

# Symptom recognition of heart attack and stroke in nine European countries: a representative survey

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## Abstract

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### Accepted for publication

14 December 2011

**Keywords:** health knowledge, heart attack, representative, stroke, symptom recognition

**Background** Cardiovascular diseases are the number one cause of death and a source of chronic disability.

**Objectives** To assess recognition of and reaction to symptoms of heart attack and stroke, and how recognition is related to the frequency of consulting physicians and other information sources.

**Design** Face-to-face computer-assisted personal interviews.

**Participants** Representative sample of 10 228 persons in Austria, France, Germany, Italy, the Netherlands, Poland, Russia, Spain and UK, aged 14–98.

**Main Outcome Variables** Recognition of heart attack and stroke symptoms and proper reaction to symptoms.

**Results** Chest pain was the only heart attack symptom recognized by more than 50% of participants. Eight percent knew no symptoms. Of 14 stroke symptoms, none was recognized by more than 50% of participants; 19% could not identify any symptom. For both heart attack and stroke, Germans and Austrians recognized the largest number of symptoms. Persons in Italy, Poland, Russia and Spain knew only about half as many symptoms as in Germany or Austria. Only 51% of Europeans would call an ambulance when someone suffers a stroke, the fewest (33 and 34%) in Germany and Austria. In most countries, people who consulted their physician more frequently had no better recognition of heart attack or stroke symptoms.

**Conclusions** The majority of persons in nine European countries recognize few heart attack and stroke symptoms; many do not know how to react. This low level of knowledge constitutes a major health risk and likely leads to delay in treatment, contributing to the high mortality and morbidity from these diseases.

Cardiovascular diseases are the number one cause of death worldwide<sup>1</sup> and are the top two leading causes of death in Europe.<sup>2</sup> Both heart

attack and stroke are also a significant cause of chronic disability.<sup>3,4</sup> Because many forms of therapy have to be applied within a few hours,<sup>5,6</sup>

rapid access to treatment reduces deaths and disability. To avoid delay of treatment, people have to recognize the symptoms quickly *and* know what to do. Patients for whom an ambulance has been called are up to four times more likely to get to an emergency unit within 3 h of onset of symptoms than those brought by other modes of transportation.<sup>7,8</sup> Thus, public knowledge about symptoms and best action appears to be a major potential factor for reducing morbidity and mortality from heart attack and stroke.

Many previous studies on the subject measured recall of symptoms rather than recognition. Yet, this may not be the best test, given that recognition, not recall, of symptoms is the relevant skill for detecting whether someone has had a heart attack or stroke. Memory research has found consistent differences between recall and recognition. For instance, one may be unable to recall a name yet easily recognize it.<sup>9,10</sup> Consequently, participants asked to recall symptoms named fewer correct symptoms. For example, one review reported that between 30 and 60% of participants in the UK, the US and Australia could not recall a single symptom of stroke in an open-ended question format;<sup>11</sup> however, those participants asked to recognize symptoms correctly recognized between 10 and 95% of symptoms from a list. Some reviews did

not differentiate between recall and recognition (e.g. ref. 12), making it difficult to compare knowledge of symptoms across studies and participants.

Most previous research on knowledge about heart attack and stroke was conducted in specific communities or groups (e.g. people in the emergency unit, self-help groups) in the US, with a few studies in Australia, the UK and Germany. To our knowledge, this is the first European-wide representative survey on heart attack and stroke to investigate symptom recognition, action knowledge and information sources. Our survey was conducted in nine countries: eight countries of the European Union (which include about 75% of the total population of 500 million in the 27 European Union countries) and in the European part of Russia. Table 1 lists the countries in the order of health expenditure in % GDP and provides basic health variables relevant to heart attack and stroke. As can be seen in the table, health-care expenditure is lowest in the Eastern European countries, namely Poland and Russia, and highest in Germany and France. Life expectancy at birth is comparable across the countries surveyed, with the exception of Poland and Russia, where life expectancy is lower. The number of deaths from ischaemic heart and cerebrovascular disease is particularly high in Austria and Poland.

**Table 1** Structural and health characteristics in the nine European countries

|  | Germany     | France      | Spain      | Austria    | Poland    | Italy      | the Netherlands | UK         | Russia    |
|--|-------------|-------------|------------|------------|-----------|------------|-----------------|------------|-----------|
| Health expenditure 2004 in % GDP (per capita in US\$)                  | 10.9 (3052) | 10.0 (3016) | 7.8 (1908) | 7.5 (2365) | 6.4 (810) | 8.7 (2424) | 9.8 (3056)      | 8.1 (2531) | 5.3 (571) |
| Life expectancy at birth <sup>31–33</sup>                              | 78.6        | 80.3        | 80.5       | 79.3       | 74.6      | 79.7       | 78.8            | 78.5       | 65.6      |
| Deaths from ischaemic heart disease per 100 000 per year <sup>34</sup> | 119.5       | 45.3        | 61.5       | 123.7      | 124.5     | 76.8       | 72.2            | 123.2      | –         |
| Deaths from cerebrovascular disease per 100 000 per year <sup>34</sup> | 53.1        | 37.3        | 52.0       | 56.0       | 95.2      | 60.6       | 50.3            | 34.8       | –         |
| Internet access in 2006 in % <sup>35</sup>                             | 67          | 41          | 39         | 52         | 36        | 40         | 80              | 63         | –         |

The main research questions behind the survey were as follows:

1. What proportion of the general public in nine European countries recognizes the main symptoms for heart attack and stroke? What differences in recognition levels exist between countries?
2. What proportion knows what to do in the event of a stroke?
3. Do those who consult their doctors (or other sources) have better symptom recognition and action-relevant knowledge?

## Method

The data analysed were collected as part of the European Consumer Study 2007 conducted between September and December 2006 by the GfK-Group (Gesellschaft für Konsumforschung, 'Society for Consumer Research').<sup>13</sup> Wording of the questions was developed in collaboration with specialists in internal medicine. The questions were first formulated in German, then translated by professional translators into the languages of the other participating countries and finally translated back into German to assure the accuracy and equivalence of the questions for participants in all countries (see ref. 14 for a description of this procedure). The questions and answer categories were field-tested to detect potential problems and then revised as needed. Participants were visited by interviewers in their home and questioned face-to-face in computer-assisted personal interviews, except in Russia, where interviewers used paper and pencil for security reasons. In general, the interviewer entered participants' responses into the computer, but if participants preferred, they could always enter the information themselves without the interviewer seeing their responses. The interviews were conducted in agreement with the ethical regulations of the GfK-Group and the Standards for Quality Assurance in Market and Social Research of ADM (Arbeitskreis Deutscher Markt- und Sozialforschungsinstitute 'Research Group of German Market and Social Research Institutes', Frankfurt am Main,

Germany). All participants were informed about the purpose of the survey and told they could stop the survey at any time without negative consequences.

## Participant characteristics

The total number of participants was 10228: 2054 from Germany and 2019 from Russia (the countries with the largest populations); 1005 from France, 1042 from the UK, 1007 from Italy, 1019 from Poland and 1024 from Spain; as well as 501 from Austria and 557 from the Netherlands (the two countries with the smallest populations). To obtain a representative sample of the population 14 years and older for each of the nine European countries, a quota method was used, a systematic sampling method that determines the proportion of individuals to be sampled from different subcategories. The five subcategories used were region, size of household, gender, profession and age, according to the official statistics in each country. The resulting samples are stratified and reflect the population structure in each country relative to these subcategories. Table 2 shows the sampling frame (taken from ref. 13).

## Measures

The original questions used in this study are available as Supporting Information. Briefly, participants were asked to indicate which of seven conditions were possible symptoms of a heart attack and which of 15 conditions possible symptoms of a stroke. In both cases, multiple answers were possible, and one of the symptoms offered was not an actual symptom. All symptoms were described in lay terms to ensure that they were understandable to the general population. Participants were also given different options of what they would do if they saw a person suffering from short-term impaired vision, speech problems, numbness or a one-sided debility and again could choose multiple answers. Also, participants were asked whether they knew if their blood pressure was currently high, too low or normal, and to report their height and current weight.

**Table 2** Sampling frame of the study

|                       | Germany | France | Spain | Austria | Poland | Italy | the Netherlands | UK   | Russia |
|-----------------------|---------|--------|-------|---------|--------|-------|-----------------|------|--------|
| <b>Sex</b>            |         |        |       |         |        |       |                 |      |        |
| Male                  | 48.0    | 48.0   | 48.6  | 48.2    | 47.8   | 48.1  | 48.2            | 48.0 | 46.7   |
| Female                | 52.0    | 52.0   | 51.4  | 51.8    | 52.2   | 51.9  | 51.8            | 52.0 | 53.3   |
| <b>Age</b>            |         |        |       |         |        |       |                 |      |        |
| 14–19                 | 7.8     | 9.1    | 8.2   | 7.2     | 8.9    | 7.2   | 6.8             | 7.0  | 9.9    |
| 20–29                 | 12.0    | 15.8   | 18.9  | 15.0    | 20.0   | 14.7  | 15.5            | 15.0 | 20.0   |
| 30–39                 | 18.2    | 17.3   | 18.7  | 19.8    | 16.0   | 18.5  | 20.4            | 21.0 | 16.7   |
| 40–49                 | 17.4    | 17.9   | 15.9  | 18.4    | 17.2   | 16.9  | 18.7            | 17.0 | 21.7   |
| 50–59                 | 14.7    | 15.7   | 13.1  | 14.4    | 17.1   | 14.8  | 16.4            | 15.0 | 15.6   |
| 60–69                 | 15.6    | 10.4   | 11.2  | 12.0    | 10.3   | 12.4  | 10.9            | 11.0 | 10.8   |
| 70+                   | 14.4    | 13.9   | 14.0  | 13.2    | 10.4   | 15.5  | 11.2            | 14.0 | 5.3    |
| <b>Occupation</b>     |         |        |       |         |        |       |                 |      |        |
| Employed              | 47.9    | 42.8   | 49.2  | 58.2    | 41.2   | 46.3  | 55.7            | 58.0 | 58.6   |
| Unemployed            | 7.5     | 7.7    | 6.6   | 2.9     | 12.2   | 4.1   | 4.2             | 6.3  | 5.8    |
| Retired               | 27.6    | 24.6   | 19.9  | 24.7    | 29.1   | 25.6  | 17.1            | 22.5 | 19.9   |
| Student               | 10.1    | 11.3   | 10.1  | 5.4     | 13.3   | 11.0  | 7.5             | 4.3  | 10.2   |
| Housewife /husband    | 7.0     | 13.7   | 14.1  | 8.7     | 4.2    | 12.9  | 12.3            | 8.4  | 5.0    |
| <b>Education</b>      |         |        |       |         |        |       |                 |      |        |
| Low                   | 41.5    | 26.8   | 11.3  | 20.2    | 55.1   | 46.2  | 26.1            | 51.4 | 16.9   |
| Medium                | 36.1    | 46.9   | 66.5  | 56.5    | 35.2   | 44.6  | 46.1            | 29.1 | 58.1   |
| High                  | 18.3    | 25.8   | 21.8  | 23.2    | 9.7    | 8.8   | 27.4            | 19.5 | 24.6   |
| <b>Household size</b> |         |        |       |         |        |       |                 |      |        |
| One person            | 19.9    | 15.4   | 15.7  | 15.8    | 8.6    | 12.2  | 17.4            | 17.9 | 8.1    |
| Two persons           | 36.7    | 30.7   | 26.9  | 28.2    | 16.2   | 26.0  | 37.1            | 33.3 | 20.2   |
| Three persons         | 19.4    | 21.3   | 23.8  | 20.8    | 20.8   | 25.8  | 17.3            | 19.5 | 26.1   |
| Four persons          | 18.2    | 18.8   | 23.6  | 20.6    | 25.2   | 26.4  | 19.5            | 17.4 | 25.1   |
| Five and more persons | 5.8     | 13.8   | 10.0  | 14.6    | 29.2   | 9.6   | 8.7             | 11.9 | 20.5   |

## Statistical analyses

Our research questions examined (1) mean differences between countries (i.e. comparing across the nine European countries surveyed the proportion of the general public that recognized symptoms of heart attack and stroke as well as the proportion that knew what to do in the event of a stroke) and (2) the association between knowledge and consulted information sources on heart attack and stroke. For mean differences (1), we calculated the mean number of symptoms recognized and the 95% confidence interval of this mean (95% CI) or the mean difference of a group comparison and its 95% confidence interval (95% CI<sub>diff</sub>). For associations between knowledge and consulted information sources (2), we ran correlation analyses;  $r$  describes the strength of association (from 0 to 1). All correlations reported in Results section have a 95%

confidence interval that does not include zero, that is, the strength of association is different from zero.

## Results

What proportion of the general public recognizes symptoms of heart attack and stroke?

### *Heart attack*

Chest pain was the only symptom of heart attack to be recognized by more than half of the Europeans interviewed. The two other symptoms recognized most often were shortage of breath and pain in arm and/or shoulder (Table 3). Germans identified the highest number of symptoms ( $M = 3.15$ ; 95% CI = 3.08–3.22), followed by Austrians ( $M = 2.91$  symptoms; 95% CI = 2.72–3.12). Participants in Italy, Spain, Poland and Russia identified the lowest

**Table 3** Percentage of participants who recognized a condition as a symptom of heart attack (all conditions except headache are typical symptoms). Mean across the nine countries was weighted by sample size. The highest recognition value for each symptom is bolded

|                              | Nine countries | Germany     | France | Spain | Austria | Poland | Italy       | the Netherlands | UK          | Russia      |
|------------------------------|----------------|-------------|--------|-------|---------|--------|-------------|-----------------|-------------|-------------|
| Chest pain                   | 79.9           | 85          | 84.5   | 65.3  | 84.2    | 83     | 66.5        | 87.5            | <b>90.9</b> | 79.1        |
| Shortage of breath           | 49.3           | 62          | 42.2   | 33.4  | 60.4    | 52.1   | 26.8        | 42.2            | <b>68.2</b> | 50.7        |
| Shoulder and/or arm pain     | 48.4           | 66.8        | 66.8   | 59.6  | 56.7    | 20.1   | 63.1        | 69.4            | <b>72.4</b> | 14.4        |
| Feeling of anxiety           | 21.4           | <b>51.2</b> | 15.1   | 11.6  | 44.9    | 17.9   | 6.7         | 14.8            | 21.3        | 15.9        |
| Intense nausea and dizziness | 21.2           | <b>40.7</b> | 17.4   | 11.7  | 37.4    | 17.5   | 8.4         | 23.5            | 26.5        | 17.2        |
| Headache                     | 12.0           | 12.0        | 11.2   | 9.8   | 11.9    | 9.9    | 3.5         | 4.2             | 9.3         | <b>19.1</b> |
| Stomach pain                 | 7.5            | 9.5         | 5.0    | 5.2   | 8.1     | 3.7    | <b>21.7</b> | 4.1             | 6.2         | 3.9         |
| I don't know                 | 7.6            | 5.4         | 4.9    | 2.0   | 0.6     | 10.0   | 8.0         | 5.0             | 3.3         | <b>11.5</b> |
| Mean of correct symptoms     | 2.3            | <b>3.2</b>  | 2.3    | 1.9   | 2.9     | 1.9    | 1.9         | 2.4             | 2.9         | 1.8         |

number. As many as 18% of participants (averaged across all countries) were not familiar with any symptom of heart attack except for chest pain, and 8% knew no single symptom.

Across all countries, the youngest age group recognized fewer heart attack symptoms than the two older age groups (young vs. middle: 2.20 vs. 2.47, 95%  $CI_{diff}$  of the mean difference  $-0.50$  to  $-0.38$ ; young vs. old: 2.20 vs. 2.43, 95%  $CI_{diff} = -0.49$  to  $-0.33$ ). More symptoms were identified by people with a high level of education than by people with a low (2.71 vs. 2.43,

95%  $CI_{diff} = 0.20-0.37$ ) or medium level (2.71 vs. 2.60, 95%  $CI_{diff} = 0.17-0.34$ ; except in Russia, where level of education was not assessed). Women recognized a higher number of symptoms than men did (2.47 vs. 2.19, 95%  $CI_{diff} = 0.32-0.22$ ). The means for each country are shown in Table 4.

Are people with a higher risk of heart attack because of high blood pressure better informed?

With the exceptions of participants in Poland and Russia, they were not (Table 4). Those at higher risk because of overweight (2.39 vs. 2.24,

**Table 4** Mean numbers of correct heart attack symptoms recognized, separated by age, education, gender, blood pressure and BMI. The highest average of recognized symptoms in each group is bolded

|                | Mean nine countries | Germany    | France | Spain | Austria    | Poland | Italy | the Netherlands | UK  | Russia |
|----------------|---------------------|------------|--------|-------|------------|--------|-------|-----------------|-----|--------|
| Age            |                     |            |        |       |            |        |       |                 |     |        |
| 14–35          | 2.2                 | 2.6        | 2.3    | 1.8   | <b>3.1</b> | 1.8    | 1.8   | 2.3             | 2.8 | 1.5    |
| 36–64          | 2.5                 | <b>3.4</b> | 2.3    | 1.9   | 3.2        | 2.1    | 2.1   | 2.6             | 3.0 | 2.0    |
| 65+            | 2.4                 | <b>3.3</b> | 2.3    | 1.8   | 3.0        | 2.1    | 1.8   | 2.3             | 2.5 | 2.2    |
| Education      |                     |            |        |       |            |        |       |                 |     |        |
| Low            | 2.4                 | <b>3.1</b> | 2.1    | 1.6   | 2.3        | 1.8    | 1.9   | 2.4             | 2.6 | –      |
| Medium         | 2.6                 | 3.2        | 2.3    | 1.8   | <b>3.4</b> | 2.1    | 2.0   | 2.5             | 3.1 | –      |
| High           | 2.7                 | <b>3.3</b> | 2.6    | 2.0   | 3.1        | 2.2    | 2.0   | 2.4             | 3.1 | –      |
| Sex            |                     |            |        |       |            |        |       |                 |     |        |
| Male           | 2.2                 | <b>3.0</b> | 2.2    | 1.8   | 2.8        | 1.9    | 1.8   | 2.2             | 2.7 | 1.6    |
| Female         | 2.5                 | <b>3.3</b> | 2.4    | 1.9   | 3.1        | 2.0    | 2.0   | 2.6             | 3.0 | 2.0    |
| Blood pressure |                     |            |        |       |            |        |       |                 |     |        |
| Normal         | 2.3                 | <b>3.2</b> | 2.4    | 1.9   | 3.0        | 1.9    | 2.0   | 2.4             | 2.9 | 1.7    |
| High           | 2.4                 | <b>3.4</b> | 2.3    | 2.0   | 2.9        | 2.3    | 1.9   | 2.7             | 2.8 | 2.2    |
| BMI            |                     |            |        |       |            |        |       |                 |     |        |
| Normal         | 2.2                 | <b>3.0</b> | 2.3    | 1.9   | 2.9        | 2.0    | 2.0   | 2.4             | 2.8 | 1.7    |
| Overweight     | 2.4                 | <b>3.3</b> | 2.4    | 1.8   | 3.1        | 2.0    | 1.8   | 2.5             | 2.9 | 1.9    |
| Obese          | 2.5                 | <b>3.5</b> | 2.2    | 1.8   | 3.0        | 2.2    | 2.0   | 2.6             | 3.0 | 2.2    |

95%  $CI_{diff} = 0.10-0.22$ ) or obesity (2.50 vs. 2.24, 95%  $CI_{diff} = 0.18-0.34$ ) identified more heart attack symptoms than did those with normal weight, but the effects are small. When testing countries separately, these effects hold only in Germany and Russia.

### Stroke

The stroke symptoms most frequently recognized were slurred speech, paralysis and lopsided face. Yet, none of the 14 stroke symptoms was recognized by more than 50% of the Europeans interviewed (Table 5). Once again, participants in Germany ( $M = 5.01$ ; 95%  $CI = 4.85-5.17$ ) and Austria ( $M = 4.94$ ; 95%  $CI = 4.49-5.40$ ) were familiar with more symptoms than were participants in other countries. As for heart attack symptoms, participants in Italy, Spain, Poland and Russia recognized the lowest number of stroke symptoms. Nineteen percent of the Europeans interviewed did not recognize any stroke symptom at all.

The association between stroke symptom recognition and age was weakly positive

( $r = 0.08$ ) across all countries, mirroring the results for heart attack symptoms. When tested separately for each country, associations were strongest in Germany ( $r = 0.14$ ), Russia ( $r = 0.19$ ) and Poland ( $r = 0.08$ ) and weakly negative in France ( $r = -0.08$ ; see Table 6 for means). The higher the level of education, the more stroke symptoms people identified (see Table 6), and women identified them more frequently than men did (3.62 vs. 3.01, 95%  $CI_{diff} = 0.72-0.49$ ).

Across all countries, people at higher risk for stroke owing to hypertension did not recognize more symptoms than did those with normal blood pressure (see Table 6 for means). People classified as overweight (3.55 vs. 3.25, 95%  $CI_{diff} = 0.17-0.43$ ) or obese (3.71 vs. 3.25, 95%  $CI_{diff} = 0.27-0.64$ ) identified more stroke symptoms than did those with normal weight. However, between countries, this difference holds only in Germany and Russia. Outside of these two countries, people at higher risk owing to hypertension or obesity were not better informed about stroke.

**Table 5** Percentage of participants who recognized a condition as a symptom for a stroke (all conditions except for earache are typical symptoms). Mean across the nine countries was weighted by sample size. The highest recognition value for each symptom is bolded

|                                  | Nine countries | Germany     | France      | Spain | Austria     | Poland | Italy       | the Netherlands | UK          | Russia      |
|----------------------------------|----------------|-------------|-------------|-------|-------------|--------|-------------|-----------------|-------------|-------------|
| Slurred speech                   | 44.0           | 53.2        | 41.6        | 27.4  | 49.7        | 36.2   | 36.2        | 64.7            | <b>65.7</b> | 38.6        |
| Paralysis                        | 43.0           | 74.4        | 43.3        | 34.9  | <b>74.9</b> | 40.2   | 31.3        | 49.5            | 38.5        | 31.4        |
| Lopsided face                    | 38.3           | 60.2        | 50.3        | 27.0  | 64.1        | 19.4   | 14.1        | <b>74.1</b>     | 48.1        | 29.6        |
| Dizziness                        | 32.5           | 45.4        | 42.3        | 26.0  | <b>47.3</b> | 39.9   | 19.1        | 20.6            | 29.7        | 28.2        |
| Inclination to fall to one side  | 29.8           | <b>45.8</b> | 44.9        | 21.8  | 39.7        | 17.4   | 16.9        | 35.1            | 38.0        | 20.6        |
| Sudden confusion                 | 26.2           | 41.5        | 41.7        | 20.8  | <b>42.9</b> | 15.0   | 24.4        | 31.3            | 34.5        | 11.2        |
| Prickly feeling                  | 24.7           | 26.9        | 19.5        | 3.0   | 20.4        | 15.2   | 20.5        | 3.2             | 25.1        | <b>39.5</b> |
| Numbness                         | 23.2           | 33.7        | 29.0        | 5.0   | 28.3        | 34.3   | 19.4        | 20.5            | <b>52.5</b> | 6.5         |
| Debility                         | 18.9           | 26.9        | 23.3        | 10.4  | 23.4        | 7.2    | 5.4         | 11.9            | 13.0        | <b>27.0</b> |
| Sudden one-sided blindness       | 17.9           | 30.1        | <b>31.9</b> | 10.6  | 31.5        | 15.3   | 7.9         | 21.0            | 25.8        | 7.4         |
| Spit running out of mouth        | 15.4           | 28.9        | 17.3        | 7.9   | <b>32.3</b> | 11.0   | 4.3         | 28.8            | 24.5        | 8.6         |
| Problems eating                  | 9.5            | <b>19.0</b> | 15.6        | 4.5   | 21.4        | 3.2    | 3.0         | 6.2             | 10.3        | 6.8         |
| Earache                          | 5.9            | 6.0         | <b>10.9</b> | 5.6   | 4.5         | 2.4    | 2.0         | 1.1             | 3.4         | 8.0         |
| Frequent difficulties swallowing | 5.6            | 10.4        | <b>11.6</b> | 4.7   | 11.3        | 4.0    | 1.2         | 3.4             | 5.4         | 3.0         |
| Runny eyes                       | 4.0            | 4.9         | 5.1         | 4.3   | <b>7.1</b>  | 3.4    | 0.8         | 3.1             | 5.4         | 3.7         |
| I don't know                     | 19.1           | 9.8         | 14.3        | 16.2  | 2.8         | 27.6   | <b>28.2</b> | 7.1             | 14.3        | 26.0        |
| Mean number of correct symptoms  | 3.3            | <b>5.0</b>  | 4.2         | 2.1   | 4.9         | 2.6    | 2.0         | 3.7             | 4.2         | 2.6         |

**Table 6** Number of correct stroke symptoms recognized, separated by age, education, gender, blood pressure and BMI. The highest average of recognized symptoms in each group is bolded

|                | Mean Nine countries | Germany    | France | Spain | Austria    | Poland | Italy | the Netherlands | UK  | Russia |
|----------------|---------------------|------------|--------|-------|------------|--------|-------|-----------------|-----|--------|
| Age            |                     |            |        |       |            |        |       |                 |     |        |
| 14–35          | 3.3                 | 4.0        | 4.3    | 2.1   | <b>6.3</b> | 2.4    | 1.9   | 3.9             | 3.9 | 2.0    |
| 36–64          | 3.9                 | 5.5        | 4.4    | 2.1   | <b>5.6</b> | 2.8    | 2.2   | 4.0             | 4.6 | 3.0    |
| 65+            | 3.5                 | <b>5.1</b> | 3.5    | 2.0   | 4.9        | 2.7    | 1.9   | 3.1             | 3.3 | 3.2    |
| Education      |                     |            |        |       |            |        |       |                 |     |        |
| Low            | 3.4                 | <b>5.0</b> | 3.4    | 1.7   | 4.9        | 2.2    | 2.0   | 3.1             | 3.5 | –      |
| Medium         | 4.0                 | 5.2        | 4.0    | 2.0   | <b>5.6</b> | 3.0    | 2.1   | 4.0             | 4.7 | –      |
| High           | 4.4                 | 5.2        | 5.4    | 2.5   | <b>6.0</b> | 3.4    | 2.3   | 4.1             | 5.0 | –      |
| Sex            |                     |            |        |       |            |        |       |                 |     |        |
| Male           | 3.0                 | 4.7        | 3.9    | 2.1   | <b>4.9</b> | 2.5    | 1.9   | 3.4             | 3.7 | 2.1    |
| Female         | 3.6                 | <b>5.3</b> | 4.4    | 2.1   | 5.0        | 2.7    | 2.2   | 4.0             | 4.6 | 3.1    |
| Blood pressure |                     |            |        |       |            |        |       |                 |     |        |
| Normal         | 3.6                 | 5.1        | 4.3    | 2.1   | <b>6.1</b> | 2.6    | 2.1   | 3.7             | 4.2 | 2.5    |
| High           | 3.7                 | <b>5.6</b> | 4.1    | 2.1   | 3.2        | 3.1    | 2.0   | 4.0             | 4.1 | 3.2    |
| BMI            |                     |            |        |       |            |        |       |                 |     |        |
| Normal         | 3.3                 | 4.8        | 4.2    | 2.2   | <b>5.4</b> | 2.5    | 2.1   | 3.8             | 4.0 | 2.3    |
| Overweight     | 3.6                 | 5.1        | 4.3    | 2.1   | <b>5.4</b> | 2.8    | 1.9   | 3.8             | 4.4 | 2.9    |
| Obese          | 3.7                 | <b>5.8</b> | 3.6    | 1.7   | <b>5.8</b> | 3.0    | 2.5   | 4.0             | 4.2 | 3.4    |

What proportion of the general public knows what to do in case of a stroke?

Fifty-one percent of participants would take the most appropriate action and call an ambulance (Table 7). Surprisingly, in Germany and Austria – the two countries where people identified most symptoms of a stroke – only 33 and 34% would have called an ambulance immediately; instead, one of about three Germans and Austrians would advise the sufferer to go to bed or take a sip of water.

Across all countries, those participants who would call an ambulance or a doctor immediately recognized on average 3.6 symptoms, and those

who would not do so recognized 3.1 (95%  $CI_{diff} = 0.32–0.55$ ). Spain was the only country where no difference was found.

#### Contribution of information source to symptom knowledge

Participants were asked how often they used 14 different sources of health information. Sixty-two percent said that they sometimes or frequently rely on friends and family for health information, followed by 59% stating their general practitioner and 54% their pharmacist as primary source. The next most frequently consulted sources were mass media (TV, 43%;

**Table 7** Percentage of participants who would take the following actions if they saw a person with stroke symptoms. The highest percentage for each action is bolded

| Action                             | Nine countries | Germany   | France | Spain     | Austria   | Poland    | Italy | the Netherlands | UK | Russian Federation |
|------------------------------------|----------------|-----------|--------|-----------|-----------|-----------|-------|-----------------|----|--------------------|
| Call an ambulance                  | 51             | 33        | 43     | 42        | 34        | <b>66</b> | 49    | 41              | 58 | 64                 |
| Call doctor immediately            | 44             | 46        | 60     | <b>61</b> | 53        | 31        | 47    | 55              | 42 | 32                 |
| Recommend going to bed and waiting | 16             | 12        | 23     | 13        | 13        | 6         | 5     | 1               | 3  | <b>32</b>          |
| Advise seeing a doctor             | 16             | <b>35</b> | 11     | 12        | 34        | 11        | 7     | 18              | 18 | 10                 |
| Give a sip of fluid                | 8              | 16        | 7      | 8         | <b>17</b> | 3         | 5     | 1               | 3  | 7                  |

popular magazines, 26%; daily newspaper, 25%; radio, 23%). Leaflets and pamphlets by health organizations were used by 21% and reference books about health topics by 20%. Health insurance companies were consulted by 17% and the Internet by only 15% of the population (when this survey was conducted in 2006, Internet was available to 49% of citizens in the 27 countries of the European Union (see table 1 for availability per country); data for Russia are not available). Information from consumer counselling and patient counselling was sought by 6% for each, and from self-help organizations, by 4% (for more details on use of information sources, see ref. 15).

#### *Heart attack*

Across all countries, the highest correlations between the frequency of consulting a source and the number of symptoms known were found for leaflets and pamphlets by health organizations ( $r = 0.16$ ) and reference books on health topics ( $r = 0.15$ ). For individual countries, reference books on health topics were the source most frequently related to recognition of heart attack symptoms (Germany,  $r = 0.23$ ; France,  $r = 0.14$ ; Austria,  $r = 0.19$ ; Italy,  $r = 0.18$ ; and Russia,  $r = 0.20$ ). Usage of the Internet for health information and recognition of heart attack symptoms was correlated in Germany ( $r = 0.08$ ), France ( $r = 0.09$ ), Italy ( $r = 0.09$ ), the UK ( $r = 0.06$ ) and Russia ( $r = 0.05$ ). The correlation between the frequency with which participants consult their general practitioner and the number of heart attack symptoms recognized was positive in Germany ( $r = 0.14$ ), Poland ( $r = 0.13$ ), Italy ( $r = 0.10$ ) and Russia ( $r = 0.13$ ); in all other countries, there was no correlation (all 95% CIs include 0).

#### *Stroke*

As for recognition of heart attack symptoms, those who most frequently consulted either leaflets and pamphlets by health organizations or reference books on health topics mentioned a higher number of correct stroke symptoms ( $r_s = 0.16$ ). In different countries, reference books on health topics were again most fre-

quently associated with symptom recognition (Germany,  $r = 0.20$ ; France,  $r = 0.18$ ; Spain,  $r = 0.16$ ; Italy,  $r = 0.20$ ; Poland,  $r = 0.16$ ; the Netherlands,  $r = 0.18$ ; and Russia,  $r = 0.19$ ). The frequency of using the Internet for health information and recognition of stroke symptoms was correlated in seven of the nine countries (Germany,  $r = 0.08$ ; France,  $r = 0.13$ ; Spain,  $r = 0.13$ ; Italy,  $r = 0.11$ ; the Netherlands,  $r = 0.16$ ; UK,  $r = 0.08$ ; and Russia,  $r = 0.05$ ). Mirroring the results for heart attack, there was a relation between the frequency of consulting a general practitioner for health information and recognition of stroke symptoms in a few countries, namely in Germany ( $r = 0.10$ ), Poland ( $r = 0.14$ ) and Russia ( $r = 0.12$ ).

#### *Use of information sources and reaction to stroke symptoms*

Across all countries, people who would call an ambulance did not consult health information sources more frequently. A striking result is that in no country except the UK did people who sometimes or frequently consult their general practitioner say more often than others that they would call an ambulance or doctor if they saw a person suffering stroke symptoms (all  $\chi^2 < 2.68$ , all  $P > 0.12$ ; exception UK,  $\chi^2 = 10.22$ ,  $P = 0.001$ ).

## **Discussion**

To our knowledge, this is the first representative survey in nine European countries relating symptom recognition and action-relevant knowledge of heart attack and stroke with information sources consulted. We found that of six valid signs listed for heart attack, only chest pain was recognized by a majority of Europeans. Of 14 symptoms for stroke, none was recognized by more than 50% of Europeans interviewed; one in five did not recognize any symptoms. Only about half of the 10 228 persons would call an ambulance immediately when witnessing someone suffering stroke symptoms. Interestingly, people at higher risk were generally not better informed about symptoms or what to do in case of stroke.



In all countries, women recognized more heart attack and stroke symptoms than men. Recognition of symptoms for both heart attack and stroke was highest in Germany and Austria, whereas only about half as many symptoms were recognized in Spain, Poland, Italy and Russia. At the same time, Poland has the highest mortality rate from ischaemic heart disease and cerebrovascular disease of all countries surveyed and among the highest mortality rates from cerebrovascular disease (numbers for Russia are not available). Ignorance about heart attack and stroke symptoms might well contribute to this high mortality rate and is thus especially worrisome.

The findings of our study differ from results from other studies. For instance, 92% of participants in a random US sample recognized chest pain or discomfort as heart attack symptoms; 31% of the participants recognized five symptoms.<sup>16</sup> The numbers across the European countries we surveyed were substantially lower, with an average of 80% recognizing chest pain and 6% recognizing five or more symptoms. Also, recognition of stroke symptoms in our study, at up to 44% for slurred speech, was substantially lower than knowledge in previous studies in the US,<sup>17</sup> Ireland<sup>18</sup> or Spain,<sup>19</sup> where 88–95% of participants recognized symptoms. Only the study by Yoon *et al.*<sup>20</sup> reported similarly low numbers for stroke symptom recognition: in a community sample in Australia, each of eleven listed symptoms was recognized by between 4 and 24% of participants. One possible explanation for the lower level of knowledge of heart attack and stroke symptoms in our European sample in comparison with earlier studies is that we used a representative sample and did not recruit participants through random digit dialling,<sup>17</sup> random selection from a telephone directory<sup>20</sup> or systematic random sampling<sup>18</sup>. It was shown, for example, that participants randomly selected through random dialling were better educated than a sample representative for the population at large. When individuals are randomly called, well-educated individuals are more likely to participate,<sup>21</sup> suggesting that studies using random procedures or community

samples might actually overestimate knowledge in the population. However, a representative sample in Spain<sup>19</sup> also showed a higher proportion of participants that recognized symptoms than in our study.

Not only is recognizing symptoms important but also knowing what to do in the event of heart attack or stroke. When asked what they would do in the event of an acute stroke, 43% of participants in a Turkish community sample,<sup>22</sup> 45% of a Spanish representative sample,<sup>19</sup> 67% in an Australian community sample<sup>23</sup> and 76% in a U.S. community sample<sup>24</sup> said they would call an ambulance. However, when the same Australian community sample was presented with symptoms that are typical of a stroke (instead of the diagnosis 'stroke'), the percentage that would call an ambulance ranged from only 1% if witnessing dizziness to 20% if witnessing weakness or paralysis.<sup>23</sup> These proportions approximately doubled if 'Going to the hospital casualty/emergency department' is also counted as a correct response.<sup>20</sup> Findings are analogue for the U.S. community sample<sup>24</sup>: if symptoms were given instead of the diagnosis 'stroke', the proportion of participants that would call an ambulance if witnessing weakness or paralysis dropped to 49%. Among patients in a UK hospital who had experienced a stroke within the last 48 h and recognized that they were experiencing a stroke, 25% had called an ambulance; of those patients who did not recognize that they were experiencing a stroke, only 12.5% had called an ambulance.<sup>23</sup> In a Brazilian community sample presented with the scenario of a relative who is experiencing a number of symptoms typical for a stroke, such as difficulty in speaking and walking, 51% would call an ambulance.<sup>22</sup> Similarly, across all nine European countries surveyed in our study, 51% would call an ambulance if they saw a person experiencing symptoms typical of a stroke. This proportion is comparable to the results in community samples in Australia, Turkey and Brazil as described earlier, where participants were presented a description of a person suffering symptoms that are typical of a stroke but they were not told this person was having a stroke. Therefore, the

higher proportions of those who would call an ambulance found in other studies might be due to the presentation format of the question, that is, when participants are explicitly told the person is suffering a stroke. As in the study among hospitalized UK stroke patients described earlier,<sup>23</sup> those who recognized that they were experiencing a stroke were more likely to call an ambulance. Increasing recognition of stroke symptoms and awareness of the most adequate response thus seems central to ensuring that more than half of the population knows what to do when they see someone experiencing a stroke.

Findings from previous studies also showed family and friends to be one of the most frequently consulted sources of health information knowledge (for a review, see ref. 11). In contrast, participants in our survey more often asked their physician or pharmacist for advice. Other studies in the US and Australia had found that their participants relied on mass media more often than on physicians or hospital personnel, whom only 11–20% of participants consulted.<sup>11,25</sup> We are not aware of other studies that related the frequency with which certain sources of health information were consulted to level of knowledge. Our study found very low correlations between level of knowledge and use of any information source. It should be noted that one source of medical knowledge that was not included in this survey is personal experience or witnessing others who have personal experience with a medical condition such as heart attack or stroke (for a review, see ref. 12). Nonetheless, even given personal experience with heart attack or stroke, participants likely consulted the information sources assessed in this survey to gather further information about their (or their loved ones') condition.

For the interpretation of our findings, it should also be noted that some structural differences in the health-care systems surveyed have elsewhere been suggested to affect how often and which health services are frequented. For example, nationalized publicly funded health systems as in the UK seem to be most effective at reducing inequalities in access to

medical services<sup>26</sup> and might increase the number of times patients see their GP in these countries. In France, health insurance is also universal, but roughly, 25% of the costs are covered by patients' co-payments, leading to a high frequency of supplementary health insurance. Patients with supplementary health insurance visit their GP significantly more often than those without it;<sup>27</sup> the importance of the GP as a source of health information might hence differ between those with and without supplementary insurance in France. However, empirical studies on factors that affect accessibility of health care in Europe are sparse and generally of poor quality.<sup>26</sup> Another important difference is the availability of thrombolytic therapy in the countries surveyed. A pan-European survey showed that between 44% (Eastern Europe) and 73% (UK and Ireland) of patients with a heart attack received thrombolytic therapy.<sup>28</sup> For people living in countries in which thrombolytic therapy is provided more often, arriving at the hospital within a few hours is even more important.

Another structural aspect related to heart attack and stroke knowledge and access to health-related information that was not considered in our survey is reading literacy, the ability to understand written information in situations that are encountered in daily life. Reading literacy differs between the countries surveyed, as the 2006 results of the Programme for International Student Assessment (PISA) show: the percentage of 15-year-olds with a proficiency level so low that they are likely to have difficulty with the most basic type of reading and thus with written information about health-related questions ranges from 15.1% in the Netherlands to 26.7% in France.<sup>29</sup> A further possible limitation is that the data reported in this article were collected in 2006 and reflect the state of heart attack and stroke symptoms in that year, without taking into account potential changes in relevant knowledge. Since then, for instance, public awareness campaigns as well as health-care system reforms have been launched. This together with the structural differences between countries described earlier should be taken into

consideration when interpreting the present study's findings on consultation of health information sources and knowledge about heart attack or stroke.

In spite of these limitations, the present survey of representative samples of nine European countries provides a major new contribution, making it possible to compare knowledge between countries and relate knowledge level of stroke and heart attack to characteristics of the health system. Altogether, awareness of warning signs of stroke and heart attack was found to be low among the European population, particularly among participants in Italy, Spain, Poland and Russia. Although people at risk because of hypertension or obesity should be better informed than those who are not (compare e.g. ref. 12), we did not find that they were. In Germany and Austria, few were aware that calling an ambulance immediately is the most efficient action to save lives and avoid disability. This poor action-relevant knowledge in both countries is in stark contrast to their high level of symptom recognition and is in line with another German survey that also showed a large discrepancy between high symptom and poor action-relevant knowledge among a smaller, non-representative sample.<sup>30</sup> These findings suggest that public health campaigns, particularly in Germany and Austria, should target action-relevant knowledge more strongly. Furthermore, the observation that, in all European countries, frequent consulting of a general practitioner contributes so little to people's understanding of the warning signals for stroke and heart disease deserves further investigation.

### Acknowledgements

This work was supported by the non-profit branch of the GfK-Group, Nuremberg, Germany, and the Harding Center for Risk Literacy, as well as by a postdoctoral fellowship of the Max Planck Society in Germany awarded to JM. The funding sources had no role in the study conduct and analysis and are not responsible for the views expressed herein.

### Supporting Information

Additional Supporting Information may be found in the online version of this article:

**Data S1.** Original questions.

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