is that we had to balance between number of items assessed and length of the questionnaire. It was, therefore, not possible to assess prevalent risk factors.

Conclusions

Health education programs to increase knowledge about stroke risk factors should focus on population groups at risk for lack of knowledge. Particularly people at an increased risk of stroke, such as older people or those from an impaired socioeconomic background, displayed less knowledge about stroke risk factors. Also, sources of information may be varied to reach the respective target group. In addition, research on the role of stress in the etiology of stroke is needed, and results should be transferred into the general population.

Acknowledgments

The study was supported by a grant from the German Federal Ministry of Education and Research. The number of the grant is 01GI9902/4, and the name of the grant is Kompetenznetz Schlaganfall.

References

1. Feigin VL, Lawes CM, Bennett DA, Anderson CS. Stroke epidemiology: a review of population-based studies of incidence, prevalence, and case-fatality in the late 20th century. *Lancet Neurol*. 2003;2:43–53.
2. Kreuter MW, Strecher VJ. Changing inaccurate perceptions of health risk: results from a randomized trial. *Health Psychol*. 1995;14:56–63.
3. Janz NK, Becker MH. The health belief model: a decade later. *Health Educ Q*. 1984;11:1–47.
4. Sappok T, Faulstich A, Stuckert E, Kruck H, Marx P, Koennecke HC. Compliance with secondary prevention of ischemic stroke: a prospective evaluation. *Stroke*. 2001;32:1884–1889.
5. Segura T, Vega G, Lopez S, Rubio F, Castillo J. Public perception of stroke in Spain. *Cerebrovasc Dis*. 2003;16:21–26.
6. Schneider AT, Pancioli AM, Khoury JC, Rademacher E, Tuchfarber A, Miller R, Woo D, Kissela B, Broderick JP. Trends in community knowledge of the warning signs and risk factors for stroke. *JAMA*. 2003;289:343–346.
7. Yoon SS, Heller RF, Levi C, Wiggers J, Fitzgerald PE. Knowledge of stroke risk factors, warning symptoms, and treatment among an Australian urban population. *Stroke*. 2001;32:1926–1930.
8. Kim JS, Yoon SS. Perspectives of stroke in persons living in Seoul, South Korea: a survey of 1000 subjects. *Stroke*. 1997;28:1165–1169.
9. Samsa GP, Cohen SJ, Goldstein LB, Bonito AJ, Duncan PW, Enarson C, DeFriese GH, Horner RD, Matchar DB. Knowledge of risk among patients at increased risk for stroke. *Stroke*. 1997;28:916–921.
10. Kothari R, Sauerbeck L, Jauch E, Broderick J, Brott T, Khoury J, Liu T. Patients' awareness of stroke signs, symptoms, and risk factors. *Stroke*. 1997;28:1871–1875.
11. Gupta A, Thomas P. Knowledge of stroke symptoms and risk factors among at-risk elderly patients in the UK. *Int J Clin Pract*. 2002;56:634–637.
12. Cheung RTF, Li LSW, Mak W, Tsang KL, Lauder IJ, Chan KH, Fong GCY. Knowledge of stroke in Hong Kong Chinese. *Cerebrovasc Dis*. 1999;9:119–123.
13. Rossnagel K, Jungehulsing GJ, Nolte CH, Muller-Nordhorn J, Roll S, Wegscheider K, Villringer A, Willich SN. Out-of-hospital delays in patients with acute stroke. *Ann Emerg Med*. 2004;44:476–483.
14. Jungehülsing GJ, Rossnagel K, Nolte CH, Müller-Nordhorn J, Roll S, Klein M, Wegscheider K, Einhäupl KM, Willich SN, Villringer A. Emergency department delays in acute stroke –analysis of time between ED arrival and imaging. *Eur J Neurol*. 2005;12:1–8.
15. Berger K, Kolominsky-Rabas P, Heuschmann P, Keil U. Die Häufigkeit des Schlaganfalls in Deutschland. Prävalenzen, Inzidenzen und ihre Datenquellen. *Dtsch Med Wochenschr*. 2000;125:21–25.
16. Berger K, Hense HW, Rothdach A, Weltermann B, Keil U. A single question about prior stroke versus a stroke questionnaire to assess stroke prevalence in populations. *Neuroepidemiology*. 2000;19:245–257.
17. Straus SE, Majumdar SR, McAlister FA. New evidence for stroke prevention: scientific review. *JAMA*. 2002;288:1388–1395.
18. Hacke W, Kaste M, Bogousslavsky J, Brainin M, Chamorro A, Lees K, Leys D, Kwiecinski H, Toni P, Langhorne P, Diener C, Hennerici M, Ferro J, Sivenius J, Gunnar N, Bath P, Olsen TS, Gugging M; European Stroke Initiative Executive Committee and EUSI Writing Committee. European Stroke Initiative recommendations for stroke management–update 2003. *Cerebrovasc Dis*. 2003;16:311–337.
19. Derex L, Adeleine P, Nighoghossian N, Honnorat J, Trouillas P. Evaluation du niveau d'information concernant l'accident vasculaire cérébral des patients admis dans une unité neurovasculaire française. *Rev Neurol*. 2004;160:331–337.
20. Lane DA, Carroll D, Lip GYH. Cardiovascular and behavioral reactions to stress and cerebrovascular disease (editorial comment). *Stroke*. 2001;32:1718–1720.
21. Andre-Petersson L, Engstrom G, Hagberg B, Janzon L, Steen G. Adaptive behavior in stressful situations and stroke incidence in hypertensive men: results from prospective cohort study "men born in 1914" in Malmö, Sweden. *Stroke*. 2001;32:1712–1720.
22. Everson SA, Lynch JW, Kaplan GA, Lakka TA, Sivenius J, Salonen JT. Stress-induced blood pressure reactivity and incident stroke in middle-aged men. *Stroke*. 2001;32:1263–1270.
23. Schneck MJ. Is psychological stress a risk factor for cerebrovascular disease? *Neuroepidemiology*. 1997;16:174–179.
24. Rosengren A, Hawken S, Ounpuu S, Sliwa K, Zubaid M, Almahmeed WA, Blackett KN, Sitthi-amorn C, Sato H, Yusuf S; INTERHEART investigators. Association of psychosocial risk factors with risk of acute myocardial infarction in 11 119 cases and 13 648 controls from 52 countries (the INTERHEART study): case-control study. *Lancet*. 2004;364:953–962.
25. Statistisches Landesamt Berlin. *Statistischen Bericht A I 3 - j 03, Bevölkerung in Berlin 2003*. Statistisches Landesamt: Berlin; 2003.

Stroke
Journal of the American Heart Association

Knowledge About Risk Factors for Stroke. A Population-Based Survey With 28 090 Participants

Jacqueline Müller-Nordhorn, Christian H. Nolte, Karin Rossnagel, Gerhard J. Jungehülsing, Andreas Reich, Stephanie Roll, Arno Villringer and Stefan N. Willich

Stroke. published online March 2, 2006;
Stroke is published by the American Heart Association, 7272 Greenville Avenue, Dallas, TX 75231

Print ISSN: 0039-2499. Online ISSN: 1524-4628