An educational multimedia campaign improves stroke knowledge and risk perception in different stroke risk groups

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Background and purpose: Stroke risk factor knowledge and individual risk perception are low in the general public. Our study aimed at identifying the educational effects of a multimedia campaign on stroke knowledge and risk perception in several subgroups at increased risk of stroke.

Methods: Telephone surveys were administered in a random sample of 500 members of the general public, before and immediately after an intense 3 months educational campaign using various mass and print media.

Results: A total of 32.7% of respondents considered themselves as being at risk of stroke before, and 41.9% ($P < 0.01$) after the intervention. Evaluation of stroke risk increased with number of appreciated individual stroke risk factors. Knowledge of different stroke risks varied considerably and proved to be especially high in obese individuals (98.7%) and smokers (97.9%) and particularly low in patients with coronary heart disease (80.6%).

Conclusions: Our data indicate that educational programs and the introduction of stroke risk factors can increase stroke risk perception in the public. Even though some risk groups (smokers, obese) reveal a ceiling effect, future campaigns should focus on high risk populations remarkably underrating their risk, like those with coronary heart disease or the elderly.

Introduction

Improving the perception of individual health risks is an established goal for educational health campaigns aiming at primary disease prevention and a strong motivation for a change in behaviour [1–3]. Because stroke is a common disease with a variety of important modifiable risk factors, effective risk reduction depends on general stroke and stroke risk factor knowledge as well as stroke risk perception of patients, their family members and the general public [4,5]. When compared to the risk perception of coronary heart disease [6,7], the individual vascular risk perception of stroke has received far less attention. Studies suggest that stroke risk factor knowledge in the general public and even amongst high-risk populations is low and varies considerably [8–11]. Little is known about the effects of different educational media or messages on risk perception amongst populations at risk. Broad educational campaigns have resulted in limited and predominantly temporary effects on stroke knowledge and individual risk perception [12–16].

We performed a telephone survey before and after a comprehensive educational campaign using various media in a central German area. The educational effects on general stroke knowledge and the intended behaviour in acute stroke have been reported elsewhere [17]. We now investigated the effect of the multimodal awareness campaign on individual stroke risk perception and stroke risk factor knowledge in different target groups at risk of stroke.

Subjects and methods

Subjects

Computer-assisted telephone interviews were conducted in German-speaking residents of five counties

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around the central Stroke Unit of the University Hospital of Mainz in western Germany. Five hundred and seven interviews were performed 3 months before and 501 interviews 2 months after the educational campaign. Calls performed by random dialling using a computer system were quoted according to the proportional number of inhabitants in every county. Once a household was reached, the household member who celebrated his birthday at the latest and who showed the appropriate age from 30 to 80 years was selected for the interview. If the eligible household member was not available at the moment of the original call to complete the questionnaire, a time was agreed upon for a later call. If there was no answer on a call, a connection was attempted on at least two further occasions in different time. For the pre-educational survey 5707 calls were performed, for the post-educational survey 6363 calls. Further sample characteristics have been described elsewhere [17].

Educational intervention

The 3-month educational program was developed and performed as a joint program by the University of Mainz, the state government of Rhineland-Palatinate and Boehringer Ingelheim Pharmaceuticals. It consisted of public announcements that covered 400 000 people in the city of Mainz and four adjoining more rural counties, all with a maximum of a 30-min journey to the central Stroke Unit of the University Hospital of Mainz. Advertisements focussed on mass media, poster advertisements and flyers that proved to be effective in earlier multilevel educational stroke campaigns [12, 13, 15].

The detailed design of the campaign has been described elsewhere [17]. In short, the educational program comprised of 400 billboard *poster advertisements*, and advertisements on local emergency transport, buses and trams as well as small poster advertisements covering all pharmacies in the area. Messages were tailored as short slogans like 'Stroke-an emergency case', 'Stroke-It could be you' to draw attention. In smaller print size, posters focussed on the most important risk factors and named typical warning signs. Slogans and full-page stroke related stories and interviews appeared in the local *newspapers* weekly. Local *radio stations* and *television* broadcasted corresponding stories, reports and interviews six times each with duration of 30 min in the evening. Three full-day *public events* focussed on personal information and provided the possibility of a computer-based assessment of the individual stroke risk. A total of 220 000 copies of '*stroke-flyers*' giving a short overview on stroke risk factors, warning signs and behaviour in acute stroke were distributed on public events, in pharmacies and at the family doctor's office and were sent to each household in the whole area by regular mail.

Outcome measures

The effectiveness of the campaign on stroke knowledge, risk perception and behaviour in the acute situation was assessed using a pre-/post-campaign design. Personal telephone interviews following a fixed questionnaire were conducted after computer-assisted dialling 3 months before and 2 months after the educational campaign in summer/autumn 2005. A detailed history of the presence of the following stroke risk factors was taken following a closed-ended question design: smoking (defined as regular daily smoking), hypertension, diabetes, hyperlipidaemia, coronary heart disease (only if a physician had diagnosed one of these diseases in the past) and obesity (self-report). The survey instrument comprised four sections: the first section dealt with general knowledge on the term stroke (German: 'Schlaganfall'). The second section focussed on knowledge of stroke risk factors and stroke risk perception. People were asked if they considered themselves as being at risk of stroke. After asking to spontaneously recall possible stroke risk factors, the interviewer presented several diseases or conditions and the respondents were questioned if they felt that they were related to an increased stroke risk (non-spontaneous recall). The third section dealt with management in the case of acute stroke. For evaluation of the impact of different educational media applied, respondents were questioned in a closed-ended design via which of the media applied they had recently obtained information on the stroke subject. The complete questionnaire is available upon request.

Data analyses

Descriptive and explorative statistical data analyses were completed using the SPSS 16 base system (SPSS Inc., Chicago, IL, USA). A descriptive analysis of the demographical characteristics was performed. We categorized age into 30–45 years, 46–65 years as well as 66 years and older (German retirement age). We grouped according to the highest completed educational level following the three-level German schooling system: primary schooling (minimal compulsory school education), secondary schooling (high school) or graduate school/college/university diploma ('tertiary'). To compare differences in responded risk factor knowledge before and after the educational intervention or between groups of different demographic cat-

egories Chi-squared test was used for dichotomous outcomes and two-tailed *t*-test for continuous outcome variables. The local significance level was set to 0.05. A multivariable logistic regression analysis was performed to assess the impact of the demographic variables age (years: linear and quadratic), gender (female versus male), educational status (primary, secondary versus tertiary) and the educational intervention itself (post-education versus pre-education cohort) on good general stroke knowledge (correct answer to question one) and high individual stroke risk perception according to the corresponding question section two. The logistic regression model was built using a backward stepwise selection with *P*-value of the score test ≤0.05 as inclusion criterion and *P*-value of the likelihood ratio test (LR-test) ≥0.10 as exclusion criterion. Variables that proved to be influential by logistic regression are presented by their odds ratio (OR), the corresponding 95% confidence interval (95%-CI), and the *P*-value of the LR-test. For those variables all possible interactions were assessed by a backward stepwise selection procedure in a second block.

Results

Samples

Demographical characteristics of both samples are given in Table 1. There were no significant differences in terms of gender, age, educational level or occupational status between the individuals who participated before and after the educational campaign.

Individual stroke risk factors

The prevalence of reported individual stroke risk factors is given in Table 1. In the pre- and post-test cohort 65%/69% of respondents reported the presence of at least one stroke risk factor. The most commonly reported vascular risks were obesity (31%/34%) and arterial hypertension (25%/28%), (35%/31%) of respondents recalled no vascular risk. While 33% (35%) reported one stroke risk factor, 19% (17%) had two, 11% (10%) three and 2% (4%) four and 1% (1%) five and more simultaneous vascular risk factors. Mean age was significantly higher in all stroke risk factor subgroups (55–69 years) than in the whole population (53 years) except for smokers (47 years, $P < 0.01$). Individuals with coronary heart disease represented the subgroup with the highest mean age (69 years). Risk factors were less common in the subgroups with higher educational level when compared to the least educated respondents.

Table 1 Demographical characteristics of respondents and stroke risk factor prevalence

	Pre-education (n = 507)	Post-education (n = 501)
Sex		
Male	225 (44.4)	219 (43.7)
Female	282 (55.6)	282 (56.3)
Age (mean ± SD), years	53.1 ± 15.0	51.6 ± 13.3
30–45	185 (36.5)	192 (38.3)
46–65	205 (40.4)	224 (44.7)
>65	117 (23.1)	85 (17.0)
Professional status		
Full-time employment	187 (36.9)	206 (41.1)
Part-time employment	89 (17.6)	98 (19.2)
Unemployed/housewife/pensioner	226 (44.6)	191 (38.1)
Student/apprentice	4 (0.8)	3 (0.6)
No response	1 (0.2)	5 (1.0)
Highest completed education level		
Tertiary	203 (40.0)	247 (49.3)
Secondary	162 (32.0)	141 (28.1)
Primary	140 (27.6)	106 (21.2)
No response	2 (0.4)	7 (1.4)
Prevalence of stroke risk factors		
Obesity	158 (31.2)	172 (34.3)
Hypertension	129 (25.4)	141 (28.1)
Smoking	119 (23.5)	129 (25.7)
Hyperlipidaemia	95 (18.7)	110 (22.0)
CAD	37 (7.3)	36 (7.2)
Diabetes	32 (6.3)	40 (8.0)
None	178 (35.1)	157 (31.3)

Values within parentheses represent percentages.
CAD, coronary artery disease.

Stroke and stroke risk factor knowledge

A total of 79.1% of respondents correctly assigned a stroke to a lesion of the brain before and 82.5% after the intervention. In a multivariable logistic regression analysis, educational background and age were independently associated with general stroke knowledge. A primary or secondary educational level decreased the chance for correct knowledge when compared to respondent with the highest educational degree (primary versus tertiary: OR = 0.45, 95%-CI: 0.30–0.68; secondary versus tertiary: OR = 0.63, 95%-CI: 0.43–0.93; LR-test: $P < 0.001$). The influence of age on general stroke knowledge was considered by a linear and quadratic term of age in the final model (linear: OR = 1.13, 95%-CI: 1.04–1.22, LR-test $P = 0.005$; quadratic: OR = 0.999, 95%-CI: 0.998–1.000, LR-test $P = 0.002$). This corresponds to a maximal chance for a correct answer at the age of 59.5 years with decreasing knowledge both with increasing or decreasing age. Stroke knowledge was worst in diabetics (69% correct identification of the brain as the organ affected in stroke) and smokers (71%), and best in obese individuals (82%) (see Table 2).

Table 2 Percentage of respondents in the different subgroups, who correctly answered the question: 'Where in the body does a stroke happen?' (Closed-ended question: 'Heart', 'Brain', 'Chest', 'Do not know')

	Pre-education (%)	Post-education (%)	Change, % (*P*)
All	79.1	82.5	+3.4 (0.11)
Obesity	90.6	92.4	+1.8 (0.75)
HT	74.4	85.7	+11.3 (0.01)
Smoking	23.5	33.6	+10.1 (0.08)
HLP	75.8	78.5	+2.7 (0.61)
CAD	73.0	81.3	+8.3 (0.41)
Diabetes	68.8	81.3	+12.5 (0.24)

HT, hypertension; HLP, hyperlipidaemia; CAD, coronary artery disease.

While smoking (96%), arterial hypertension (95%) and obesity (94%) were well-known stroke risk factors across all subgroups, other risks like heart disease (74%), diabetes (67%) and advanced age (62%) showed significantly lower rates of recognition (see Table 3).

In the subgroups of patients owning a special stroke risk factor, correct identification of this risk was generally very high (≥94%), apart from patients with diabetes (88%) and especially those with coronary heart disease (81%). Only 50–60% of patients with an established risk factor considered themselves as being at risk of stroke (see Table 4). Evaluation of individual stroke risk significantly increased with number of individual stroke risk factors. Eight per cent of individuals with no risk factor considered themselves as being at risk of stroke, 33% of respondents with one risk factors, two risk factors: 59%, three risk factors: 71%, four risk factors 78%, more than four risk factors: 75%. In a multivariable logistic regression analysis, sex (man versus female: OR = 1.44, 95%-CI: 1.11–1.88, LR-test $P = 0.007$) and educational background (primary versus tertiary: OR = 2.02, 95%-CI: 1.46–2.81; secondary versus tertiary: OR = 1.47, 95%-CI: 1.08–2.00; LR-test: $P < 0.001$) were the only biographic variables independently associated with the evaluation of being at increased risk of stroke additional to the information campaign.

Perception of educational campaign

As previously reported, the most frequently named information sources remembered from the campaign were newspapers (67%), television/radio (60%), and stroke flyers in pharmacies and at the doctor's office (61%) [17]. Perception of the campaign, however, varied considerably between different risk groups.

Table 3 Proportion of patients in different self-identified risk groups that correctly identified a presented item as a stroke risk factor (closed-ended question), before ($n = 507$) and after ($n = 501$) the educational intervention

Risk factor										
Risk group	Smoking	HT	Obesity	Prior stroke	Lack of exercise	HLP	Alcohol abuse	Heart disease	Diabetes	Advanced age	Hormones
All	96.1/95.2	95.1/94.1	94.1/95.2	92.0/91.0	88.0/87.2	87.0/86.1	81.1/78.8	74.0/74.4	67.1/68.8	59.0/58.6	47.9/33.1
Obesity	93.0/94.4	96.0/96.2	93.6/96.3	91.8/90.2	91.8/92.0	88.9/90.4	84.2/82.2	73.1/82.9	73.1/71.4	57.9/61.2	49.1/32.9
Hypertension	95.0/96.2	98.1/89.4	95.0/97.6	90.0/87.9	91.2/90.9	88.1/92.6	81.3/82.9	71.3/89.5	71.9/79.0	50.0/63.6	41.3/35.5
Smoking	97.9/96.0	93.2/89.4	93.2/89.4	92.1/89.3	85.8/82.5	85.3/79.2	80.0/76.5	74.2/71.5	66.8/61.2	64.2/51.2	53.2/30.5
HLP	95.1/93.6	98.8/97.6	96.3/95.3	92.1/92.3	93.3/91.8	93.9/91.9	82.3/78.8	76.2/82.1	65.2/73.7	62.2/59.9	43.9/30.3
Diabetes	93.8/93.1	100.0/97.3	91.3/95.9	88.2/94.5	91.3/90.7	93.8/82.2	75.2/84.0	72.0/83.4	88.2/93.4	47.2/60.2	37.9/22.4
CAD	100.0/89.5	97.4/100.0	88.7/100.0	84.1/91.4	80.8/90.2	92.1/100.0	86.8/75.4	80.8/90.6	80.8/73.3	60.3/59.7	46.4/36.3

HT, hypertension; HLP, hyperlipidaemia; CAD, coronary artery disease.

Table 4 Percentage of respondents in different subgroups, who considered themselves as being at increased risk of stroke before (n = 507) and after (n = 501) the educational intervention

	Pre-education (%)	Post-education (%)	Change, % (P)
All	33.7	43.7	+10.2 (0.001)
Obesity	55.1	59.8	+4.7 (0.36)
HT	59.7	76.7	+17.0 (0.003)
Smoking	51.2	59.0	+7.8 (0.21)
HLP	53.6	60.0	+6.4 (0.39)
CAD	59.5	54.0	−5.5 (0.61)
Diabetes	56.3	76.3	+20.0 (0.07)

HT, hypertension; HLP, hyperlipidaemia; CAD, coronary artery disease.

Television and radio were named significantly more often in all risk groups when compared to individuals without a known stroke risk factor ($P < 0.05$). This applied especially to respondents suffering from obesity (78% vs. 63%) and hyperlipidaemia (75% vs. 63%, $P < 0.05$).

Educational effects

Following the campaign, general stroke knowledge increased especially in subgroups with diabetes (+12% correct answers in section one), hypertension (+11%, $P < 0.05$) and in smokers (+10%). Only in obese individuals no major gain in knowledge was to be reported (+2%) (see Table 2). Table 3 shows the proportion of individuals in the different risk groups that correctly identified presented items as stroke risk factors before and after the educational intervention. None of the risk factors was significantly better known after the intervention when regarding the whole cohort. A better identification of the own individual condition as a stroke risk factor after the campaign applied especially to those with heart disease (+10%) and diabetes (+8%). These effects did, however, not reach significance in any of the self-identified subgroups at risk. After the campaign significantly more respondents considered themselves as being at risk of stroke than before (41.9% vs. 32.7%, $P < 0.01$). According to a multivariable regression analysis the educational intervention proved to be an independent factor associated with a higher stroke risk evaluation after the campaign (OR = 1.531, 95%-CI: 1.178–1.991; LR-test: P = 0001). The increase in stroke risk perception especially concerned diabetics (+21%) and individuals with hypertension (+17%, $P < 0.02$). No effect on stroke risk perception could be achieved in individuals with heart disease (−7%), see Table 4. When regarding the number of individual stroke risk factors, the change in risk perception was greatest in those with one risk factor (+15%) and progressively decreased with number of risks (two risk factors: 6%, three risk factors: 9%, four risk factors: 4%).

Discussion

Educational effects on stroke risk perception

Our study indicates that educational multimedia campaigns may effectively increase stroke risk perception in the general public. In the first analysis concerning the present campaign, we could demonstrate that educational effects on detailed stroke knowledge like specific warning signs or the number of the emergency call were only limited and that the gain in knowledge did not lead to a change in the intended behaviour in acute stroke [17]. According to the further analysis, educational effects and stroke risk factor knowledge vary considerably in different subgroups. Obesity was rated as a prominent risk factor by 93% of individuals even before the educational intervention. According to earlier epidemiological studies, cigarette smoking was a further well known vascular risk [18]. Obesity, cigarette smoking and hypertension were correctly assigned as vascular risks by more than 90% of respondents. This may reflect intensive public debates and awareness campaigns on the multiple health risks of these factors On the other hand, the impact of further important risks like diabetes or coronary heart disease was by far underestimated and these items are rarely in the focus of public health debates. Our campaign aimed at a wide range of possible stroke risk factors, but succeeded in improving knowledge only about some of the underrated risks like diabetes, while educational effects on knowledge of single risk factors were generally rather small. According to earlier investigations, modifiable risks were generally better known than non-modifiable ones like familial risk or age [19]. The underestimation of age as a stroke risk factor is alarming, because age is by far the most important stroke risk factor [20]. Moreover, according to our data the elderly and especially the old with low educational background reveal the highest number of vascular risk factors.

Respondents with a specific individual risk factor were generally well informed about the significance of this risk, with the exception of individuals suffering from diabetes and coronary heart disease. Apart from the lack of corresponding health education, in these subgroups competitive health threats like heart attack or diabetic damage to other organs may lead to the underestimation of the actual stroke risk. Moreover, these risk groups include a higher proportion of aged individuals, and according to our data, age older than 60 years is associated with a decline of general stroke

knowledge. Thus, future campaigns should preferentially address elderly, male and less educated individuals, who accidentally represent the subgroup at highest risk of stroke.

Only one-third of respondents considered themselves as being at risk of stroke, although more than 60% of respondents presented at least one stroke risk factor. These rates are even higher than what is reported from earlier investigations for example in the US, where $<50\%$ of individuals with known risk factors considered themselves as being at risk [3,8]. Many modifiable risk factors of stroke and myocardial infarction overlap and risk factor knowledge and individual risk perception have been studied in more detail concerning myocardial infarction and coronary heart disease so far [7,21]. We could demonstrate that, like in myocardial infarction, risk perception continuously increases with awareness of stroke risk factors. According to theoretical models an underestimation of the individual disease risk is associated with impaired compliance with regard to preventive action [22], and individuals at risk tend to underestimate their actual risk of a serious medical event especially if no symptoms are bothering beforehand, like in stroke [10]. While theoretic knowledge is a prerequisite, it is according to several models on health perception not always sufficient for behavioural changes [10,23].

Effects of different media applied

While our multimodal approach led to an increase in individual stroke risk perception, it is widely unknown, how these programs do influence individual stroke risk perception [10]. According to educational interventions in myocardial infarction, a corresponding individual feedback may be especially effective in improving risk perception [6], but data on stroke risk perception are lacking.

So far, most educational campaigns broadly address large parts of the population to achieve a better knowledge and awareness of stroke risks in the general public [24]. For focussed and economic interventions more data are needed on the efficacy of different media especially in different subgroups at risk of stroke. In two pre-existing investigations from the US newspapers and television broadcasts were well remembered tools in stroke education [14,15]. We could demonstrate in an earlier analysis that in our cohort this applied especially to older individuals and those of lower educational background [17]. This is probably due to their easy access especially for elderly and predominantly housebound individuals. Particularly expensive large public poster advertisement did not specifically attract attention in all stroke risk groups (mean 26.6%). It is unclear if this is based on the medium itself or the fact that the kind of advertisement did not address the population. Our present data indicate that also individuals with multiple risks like obesity, hyperlipidaemia and older age preferentially use these mass media as information sources on stroke. Mass media are, however, extremely cost-intense and according to some investigations recipients are mainly left with incoherent information on isolated stroke topics [25]. Therefore, they should be accompanied by further more personalized information sources. Flyers and posters in pharmacies were also well remembered tools, especially in the elderly. Only 2% of respondents stated that they had recently received information on stroke risk factors and individual stroke risk by their family doctor. This is alarming, because in earlier investigations especially old and male patients cited the general practitioner as an important information source [11]. Family doctors should be in the centre of interest when designing future campaigns on stroke risk perception as they are involved in immediate preventive action.

For economic reasons a tailoring of educational campaigns to risk-groups like the elderly [18,26] or those with little knowledge [11] seems sensible. On the other hand, not only people at risk of stroke are in need of proper knowledge and risk perception. Patients with acute stroke often depend on the help of relatives or friends to recognize stroke symptoms and call emergency care. Correspondingly, a combination of both, broad awareness campaigns and focussed education in several risk groups might be a promising approach for the future. The results of his study may contribute to the development of tailored educational campaigns focussing economically on subgroups at high risk and those with low risk perception.

Limitations

One limitation of our study is the fact that it is based on a telephone survey. As such it may have omitted parts of the population from the sample. Moreover, no control or comparison community or region was used to assess changes in the intervention region versus a non intervention region. We asked for remembered information sources. This can only be in part considered as a surrogate of efficacy, because unconscious memorising may have led to further educational effects, that are, however, difficult to be assessed.

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