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Childhood and Adult Social Conditions and Risk of Stroke

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Key Words
Stroke · Social conditions · Risk factor

Abstract

Background: Socioeconomic conditions may strongly influence the risk of stroke. We tested the hypotheses that indexes of social status in different life periods including childhood are inversely associated with stroke risk and that there is a cumulative effect of social conditions during lifetime on the risk of stroke. Furthermore, we investigated whether social advancement compared to the parental generation is associated with reduced stroke risk. ***Methods:*** In a case-control study, we assessed parental professional status, highest school degree, professional education and the last professional activity in 370 consecutive patients with ischemic or hemorrhagic stroke or transient ischemic attack [TIA; age 60.7 ± 12.8 years (mean ± standard deviation); 31.1% women] and 370 age- and sex-matched control subjects randomly selected from the general population of the same area. ***Results:*** Higher level of school exams [odds ratio (OR) 0.58, 95% confidence interval (CI) 0.39–0.86], university or polytechnic high school degrees (OR 0.39, 95% CI 0.24–0.63), nonmanual (last or current) professional activity (OR 0.51, 95% CI 0.37–0.71) and father's nonmanual professional activity (OR 0.64, 95% 0.43–0.97) were associated with a lower risk of stroke/TIA. Adjustment for vascular risk factors including current smoking and alcohol consumption reduced the strength of these associations and rendered them nonsignificant except for university or polytechnic high school degrees (OR 0.49, 95% CI 0.27–0.87). Additional adjustment for regular sports activity further attenuated the association between academic degrees and risk of stroke/TIA (OR 0.56, 95% CI 0.31–1.02). A score summarizing 4 lifetime social indexes was not independently associated with stroke risk (OR 0.67, 95% CI 0.39–1.16). Social advancement as assessed by changes from paternal manual work to nonmanual work in the index generation was more common among control subjects (23.5%) than patients (15.3%; p = 0.0097), but such advancement was not independently associated with stroke/TIA after adjustment for all covariables (OR 0.82, 95% CI 0.50–1.33). ***Conclusions:*** Socioeconomic conditions were inversely linked to the risk of stroke/TIA. These associations were strongly influenced by lifestyle factors such as smoking, alcohol consumption and mainly sports activity. Stroke preventive strategies may have a particularly large potential if they focus on such lifestyle habits in socially disadvantaged groups.

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Introduction

Socioeconomic status is inversely associated with stroke mortality, an association that is relatively strong in comparison to other diseases [1]. Such socioeconomic stroke mortality differentials persisted or even widened in several parts of the world during recent decades [1–4]. Low socioeconomic status was also correlated with stroke incidence in most studies, although this effect was attenuated and partly rendered nonsignificant after adjustment for vascular risk factors, indicating that differences in risk factor prevalence and severity may partly account for this variation [1]. Socioeconomic status is complex to define and assess, and its impact on health implies several material, behavioral and psychosocial factors. The most important determinants of socioeconomic status include school education, occupation and income. Socioeconomic conditions can change during an individual's lifetime, and there is evidence that the influence on health of determinants of socioeconomic status is cumulative over an individual's lifespan [1]. Several studies have indicated that poor socioeconomic conditions in childhood and during prenatal life are associated with an increased risk of stroke in adulthood [5–8]. Such increased risk may not be ameliorated by improvements in socioeconomic status later in life [5, 6].

We assessed parental professional status as an index of childhood social status, highest school degree as an indicator of juvenile educational level, professional education as a feature of social status in adolescence and early adulthood and the last professional activity as a socioeconomic index of later adulthood. We tested the hypothesis that one or more of these social determinants is associated with the odds of stroke and analyzed the impact of vascular risk factors, diseases and lifestyle factors on such an association. Furthermore, we analyzed whether there is a cumulative effect of social conditions during the lifespan and whether social advancement or decline is associated with the odds of stroke.

Methods

We studied 370 consecutive patients admitted to the Neurology Department of the University of Heidelberg for ischemic or hemorrhagic stroke or transient ischemic attack (TIA) and 370 control subjects randomly selected from the general population between November 2001 and April 2003 [9, 10]. Patients who were >80 years (>75 years after the first 6 months of the study), resided outside the study area (city of Heidelberg and the neighboring county) or were unable to give informed consent were excluded. Among 385 eligible patients, 370 (96.1%) agreed to participate in the study. All patients received a cranial CT or MRI scan, extra- and transcranial Doppler sonography, ECG and, in most cases, transthoracic or transesophageal echocardiography and Holter monitoring. Ischemic stroke was defined as either a central nervous deficit lasting ≥24 h without evidence of a nonvascular cause or cerebral hemorrhage or a new ischemic lesion on neuroimaging corresponding to acute neurological symptoms regardless of symptom duration. Diagnosis of intracerebral hemorrhage was based on neuroradiological evidence. TIA was diagnosed if a neurological deficit of vascular origin lasted <24 h without new corresponding vascular lesions on neuroimaging.

Control subjects were randomly selected from the general population and matched to patients one-to-one for age (±2 years), sex and area of residence [9, 10]. Within 1 week after a patient was included, the first matching subject identified from a 2% random sample of the study population was contacted by mail and thereafter by phone. The random sample was obtained from the local Inhabitant Registration Administration, which contained information on name, age, sex and address. Registration is enforced by German law. The same exclusion criteria as for patients were valid for control subjects. With high probability, control subjects would have become patients in the Neurology Department if they had suffered a stroke or TIA. Among 430 subjects who could be contacted by phone, 370 (86.0%) agreed to study participation. All subjects were interviewed by trained interviewers using a structured questionnaire. Interviews were performed face-to-face in patients and by phone in control subjects. To avoid any classification bias between groups, self-reported risk factors and diseases were acknowledged if subjects affirmed that a physician had made the respective diagnosis before the stroke or interview. The ethics committee approved the study protocol. All subjects gave informed consent.

Subjects were asked for their marital status and their highest school degree. Five categories were differentiated according to the German school system: no school exam; secondary school exam after 8–9 school years; secondary modern school exam after 10 years; degree for polytechnic schools after 12 years, and degree to enter universities after 12–13 years. The professional training was categorized as follows: no completed professional training; apprenticeship for manual professions; apprenticeship for business and administrative professions; degree from technical schools; degree from polytechnic high schools; university degree, and other degrees. Subjects were furthermore questioned regarding their last profession before the stroke or interview or in pensioners or unemployed subjects before retirement or unemployment. These jobs or professions were categorized by the interviewer or in ambiguous cases by the study team as follows: (1) unskilled manual work; (2) skilled manual work; (3) white-collar jobs not requiring academic training, and (4) jobs requiring academic training. Furthermore, current unemployment, including retraining, retirement and housework, was assessed. The subjects were asked about the professions of their fathers and mothers, and in the case of multiple professions, that which dominated temporally during the childhood and youth of the interviewed subject was recorded. Such professions were categorized as described above. In a lifetime social status score, 1 point each was given for (1) a school degree after 12–13 years, (2) a polytechnic or academic degree, (3) a white-collar job of the subject him/herself or (4) a white-collar job of the subject's father, yielding a range of 0–4 points.

Table 1. Demographic data, risk factors and previous diseases in patients and control subjects

Parameter		Patients	Control subjects	p value
Age, years (mean ± SD)		60.7 ± 12.8	60.6 ± 12.7	–
Female sex		115/370 (31.1%)	115/370 (31.1%)	–
Marital status	Married/living in partnership	280/362 (77.4%)	283/367 (77.1%)	0.55
	Unmarried/without partnership	31/262 (8.6%)	27/367 (7.4%)	
	Divorced/separated	22/362 (6.1%)	18/367 (4.9%)	
	Widowed	29/362 (8.0%)	39/367 (10.6%)	
School education	Without final school exam	6/359 (1.7%)	4/365 (1.1%)	0.0053
	Secondary school exam (8–9 years)	244/359 (68.0%)	213/365 (58.4%)	
	Secondary modern school exam (10 years)	44/359 (12.3%)	57/365 (15.6%)	
	School exam after 12 years	18/359 (5.0%)	14/365 (3.8%)	
	School exam after 13 years	41/359 (11.4%)	75/365 (20.6%)	
	Unclassified	6/359 (1.7%)	2/365 (0.6%)	
Professional training	No professional training	39/329 (11.9%)	34/331 (10.3%)	<0.0001
	Apprenticeship (manual)	189/329 (57.5%)	157/331 (47.4%)	
	Apprenticeship (nonmanual)	50/329 (15.2%)	62/331 (18.7%)	
	Technical college	21/329 (6.4%)	9/331 (2.7%)	
	Academic degree (polytechnic)	8/329 (2.5%)	15/331 (4.5%)	
	Academic degree (university)	22/329 (6.7%)	54/331 (16.3%)	
Employment status	Unemployed	5/339 (1.5%)	6/348 (1.7%)	
	Pensioner	88/339 (26.0%)	90/348 (25.9%)	
	Working[1]	246/339 (72.6%)	252/348 (72.4%)	
Current/last professional activity	Housework	17/339 (5.0%)	26/348 (7.5%)	<0.0001
	Unskilled manual	66/339 (19.5%)	38/348 (10.9%)	
	Skilled manual	173/339 (51.0%)	149/348 (42.8%)	
	Nonacademic, nonmanual	59/339 (17.4%)	74/348 (21.3%)	
	Academic	24/339 (7.1%)	61/348 (17.5%)	
Father's profession	Housework	1/332 (0.3%)	1/345 (0.3%)	0.18
	Untrained manual	105/332 (31.6%)	89/345 (25.8%)	
	Skilled manual	168/332 (50.6%)	170/345 (49.3%)	
	Nonacademic, nonmanual	37/332 (11.1%)	53/345 (15.4%)	
	Academic	21/332 (6.3%)	32/345 (9.3%)	
Mother's profession	Housework	228/332 (68.7%)	223/352 (63.4%)	0.58
	Unskilled manual	55/332 (16.6%)	65/352 (18.5%)	
	Skilled manual	31/332 (9.3%)	44/352 (12.5%)	
	Nonmanual, nonacademic	13/332 (3.9%)	13/352 (3.7%)	
	Academic	5/332 (1.5%)	7/352 (2.0%)	
Stroke risk factors	Arterial hypertension	217/369 (58.8%)	151/370 (40.8%)	<0.0001
	Diabetes mellitus	81/369 (22.0%)	49/370 (13.2%)	0.0019
	Hyperlipidemia	143/70 (38.7%)	114/370 (30.8%)	0.025
	Previous stroke	69/370 (18.7%)	21/370 (5.7%)	<0.0001
	Previous TIA	74/327 (22.6%)	17/363 (4.7%)	<0.0001
	Coronary heart disease[2]	66/370 (17.8%)	48/370 (13.0%)	0.065
	Peripheral arterial disease	70/368 (18.9%)	45/370 (12.2%)	0.011
	Current smoking	105/369 (28.5%)	70/370 (18.9%)	0.0023
	Previous smoking	126/337 (37.4%)	131/362 (36.2%)	0.74
	Never smoked	106/337 (31.5%)	16/362 (44.5%)	0.0004
	Alcohol consumption			0.0002
	Never	90 (24.4%)	57 (15.4%)	0.0022
	<1 portion per day	173 (46.9%)	215 (58.1%)	
	1 portion per day	65 (17.6%)	77 (20.8%)	
	>1 portion per day	41 (11.1%)	21 (5.7%)	0.0077
	Body mass index >25	199/362 (55.0%)	180/368 (48.9%)	0.10
	Recent regular sports activities[3]	94/370 (25.4%)	162/370 (44.6%)	<0.0001

[1] Including housework and part-time work. [2] Including a history of myocardial infarction, aortocoronary bypass surgery, coronary stenting or angina pectoris. [3] Defined in accordance with the definition of the German Olympic Sports Association as any leisure time motoric activity that has its aim in itself or is performed for no other purpose than to improve or maintain physical fitness [10].

Table 2. Univariate and multivariate analysis of socioeconomic parameters

Parameter	Univariate analysis			Multivariate analysis								
				model 1			model 2			model 3		
	OR	95% CI	p value	OR	95% CI	p value	OR	95% CI	p value	OR	95% CI	p value
School education ≥12 years	0.58	0.39–0.86	0.0072	0.61	0.39–0.97	0.035	0.73	0.45–1.17	0.19	0.81	0.50–1.31	0.39
Professional training (academic degree vs. none)	0.39	0.24–0.63	<0.0001	0.43	0.25–0.76	0.0035	0.49	0.27–0.87	0.015	0.56	0.31–1.02	0.060
Last professional activity (nonmanual vs. manual work)	0.51	0.37–0.71	<0.0001	0.68	0.47–0.997	0.048	0.73	0.50–1.08	0.12	0.80	0.53–1.20	0.27
Father's professional activity (nonmanual vs. manual work)	0.64	0.43–0.97	0.034	0.69	0.43–1.10	0.12	0.74	0.45–1.20	0.22	0.79	0.48–1.30	0.35
Mother's professional activity (nonmanual vs. manual work)	0.94	0.46–1.90	0.86	0.69	0.31–1.54	0.37	0.73	0.32–1.70	0.47	0.73	0.31–1.69	0.46
Lifetime social status score (3–4 vs. 0–2 points)[1]	0.55	0.35–0.85	0.008	0.57	0.34–0.95	0.031	0.63	0.37–1.09	0.098	0.67	0.39–1.16	0.15

All models contain only one social parameter. Model 1 included arterial hypertension, diabetes mellitus, hyperlipidemia, previous stroke/TIA and PAD. Model 2 added current smoking, alcohol abstinence and high alcohol consumption to model 1. Model 3 added leisure time sports activity to model 2.

[1] One point each was given for (1) a school degree after 12–13 years, (2) a polytechnic or academic degree, (3) a white-collar job of the subject him/herself or (4) a white-collar job of the subject's father.

Continuous variables are given as means ± standard deviation and were compared using Student's t test. Categorical variables are reported as percentages, and for comparison, the χ^2 test with respective degrees of freedom was used. Odds ratios (ORs) and 95% confidence intervals (CIs) are given for all risk factors. Conditional logistic regression analysis for matched pairs was applied to adjust for other variables. To analyze the influence of covariables on social determinants, several predefined multivariate models were used, as follows: one that included generally accepted stroke risk factors (hypertension, diabetes mellitus, previous stroke/TIA and hypercholesterolemia) plus those risk factors that were significant ($p < 0.05$) in univariate analysis except from behavioral risk factors; a second model that added smoking and alcohol consumption to model 1, and a third model that added leisure time sports activity to model 2. The correlation between social determinants was assessed using Spearman's rank correlation coefficient (Rs). Patients with missing values were excluded from the analyses. In a power calculation, the 370 cases and 370 controls allowed detection of an OR of 0.66 with a power of 79% (α = 0.05) if the factor has a prevalence of 50%. Data were analyzed using the software package SAS.

Results

School education differed between the groups, with more patients having low-level school exams and more control subjects having passed medium- or high-level school exams (p = 0.0053; table 1). School exams after 12–13 years allowing entry into universities or polytechnic schools were associated with a lower risk of stroke/TIA (OR 0.58, 95% CI 0.39–0.86; p = 0.0072; table 2). Similarly, the groups differed regarding professional training ($p < 0.0001$; table 1). Apprenticeship in blue-collar professions was more common among patients, whereas academic degrees were less common. A university or polytechnic school degree was associated with a lower risk of stroke/TIA (OR 0.39, 95% CI 0.24–0.63; $p < 0.0001$; table 2). Marital status and working status were not different between the groups. Last or current professional activity differed between the groups ($p < 0.0001$), with more patients being unskilled or skilled workers and fewer patients having academic or nonacademic white-collar jobs. A nonmanual profession was associated with a lower risk of stroke/TIA (OR 0.51, 95% CI 0.37–0.71; $p < 0.0001$; table 2). The professional activity of the subjects' fathers did not differ significantly between the groups in nondichotomized analysis (p = 0.18). Paternal jobs were more often characterized by untrained or skilled manual work and less often by white-collar jobs in patients than control subjects. Paternal academic and nonacademic white-collar jobs were associated with a lower odds of stroke/TIA among their sons and daughters (OR 0.64, 95% CI 0.43–

0.97; $p = 0.022$). The subjects' mothers were mainly occupied by housework, and maternal professional activity did not differ between the groups.

Conventional risk factors that varied significantly between the groups included arterial hypertension, diabetes mellitus, hyperlipidemia, previous stroke or TIA, peripheral arterial disease (PAD), current smoking, alcohol abstinence, high alcohol consumption and leisure-time sports activity (table 1). Patients and control subjects with manual professions were less often engaged in regular sports activity (patients: 19.4 vs. 39.1%, $p < 0.001$; control subjects: 31.0 vs. 49.3%, $p < 0.001$). Patients (but not control subjects) with manual professions were more often current smokers (32.6 vs. 18.1%; $p = 0.012$) and more often had PAD (21.1 vs. 9.6%; $p = 0.019$) than patients with white-collar jobs. Control subjects (but not patients) with manual professions more often had diabetes mellitus (17.4 vs. 8.2%; $p = 0.015$) or a history of previous stroke (12.7 vs. 3.0%; $p = 0.002$) and were more often alcohol abstainers (19.3 vs. 9.6%; $p = 0.016$) than control subjects with white collar jobs.

After adjustment for arterial hypertension, diabetes mellitus, hyperlipidemia, previous stroke/TIA and PAD, effects associated with higher school education, better professional training and nonmanual professional activity weakened but remained significantly associated with a lower risk of stroke/TIA, whereas the father's professional activity was rendered nonsignificant. Additional inclusion of current smoking and alcohol consumption weakened the independent effect of the above social determinants, and school education and last professional activity had no significant impact in this model. Inclusion of sports activity into the multivariate model further reduced the strength of the association between professional training and stroke/TIA to borderline significance (table 2). A high lifetime social status score (3–4 vs. 0–2 points) was not independently associated with the odds of stroke/TIA (table 2).

Subgroup analyses did not show relevant differences between sex and age groups apart from greater effects of professional training in younger subjects in univariate analysis, although this was less pronounced after adjustment. Results for the ischemic stroke subgroup were similar to the total group of patients with stroke and TIA (table 3).

Based on dichotomized analyses (as in table 2), better school education was correlated with both higher professional education and nonmanual work among patients ($Rs = 0.45$, $p < 0.0001$, respectively) and control subjects ($Rs = 0.54$ and $Rs = 0.60$, $p < 0.0001$, respectively). The subjects' own and their fathers' professional status were moderately but significantly associated with each other among both patients ($Rs = 0.35$; $p < 0.0001$) and control subjects ($Rs = 0.27$; $p < 0.0001$). Social advancement between the two generations (from manual to nonmanual work) was more common among control subjects (76/324, 23.5%) than patients (48/313, 15.3%; $p = 0.0097$) but was not independently associated with stroke/TIA (OR 0.82, 95% CI 0.50–1.33; model 3). Social decline did not differ between the groups (30/324, 9.3% vs. 23/313, 7.4%; $p = 0.38$).

Discussion

Studies show a fairly consistent pattern of socioeconomic inequality explaining variations in stroke mortality within societies and between countries. Differences in stroke mortality between European countries are to a large degree explained by variations in nations' gross domestic product, indicating a strong role of economic conditions in stroke risk [11]. In our case-control study, we found that all indicators of social status in different life stages were associated with the odds of stroke in univariate analyses. Such effects could be explained by differences in risk factor prevalence or severity along social trajectories. There is an inverse association between socioeconomic status and risk factors such as hypertension, diabetes mellitus, smoking, physical activity and obesity in the general population [1, 12–14], although not all studies report such an association for all risk factors [15]. Furthermore, socioeconomic conditions may play a role in other stroke risk factors, e.g. infections and familial aggregation [16, 17], that were not assessed here. We found significant differences between higher and lower professional status regarding physical activity, smoking, alcohol consumption and diabetes mellitus among patients and/or control subjects.

Adjustment for multiple risk factors including alcohol consumption and smoking attenuated the effect and rendered it nonsignificant for all social determinants besides professional training. Physical activity showed a strong inverse relationship with social status, and its addition to the multivariate model further attenuated the effects, with professional training showing a borderline significant association with the odds of stroke/TIA. In previous studies, vascular risk factors explained the socioeconomic differences in stroke risk to various degrees [15, 18], and in some studies, the association remained significant even after adjustment for smoking, alcohol and physical activity [19].

Table 3. Socioeconomic status and odds of stroke/TIA: subgroup analyses

Subgroup	Univariate/multivariate analysis[1]							
	school education		professional training		last profession		father's profession	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Age <60 years	0.61	0.36–1.02	0.27	0.13–0.57	0.40	0.24–0.69	0.54	0.28–1.03
(n = 149)	0.86	0.41–1.79	0.51	0.19–1.33	0.65	0.30–1.41	0.88	0.34–2.29
Age ≥60 years	0.55	0.30–1.02	0.54	0.28–1.06	0.55	0.35–0.85	0.69	0.40–1.18
(n = 221)	0.69	0.33–1.43	0.64	0.28–1.47	0.77	0.46–1.31	0.83	0.43–1.58
Women	0.45	0.19–1.02	0.31	0.10–0.94	0.48	0.25–0.93	0.52	0.25–1.09
(n = 115)	0.74	0.25–2.19	0.62	0.15–2.54	1.07	0.46–2.51	1.17	0.46–2.99
Men	0.61	0.39–0.96	0.39	0.22–0.68	0.52	0.35–0.77	0.68	0.42–1.13
(n = 255)	0.82	0.47–1.45	0.54	0.28–1.05	0.75	0.46–1.20	0.72	0.39–1.32
Ischemic stroke	0.55	0.34–0.89	0.38	0.21–0.68	0.51	0.34–0.76	0.60	0.36–0.98
(n = 244)	0.91	0.49–1.67	0.63	0.31–1.29	0.72	0.44–1.17	0.69	0.37–1.27

[1] Model 3 in table 2.

The association between social conditions and stroke can be caused by various linking mechanisms that may differ between regions and over time. In the population examined here, behavioral factors such as smoking, alcohol consumption and mostly physical activity clearly influenced the association between stroke and socioeconomic determinants. This indicates that stroke preventive strategies may be particularly beneficial when focusing on lifestyle factors such as smoking and physical activity in socially disadvantaged groups.

Assessment of socioeconomic status is difficult, and previous studies have used various methods, all of which possess limitations. Education, professional status and income or wealth are commonly viewed as the most important determinants of the individual's social position [1]. We restricted ourselves to the assessment of school education, professional training and parental and own professional activity, as these items can be expected to be well remembered in the setting of a case-control study with acutely ill patients. Nevertheless, participants of both groups may have avoided socially undesirable answers, as the proportion of subjects without a final school exam is lower than can be expected in both groups; most likely, some of the subjects who stated having passed secondary school exams had in fact left school without a formal exam. Similarly, the reported unemployment rate was lower in both groups than could be expected from official statistics (5.5–6.3% in 2001–2003) [20], although it is possible that unemployed people were more likely to decline participation in the study. However, differential response behavior in both groups does not appear likely. It is also a limitation of our study that the individual hierarchical position at work or other psychosocial aspects as well as income and other material factors were not assessed here. Differences in the interview situation between the groups may also be considered a weakness, although the telephone interview in controls certainly increased the willingness to participate. On the other hand, the high participation rate of subjects, the high degree of completeness of data and the multiple parameters assessed are among the strengths of this study.

Variations in disease risk may be partly determined by cumulative differential exposure to adverse material conditions and behavioral and psychosocial risks during an individual's lifetime [21]. We adopted a life course perspective and assessed indicators of social status during various periods of life. As could be expected, the single social determinants were significantly correlated with each other. Nevertheless, the predictive value of the factors regarding stroke risk differed. In contrast to a previous study from our group that focused on dental health and particularly periodontitis as a stroke risk factor and that guided several hypotheses for the present work [22], paternal profession was not an independent risk factor of stroke here. In other studies, childhood socioeconomic conditions predicted stroke risk independently of social status in adulthood [18, 21]. Professional training was the one social factor that was most strongly associated with stroke risk, although behavioral and other risk factors clearly influenced its predictive value. If confirmed by larger studies, this could mean that factors adopted during early adulthood and associated with professional education are particularly important in modifying stroke risk. The lifetime social status score did not show any stronger association with stroke/TIA than professional training itself. Social advancement as assessed by comparison of paternal and own professional activity was less common among stroke patients than control subjects. This could indicate that a more ambitious lifestyle could be associated with a lower risk of stroke, although counteracting mechanisms (e.g. increased psychosocial stress) need to be considered in this respect in future studies.

This study was not very large, and therefore the results must be interpreted in the light of the power to detect a certain OR with the given sample size. The sample size of our study allowed detection of an OR of 0.66 with a power of 79% ($\alpha = 0.05$) if the factor has a prevalence of 50%. We also observed ORs closer to 1 and considered factors with a lower prevalence. Therefore, we may have missed an existing association which could have been detected with a larger sample size, and the results must be seen in the light of this fact.

In conclusion, favorable social conditions showed strong inverse associations with the odds of stroke/TIA in our study. These associations were influenced by lifestyle factors such as smoking, alcohol consumption and particularly sports activity. Preventive strategies may thus focus on such lifestyle factors, particularly in socially disadvantaged groups.

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