UNIVERSIDADE DO PORTO

Faculdade de Medicina

Instituto de Ciências Biomédicas Abel Salazar

Profiles and Pitfalls in the Stroke Care Chain:

Population and Doctors Counterparts

Dissertação de Mestrado em Saúde Pública

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Porto, 2009

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Dissertação de candidatura ao grau de Mestre em Saúde Pública apresentada à Faculdade de Medicina e Instituto de Ciências Biomédicas Abel Salazar, Universidade do Porto

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Ao André

Acknowledgments

Na elaboração deste estudo, agradeço à Professora Doutora Carolina Costa e Silva por todo o acompanhamento do meu percurso na investigação, pelas valiosas aprendizagens que me tem proporcionado e pela construção próxima de uma relação envolvida na investigação e no conhecimento. Ainda dentro da equipa ACIN agradeço ao Dr. Rui Magalhães pelo genuíno companheirismo no meu percurso enquanto bolseira, sapiência e paciência nas aprendizagens que me proporcionou no dia-a-dia e também pela preciosa ajuda na elaboração da tese, ao Professor Doutor Manuel Correia pela forma simpática e respeitosa como me integrou numa equipa de trabalho e me transmitiu não apenas conhecimentos na Neurologia, mas também o entusiasmo por investigar e conhecer, à Dra Assunção Tuna, colega e amiga, pelo companheirismo desde o primeiro momento em que entrei na equipa e pelo privilégio da partilha de conhecimentos e sensibilidades. Tenho ainda que agradecer ao meu grande amigo e colega Tiago Pimentel, companheiro também nesta viagem, por ser personagem constante na minha vida, pela fortíssima amizade e pela forma humorada e colorida como construimos experiência.

Em Viana, agradeço a todos os intervenientes neste estudo: em primeiro lugar ao Dr. Carlos Daniel Pinheiro, director da Sub-região de Saúde de Viana do Castelo, pelo apoio neste projecto e pela co-construção de estratégias de abordagem ao terreno; à Direcção Clínica do Centro Hospitalar de Viana Castelo (CHAM), na pessoa da Dra. Amélia Marques, ao Enfermeiro – Chefe do Serviço de Urgência do CHAM e aos Directores dos Centros de Saúde, pela dinamização e mobilização dos colegas numa tarefa a acrescentar à preenchida rotina dos Centros de Saúde. Agradeço também às Enfermeiras que lideraram o inquérito à população pela próxima e preciosa colaboração tanto na gestão da recolha de dados realizada pelas colegas, como no nosso apoio logístico nos dias de recolha intensiva nos Centros de Saúde. Em geral, a todos os Médicos e Enfermeiros envolvidos neste estudo, agradeço o tempo disponibilizado para as várias tarefas que solicitámos. Um agradecimento especial a todos os participantes no inquérito à população que, apesar de não terem qualquer recompensa imediata objectiva, aceitaram dedicar alguns momentos a pensar no Acidente Vascular Cerebral.

Outras pessoas envolvidas no trabalho da equipa merecem também agradecimentos pelo empenho e qualidade com que colaboraram na realização do estudo: a Dra. Joana Damásio, a Dra. Ester Coutinho, o Dr. Márcio Cardoso, o Nuno Silva e a Dra. Ana Marques. Agradeço ainda aos Neurologistas do Serviço de Neurologia do Centro Hospitalar do Porto que preencheram e discutiram os casos clínicos.

Quero agradecer também a outras pessoas muito importantes no meu percurso: à Professora Doutora Alice Bastos, pela proximidade e entusiasmo no acompanhamento e reforço do meu trabalho, sendo essencial na alimentação de ânimo especialmente na fase de redacção da tese; aos colegas de Departamento da Escola Superior de Educação de Viana do Castelo, pelo apoio na fase de redacção da Tese e ainda à Professora Doutora Orlanda Cruz, à Professora Doutora

Margarida Henriques e ao Dr. António Bastos, pelo apoio, amizade e inspiração persistentes desde a licenciatura.

Aos meus mais próximos amigos, devo agradecer o apoio, compreensão e a introdução de alguma diversidade ao conteúdo da minha narrativa: Ana Isabel Guimarães, Ana Isabel Costa, Estela Queiroz, Frederico Styliano, Angélica Morais, Agostinho Campos e Ana Isabel Vila.

Por fim, devo homenagear a base de apoio constante e transversal ao meu percurso pessoal e profissional: os meus pais, pelo enorme apoio, respeito e por constituírem pilares seguros na minha vida, o meu irmão, pela cumplicidade, amizade e por se manter como a minha grande referência, a minha cunhada pela cumplicidade e reforço, os meus avós por todo o carinho e o André, pelas experiências emocionantes que me proporciona desde que nasceu e por constituir a maior fonte de inspiração de sempre.

Este estudo foi realizado no âmbito da Bolsa de Investigação referência POCI-59885-PR351101-BI, integrada no Projecto "*Prognóstico a Longo Prazo de Acidentes Neurológicos*" – POCI/SAU-ESP59885/2004, que foi financiado pela Fundação para a Ciência e Tecnologia, através das entidades proponentes Instituto de Biologia Molecular e Celular e Centro Hospitalar do Porto, tendo decorrido sob os auspícios da Administração Regional de Saúde do Norte.

Abbreviations

ACINrpc – a prospective community-based registry of neurological attacks undertaken between October 1998 and September 2000 in city of Porto (urban area) and in Vila Pouca de Aguiar and Mirandela (rural area)

CT scan – Computer tomography scan

FAST – *Face, arm, speech – time to call 911*, expression used in the public campaign *Stroke Hero acts fast* by the Massachusetts Health Promotion Clearinghouse

GP – General Practitioners

HBP – High blood pressure

HC – Health Centre

ICD 10 – International Clinical Diagnosis 10th edition

NHS – National Health Service

NINDS-rt-PA Stroke Study Group – National (USA) Institute of Neurological Disorders and Stroke Study Group

rt-PA – recombinant tissue plasminogen activator, substance used in the thrombolytic treatment

TIA – Transient Ischemic Attack

USA – United States of America

Abstract

Introduction: The high stroke incidence and the likelihood of long lasting disability added to a high mortality rate can be improved either by an early prevention or the effective treatment actually available. Both rely heavily on population awareness of stroke risk factors, warning symptoms/signs and emergent action. However, recent studies report that knowledge is poor, even in those at high risk, and patients frequently seek the general practitioner (GP) instead of dialling the emergency number or going straight to hospital. If so GP diagnosis and referral practices acquire a decisive importance in the acute stroke care chain. A community based project was then set up for analysing the stroke care chain and disclosing population and GP pitfalls.

Methods: During a 4-month period in the first semester 2007, 3 studies were undertaken in rural (Arcos de Valdevez and Ponte da Barca) and urban (Ponte de Lima) populations from the Viana do Castelo district: a population survey on stroke knowledge, a collection of case scenarios for studying GP diagnosis accuracy and an incidence study of stroke and transient ischemic attack (TIA). About 1% of all persons registered at the HCs answered a questionnaire designed for knowing about population awareness of stroke risk factors, lesion location, characteristic symptoms/signs and respective action. All GPs (n=68) working in the 3communiti received a questionnaire comprising 16 “real” case scenarios and were asked to indicate the most likely diagnosis among four options: stroke, TIA, other transient focal signs/symptoms or other neurological disease, as well as name the major reasons for choosing the specific option. Throughout the same period, all GPs were asked to identify patients with a stroke or TIA by filling a questionnaire with patient’s socio-demographic characteristics, place and date for the identification and details of the event. For complete ascertainment of cases routine information from hospital admissions (either in the emergency department or medical unit) and death certificates were checked. By linking patient’s action in case of specific stroke symptoms/signs, GP accuracy in diagnosing these specific cases and their referral practice, it was possible to depict the patient pathway within the NHS, namely the “entrance door” and the GPs role in this pathway.

Results: A total of 663 persons answered the questionnaire, 316 from rural and 347 from urban areas. Knowledge of stroke risk factors was similar in both settings, as well as the number of stroke symptoms identified, despite rural populations being older and less educated than the urban ones. The rural/urban contrast emerged in intention of action in case of stroke, 51.6% and 75.0% would dial the emergency number/go to hospital, respectively. Action was modelled by age/education, residential area and specific stroke warning symptoms/signs; the youngest were twice more likely to act well and urban residents were 3 times more likely to act well. Half of GPs participated in the case scenarios study, although only 31 (45.6%) completed all 16 case scenarios. Using as golden standard the diagnosis made by a group of 10 neurologists (unanimity/majority), GP sensitivity was 79.6% (95% CI: 74.4-84.8) and specificity was 82.5% (95% CI: 76.0-89.9), attaining the highest values in typical stroke cases describing old patients with vascular risk factors and presenting weakness in the hemibody/hemiparesis and anosognosia, and the lowest in cases describing less

old patients (<60 years of age) presenting only visual or speech abnormalities, more frequently TIAs.

Stroke incidence was 3.50 per 1000 person-years and 50% of death certificates stated inaccurately stroke as cause of death. Patients residing in rural areas sought more frequently first help from the GP in case of stroke or TIA (41.7 vs. 7.3%). Overall GPs referral rate was 81.8% increasing to 92.6% in confirmed stroke/TIA patients. Based on the population intended action and GPs accuracy/ management according to stroke warning symptoms/signs, it was possible to estimate the pitfalls in the acute stroke care chain. In case of the most important well recognized stroke symptoms/signs (hemiparesis/weakness in the hemibody) the system pitfalls result mainly from population misrecognition rather than GPs (28.8% vs. 2.6%). For less acknowledged symptoms/signs as speech problems, GPs misdiagnosis play a more important part, since 21.5-24.3% of cases would be inadequately cared and 25.6% would be misrecognized by the population. For other symptoms/signs these proportions are 21.5 and 35.0%, respectively.

Conclusion: Since there are no risk factors and/or acknowledged stroke symptoms/signs consistently associated to action, it seems that the correct action may be attributed to “seriousness” of specific symptoms independently of its relation with stroke, or to other external factors as accessibility of health services.

To shorten acute stroke care chain, it is crucial to show people that recent treatment options are available and they may benefit from seeking timely hospital services. Moreover, GPs should be trained to identify and to refer emergent situations of stroke/TIA, since they are still an important link in the acute stroke care chain.

Resumo

Introdução: A elevada incidência de AVC, o possível longo défice resultante, juntamente com a elevada mortalidade podem ser minimizados tanto com a prevenção de factores de risco vascular como com o tratamento eficaz disponível hoje em dia. Ambos dependem em grande parte do alerta da população relativamente aos factores de risco de AVC, aos seus sinais e sintomas e à urgência da acção numa situação de AVC. No entanto, estudos recentes referem que o conhecimento da população em geral é restrito, mesmo naqueles que estão em risco mais elevado e também que os doentes com AVC procuram frequente o clínico geral, em vez de ligar o número de emergência médica ou irem directamente para o hospital. Deste modo, o diagnóstico e as práticas de referenciação do clínico geral adquirem uma importância decisiva na cadeia de cuidado do AVC agudo. Neste sentido, foi desenvolvido um projecto na comunidade com o objectivo de analisar o cuidado ao AVC e detectar falhas da população e dos clínicos gerais nessa cadeia de apoio.

Método: Durante um período de 4 meses do primeiro semestre de 2007, foram realizados 3 estudos com populações rurais (Arcos de Valdevez e Ponte da Barca) e urbanas (Ponte de Lima) do distrito de Viana do Castelo: um inquérito à população sobre conhecimento de AVC, um estudo sobre a precisão dos diagnósticos dos clínicos gerais a um conjunto de casos clínicos apresentados e um estudo de incidência de AVC e Acidente Isquémico Transitório (AIT). Cerca de 1% das pessoas registadas nos centros de saúde responderam ao questionário desenhado para conhecer o alerta da população para os factores de risco do AVC, o local da lesão, e os sinais e sintomas característicos, assim como a respectiva intenção de acção. Todos os clínicos gerais (n=68) receberam também um questionário que incluía 16 casos clínicos “reais”, tendo-lhes sido pedido que indicassem o diagnóstico mais provável entre quatro opções – AVC, AIT, outros sinais/sintomas neurológicos focais transitórios ou outras doenças neurológicas – assim como as razões principais para escolher aquela opção específica. Durante o mesmo período, foi pedido a todos os clínicos gerais para notificar doentes com AVC ou AIT, através do preenchimento de um questionário, que incluía informação sobre características sócio-demográficas do doente, local e data da notificação, e detalhes do evento. Para realizar um levantamento completo de todos os casos, foram analisados registos de rotina hospitalar referentes aos serviço de urgência e ao internamento, assim como, certificados de óbito. Ligando a intenção de acção da população perante sinais e sintomas específicos, a precisão do diagnóstico dos clínicos gerais a esses mesmos sinais e sintomas e as suas práticas de referenciação, foi possível desenhar o trajecto do doente com AVC/AIT ao longo do Serviço Nacional de Saúde, nomeadamente a “porta de entrada” e o papel dos clínicos gerais neste caminho.

Resultados: Um total de 663 pessoas respondeu ao questionário, 316 da área rural e 347 da área urbana. O conhecimento dos factores de risco foi semelhante em ambos os locais, assim como o número de sintomas de AVC reconhecidos, apesar da população rural ser mais velha e menos escolarizada do que a urbana. O contraste rural/urbano surge perante a intenção de acção em

caso de AVC: 51,6% e 75,0% respectivamente, ligaria o número de emergência médica ou iria ao hospital. A intenção de acção é explicada pela idade/educação, área residencial e o reconhecimento de sinais e sintomas específicos como sendo de AVC; os mais novos têm uma probabilidade de agir correctamente duas vezes superior aos mais velhos e os residentes em zonas urbanas têm uma probabilidade de agir correctamente três vezes superior aos residentes em zonas rurais. Metade dos clínicos gerais participou no estudo dos casos clínicos, apesar de apenas 31 (45,6%) terem completado os 16 casos apresentados. Considerando como *golden standard* os diagnósticos realizados pelo grupo de 10 neurologistas (unanimidade/maioria), a sensibilidade dos diagnósticos dos clínicos gerais foi 79,6% (IC 95%: 74,4-84,8) e a especificidade foi 82,5% (IC 95%: 76,0-89,9), atingindo os valores mais elevados em casos típicos de AVC (que descrevem doentes idosos com factores de risco vascular e que apresentam hemiparésia/fraqueza no hemicorpo e anosoagnosia) e os valores mais baixos, em casos que descrevem doentes menos idosos (<60 anos) que apresentam apenas alterações visuais ou do discurso, principalmente nos casos de AIT.

A incidência de AVC foi 3,50 por 1000 pessoas-ano e 50% dos certificados de óbito referem incorrectamente “AVC” como causa de morte. Quando sofrem um AVC ou um AIT, os doentes que residem nas zonas rurais procuram mais frequentemente a primeira ajuda no clínico geral (41,7 vs. 7,3%). Na globalidade, a taxa de referenciação dos clínicos gerais foi de 81,8%, aumentando para 92,6% nos casos dos doentes cuja suspeita de AVC/AIT foi confirmada. Com base na intenção de acção da população e na precisão e gestão dos clínicos gerais relativamente a sinais e sintomas de AVC específicos, foi possível estimar as falhas na cadeia de cuidado do AVC agudo. No caso dos sinais e sintomas de AVC mais conhecidos (hemiparésia/fraqueza no hemicorpo), as falhas do sistema resultam mais do não reconhecimento da população do que da acção dos clínicos gerais (28,8% vs. 2,6%). Para os sinais e sintomas de AVC menos conhecidos, como problemas na fala, as práticas dos clínicos gerais apresentam um peso mais significativo, pois 21,5-24,3% dos casos seriam inadequadamente tratados e 25,6% não seriam reconhecidos pela população. Relativamente a outros sinais e sintomas de AVC, as proporções são 21,5 e 35,0%, respectivamente.

Conclusão: Atendendo a que não existe uma associação consistente entre factores de risco e/ou conhecimento de sinais e sintomas e a intenção da acção perante o AVC, a acção correcta poderá ser atribuída à interpretação de “seriedade/gravidade” de sintomas específicos independentemente da sua relação com o AVC ou a outros factores externos, como a acessibilidade dos serviços de saúde.

De modo a encurtar a cadeia de cuidado do AVC agudo, é crucial mostrar à população que, actualmente estão disponíveis opções de tratamento, do qual podem beneficiar se chegarem atempadamente aos serviços hospitalares. Para além disso, deve ser organizada formação mais dirigida ao treino dos clínicos gerais para a identificação e referenciação de situações urgentes de AVC/AIT, pois eles constituem uma ligação importante na cadeia de apoio ao AVC agudo.

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1 Introduction

It is well known in the scientific community that stroke is the third leading cause of death accounting for 10% of deaths in Europe and USA, being the second cause of death worldwide.[1;2] Besides an high fatality rate, stroke has also an enormous financial and social burden not only for families but for the society as a whole.[3] The efficacy of acute treatment, like thrombolysis with alteplase brings the opportunity to decrease the risk of death, handicap and, in most cases, an effective solution for a neurological condition that previously could signify great costs for human life.[4-7] Even so, its efficacy depends not only on medical services but also on people awareness of stroke symptoms/signs in order to act within a 3- to the recently 4.5 hour-time window.[7] The third international stroke trial (IST-3) – a multicentre, prospective, randomised, open, blinded endpoint trial of intravenous rt-PA in acute ischemic stroke – aims to test the treatment efficacy within 6 hours of developing symptoms, and to determine whether a wide range of patients (some excluded from other trials) may benefit from it.[8] Despite the efforts performed in order to widespread the treatment efficacy to a larger time-window and older ages, current evidence on rt-PA efficacy meets the criteria for stroke being held as an emergency situation.[4-7;9-12] On the other hand, research on patients admission to hospital emergency departments shows that the majority of patients do not seek timely medical attention.[10;13-22]

Many studies illustrate the association between time to hospital presentation and the resulting severity of stroke disabilities, with early presentation providing a greater opportunity for effective stroke management and treatment, thus a better recovery.[8;23-25] Studies conducted with stroke patients have shown that many were unaware of the warning signs of stroke and did not seek medical attention because they had misjudged the severity of their symptoms. In addition, it has

been shown that patients presenting early were more likely to arrive by ambulance as they had initially contacted this service following the onset of their symptoms.[13;26] According to the NINDS rt-PA study group, stroke admission delay may be a question of an a) appraisal delay, the time from noticing a symptom to deciding one is ill, b) illness delay, the time from the onset of symptoms to seeking professional help, and c) utilization delay, the time from seeking professional care to arrival at the hospital.[9;27] Appraisal and illness delay depend mostly on patient's representation of stroke: awareness of stroke symptoms/signs, intention of action towards stroke, as well as the recognition that it is an emergent situation.[9-11;20;21;28-30] Nonetheless patient awareness may be not enough since he may not be able to act on his own and others for him have to act in accordance.[21;22]

While knowledge alone may be insufficient to ensure appropriate preventive and responsive behaviours, it is considered a prerequisite for appropriate actions, thus predicting behaviour in case of stroke.[22] Since the middle 1990s, many educational programs on stroke were created and implemented mainly in Europe and the United States of America, especially after recognition of thrombolytic treatment efficacy[31-35] While these programs efficacy remains to be proved,[33;34] most patients with stroke or transient ischemic attacks (TIA) continue to overlook "acute care" action, believing his General Practitioner (GP) will be able to solve the problem.[9;13;36-41] If so, timely action is at risk, but appropriate treatment also depends on GPs accurate diagnosis and referral practices. Some studies have assessed the nonneurologist diagnosis either using case scenarios or real cases. Accordingly, the majority of GPs patients sent to hospital by suspected stroke turn to be diagnosed with stroke, but this high "positive predicted value" falls short in cases of less known symptoms/signs (other than hemiparesis or weakness) in non-typical patients (young and without markedly risk factors) and specially in patients with a TIA.[42-44] A TIA may present a golden opportunity for preventing stroke but also tends to be disregarded by the population as a high risk condition and is often misdiagnosed by GPs. Some studies have shown a general lack of knowledge on TIAs and because of the spontaneous resolution of symptoms/signs lay people are less willing to seek hospital care and usually don't connect that episode to a high risk of stroke, even though evidence is scarce and somehow discrepant.[45;46]

A community-based study in Northern Portugal, performed in the city of Porto (urban area) and Vila Pouca de Aguiar and Mirandela (rural area) showed a high stroke incidence, mainly in rural seniors[47] and the highest risk of a stroke within a month after a TIA.[48] Moreover, the study showed that approximately half of rural patients with a first-ever-in-the-lifetime stroke were first examined at the health centre and 5% died without seeking medical help. Despite the fact that most patients were assessed in the first 24h after the episode, why do most patients ignore "an emergent" situation? Do people recognize a stroke? Do they know how to act correctly? What might happen if they seek their family doctor (GP) instead of dialling the emergency number or going to the hospital? And what about the GP practices in a suspected situation of stroke/TIA? How does he act in typical and less typical neurological symptoms/signs? These questions were the major reason for undertaking a community-based study aiming to disclosure lay people and GPs counterparts in pitfalls on acute stroke care.

2 Methods

Viana do Castelo district was chosen to perform this study mainly because it experienced the highest mortality rates by cerebrovascular disease in the 2000-05 period. According to the official mortality statistics, these rates range from 331.2 per 100000 inhabitants in 2000 to 230.0 per 100000 in 2005 (standardized to the European population,172.6 and 107.0), respectively.[49-54] This high mortality could be associated to an overall or specific high incidence rate for any stroke type, inaccuracy of death certificates or flaw in the stroke care chain. All these chain links were under analysis in this study.

Since the National Health Service (NHS) has universal coverage, three health centres (HC) were chosen in order to contact urban (Ponte de Lima, n=34175) and rural (Arcos de Valdevez, n=20377 and Ponte da Barca, n=10248) populations 20 years and older (see Appendix 1). After granting permission from the regional health authorities, in January 2007, the research team had the first meeting with directors and head-nurses of the three health centres (HC) to present the study. It encompassed different activities to examine population awareness, GP's knowledge and ascertainment of patients "clinical pathway" (the continuity and co-ordination of care across different sectors) within the NHS in case of stroke.

2.1 Population survey

HC users were invited to fill in, with the help of the nursing staff, a questionnaire designed by the research team to perceive population knowledge about stroke (see Appendix 2). A sample size of

approximately 1% of the HC lists was judged enough to get a margin of error of 5% for a 95% confidence interval for the population proportion knowing about stroke risk factors, lesion location, characteristic symptoms/signs and action in case of stroke. In order to reach the desired sample size it was planned for two members of the research team to do a monthly intensive data collection day at each HC.

Data was collected during the first semester of 2007, from February to July. Besides demographic data and history of stroke experience, participants were inquired about their knowledge of a) stroke risk factors, b) stroke lesion location, c) stroke warning symptoms/signs, as well as d) their intention of action if they suffered specific stroke warning signs and they suffered a “stroke”, using closed-ended multiple answer questions. The list of vascular risk factors included high blood pressure (HBP), stress, unhealthy diet, smoking, high cholesterol, overweight, family stroke history, insufficient exercising, excessive alcohol intake, diabetes, heart disease, arrhythmia and sedentary lifestyle.[55] For identification of lesion location, 4 options were given: a) brain, b) face, arm, leg, c) heart, d) other location. Stroke warning signs were identified from a list comprising three distinct groups: a) isolate stroke symptoms even when occurring alone (paralysis in hemibody, sudden difficulty in speaking/ understanding/ writing, weakness/difficulty in movement of arms, legs and face, loss of vision in one eye), b) stroke symptoms whenever occurring in combination (imbalance in walking, paralysis in any part of the body, dizziness, vertigo, numbness in a part of the body, loss of consciousness, disorientation, difficulty in swallowing, double vision) and c) other symptoms (chest pain, blurred vision, unexplained falls, shortness of breath, loss of urine and faeces, pain without a specific location, tinnitus). Concerning hypothetic situations of a) dizziness/vertigo, b) numbness in a part of the body, c) speech difficulty, d) weakness/paralysis in hemibody or a situation of “stroke”, respondents were then asked to indicate how they would act (dial emergency number, go to hospital emergency, made an appointment at the health centre - family doctor nurse, self-medication, waiting for it to disappear, or do not know what to do).

Whenever necessary, nurses and interviewers helped survey participants, by explaining the terminology and the aim of specific questions or filling in the questionnaire.

2.2 GP survey

Following a meeting held at each HC to show recent advances on the topic and epidemiological results from a previous survey undertaken in Portugal,[47;48] all GPs working there (n=68) received a questionnaire comprising 16 “real” case scenarios. For each case scenario, they were asked to indicate the most likely diagnosis among four options: stroke, TIA, other transient focal symptoms/signs or other neurological disease, being able to specify the suspicion in the last two options. Following the diagnosis, they were prompted to name the major reasons for choosing the specific option. In a three-month period few answers were received. Thus, another meeting was held at each HC, in which cases were described and projected on screen by a neurologist from the research team, in order to increase their adhesion.

2.3 Incidence study and clinical pathway

Throughout a four-month period, from February to June 2007, all GPs were asked to identify patients with a stroke or TIA by filling a questionnaire with patient socio-demographic characteristics, place and date for the identification and details of the event (date, major symptoms/signs, and suspected diagnosis and CT scan results if available). Within the same time period all other sources of information for events were sought, namely all hospital admissions, either in the emergency department or medical unit (ICD10: 431, 1531, 4359, 25022, 43400, 43401, 43410, 43411) and death certificates. By matching the information for all events identified it was possible to depict the patient pathway within the NHS, namely the "entrance door" and the GPs role in this pathway. Based on a previous stroke and TIA incidence study[47] within this time period about 100 events were expected to happen.

2.4 Data analysis

In order to compare the sample marginal and joint age/gender distributions with the Census 2001 population the chi-square goodness of fit was used. Urban and rural populations were compared using non-parametric tests. A logistic regression model was used to identify independent predictors for a correct action, among socio-demographic characteristics and symptoms/signs recognition. For comparing results from population survey with identical findings from other worldwide studies using the same method, a systematic review was undertaken and results are shown as proportions and respective 95% confidence intervals. (Appendix 3)

The Cochran's Q for multiple matched samples was used to evaluate homogeneity of diagnosis on the 16 case scenarios by the group of participating GPs and another group of 10 neurologists from the Centro Hospitalar do Porto who volunteered to participate in the survey on the 16 case scenarios. This analysis was followed by a Q partition to evaluate GPs and neurologists specific variability.[56] To perform this analysis cases were grouped as "of vascular origin" (stroke and TIA) and "non vascular" (other transient focal symptoms/signs or neurological diseases). The GPs sensitivity and specificity for interpreting vascular acute symptoms were calculated by comparison to a "standard" taken as the more frequent diagnosis (by unanimity or majority) attributed by the group of neurologists. False-negatives and false-positivies for each case scenario are described in terms of frequency, patient's characteristics (age and gender), presence/absence of risk factors, specific symptoms/signs and details of neurological examination. The kappa statistic was used to study agreement according to the standard and the McNemar to study homogeneity of marginal distributions of each GP and the standard, using the binomial distribution.

Incidence of stroke by person-years was calculated based on all data sources (GPs, hospital in-patient and outpatient and death certificates) and is reported as crude rates and age standardized rates to the standard European population. The 95% CIs for incidence were calculated using the

Poisson distribution. Information on death certificates was matched with GPs registries in order to confirm the cause of death.

To analyse clinical pathways all data from the several sources was matched and chronologically-ordered. Beginning with the population action towards the stroke warning sign, three options are depicted. If the patient goes to the hospital/calls the emergency number, it is considered the correct action and treatment option. When HC is chosen, the information about false negatives is used to estimate GP under-recognition of stroke. After GP contact, referral practice for the specific symptom/signs is used to estimate the under-treatment. Whenever other options are taken by participants, like self-medication or waiting to disappear, there is an obvious under-treatment situation. Overall, for three possible combinations of stroke symptoms/signs (hemiparesis/weakness in the hemibody, speech difficulties and numbness, double vision, vertigo/dizziness) the proportion of correct action/treatment, the proportion of GP “failures” and population’s failures are calculated. For those attending HC services, delay between onset and medical observation as well as recurrence are analysed.

For all statistical procedures the null hypotheses was rejected limiting the type 1 error in 0.01. Data analysis was performed using SPSS (Statistical Package for Social Sciences) version 15.0.

3 Results

3.1 Population survey

3.1.1 Population awareness and action towards acute stroke

Between February and July 2007, a total of 663 HC users (1% of the 3 HC user's population) were willing to participate in the study and interviewed, just over 50% from the urban area (52.3%). Concerning population and sample age and gender distributions in both areas, youngest men (18-34 years) are under-represented in contrast with youngest women, though in the rural area women aged 50-64 years are as well over represented (chi-square>57, df=9, p<0.001). Rural respondents are older than urban (chi-square=18.1, df=4, p<0.001), and fewer rural women participated (64.9 vs. 75.2) (Table 1). As expected urban residents are more educated (12.1% with less than 4 years of education vs. 21.2%), and fewer persons are retired (21.2 vs. 31.6%). Knowledge of stroke risk factors was similar in both settings, as well as the number of stroke symptoms identified. In case of stroke, 423 (63.8%) participants would act correctly (dialling the emergency number or going to the hospital), while 18.4% would make an appointment to the family doctor. More persons would dial the emergency or seek hospital emergency services in the urban area (75% vs. 51.6%), whereas in the rural area the other frequent option is the 24h health centre service (23%).

Table 1. Socio-demographic characteristics of respondents and recognition of stroke

	Rural (n = 316)		Urban (n = 347)		All (n = 663)		Test*	
Characteristics	n	%	N	%	N	%	X^2	p
Age (years)†	50.8 (49 - 53)		46.2 (44 - 48)		48.4 (47-50)			
18-34	73	23.1	94	27.1	167	25.2	18.1	0.001
35-49	75	23.7	121	34.9	196	29.6		
50-64	96	30.4	71	20.5	167	25.2		
65-74	41	13.0	41	11.8	82	12.4		
≥ 75	31	9.8	20	5.8	51	7.7		
Gender (% women)	205	64.9	261	75.2	466	70.3	8.5	0.04
Education (years) ‡	4	(4-9)	6	(4-9)	4	(4-9)		
< 4	67	21.2	42	12.1	109	16.4	11.0	0.012
4- 6	158	50.0	193	55.6	351	52.9		
7-11	48	15.2	67	19.2	115	17.3		
≥ 12	43	13.6	45	13.0	88	13.3		
Occupational Status							9.70	0.044
Employed	119	38.4	147	42.7	266	40.7		
Unemployed	20	6.5	31	9.0	51	7.8		
House-wife	59	19.0	77	22.4	136	20.8		
Retired	98	31.6	73	21.2	171	26.1		
Others	14	4.5	16	4.7	30	4.6		
Unknown	6		3		9			
History of stroke experience[(a)]	38	12.0	45	13.0	83	12.5	0.10	0.71
Looked for medical care?[(b)]	6	15.8	9	20.0	15	18.1	0.25	0.62
No of risk factors identified (out of 13) ‡	8 (4 - 11)		8 (5 - 11)		8 (4 - 11)		0.11	0.92
Stroke lesion location							0.51	0.92
Brain	155	49.1	176	50.7	331	49.9		
Face, arm or leg	34	10.8	32	9.2	66	10.0		
Heart	66	20.9	71	20.5	137	20.7		
Others (or do not know)	61	19.3	68	19.6	129	19.5		
No of “correct” symptoms identified (out of 12) ‡	5	(3-8)	5	(3-7)	5	(3-8)	0.76	0.45
No of other symptoms identified (out of 7) ‡	1	(0-3)	1	(1-2)	5	(3-8)	0.73	0.46
Action in case of “stroke”							61.3	0.001
Dial emergency number (112)	122	38.6	165	47.6	287	43.3		
Hospital emergency	41	13.0	95	27.4	136	20.5		
Family doctor (health centre)	62	19.6	60	17.3	122	18.4		
Others	91	28.8	27	7.8	118	17.8		

† Mean (95%CI); ‡ (median, P_{25} – P_{75}) Mann-Whitney (Z)

[(a)] Stroke or TIA in last year in participant or a relative

[(b)] This proportions are calculated for those who have history of stroke experience

3.1.2 Stroke risk factors

HBP by 86.0% (95%CI: 83.3 to 88.6%), high cholesterol by 78.4% (95%CI: 75.3 to 81.6%), followed by overweight, 66.5% (95%CI: 62.9 to 70.1%), excessive alcohol intake, 64.9% (95%CI: 61.2 to 68.5%) and smoking, 61.7% (95%CI: 58.0 to 65.4%) are the more frequently acknowledged vascular risk factors (see Appendix 4). Family history of stroke, sedentarity and arrhythmia are the least recognized, by 40.7% (95%CI: 37.0 to 44.5%), 36.8% (95%CI: 33.1 to 40.5%) and 33.5% (95%CI: 29.9 to 37.1%), respectively. The majority of participants identified at least one risk factor (96.5%) and the number of risk factors identified increased with age (Spearman r=0.17, p<0.001) from a median of 6 for those aged 18 to 44 years to 10 in those 65 years or more. This pattern is expressed in specific risk factors, as arrhythmia identified by 23.5% aged less than 44 years to 50.4% for those over 65 years, heart disease (40.6 vs. 66.2%), diabetes (47.3 vs. 63.9%) and stress (51.7 vs. 69.9%) (linear trend chi-square>11, df=1, p<0.001). Recognition of risk factors was independent of gender, education and residential area.

3.1.3 Stroke lesion location, warning signs and action

Brain as the stroke lesion location is known by 49.9% (95%CI: 46.1 to 53.7%) of participants, 20.7% mentioned the face, arm or leg, 10.0% the heart and 19.5% stated combinations of these or did not answer. Correct answers were similar in men and women and in urban/rural environments, though more educated and younger participants stated the correct answer more often than the remainder (chi-square>30, df=1, p<0.001) (Table 1).

About 95% of participants identified at least one stroke warning symptom/sign. Most identified are paralysis in hemibody, by 64.1% (95%CI: 60.3 to 67.7%), sudden difficulty in speaking, understanding or writing by 60.6% (95%CI: 56.8 to 64.4%) and weakness/difficulty in movement of arm, leg and face by 60.5% (95%CI: 56.6 to 64.2%) and less recognized were difficulty in swallowing by 20.1% (95%CI: 17.1 to 23.4%) and double vision by 18.6% (95%CI: 15.7 to 21.8%) (see Appendix 4 and Figure 3). On the other hand, symptoms/signs not specific of stroke, as chest pain, blurred vision or unexplained falls were stated by 39.4%, 36.2% and 30.0% of participants, respectively. The number of stroke warning symptom/signs and the number of other symptoms/signs identified by the respondents is strongly correlated (Spearman r=0.60, p<0.001).

Overall only 39.7% of participants mentioned simultaneously the three key warning signs – paralysis in hemibody, sudden difficulty in speaking/understanding/writing and weakness/difficulty in movement of arm, leg and face. This knowledge is independent from gender, education and residential area, but increases with age, from 35.2% in participants less than 44 years to 46.6% for those aged 65 years or more (linear trend chi-square=5.4, df=1, p<0.03).

Considering the correct action in case of “stroke” (dialling the emergency number or seeking emergency hospital services), the participants more willing to act correctly are women, young, more educated, from an urban area, and those that know that stroke is a brain attack and think that its warning signs are paralysis in hemibody, speech difficulties, numbness or chest pain (see

Appendix 5). In the multivariate model, the odds for a correct action almost doubles in the youngest and in those who think that numbness or chest pain is a stroke sign and more than triplicates in urban populations. On the contrary, those who think that loss of vision in one eye is a stroke symptom are less likely to act well.

3.2 GP recognition of vascular acute symptoms

From all 68 GPs that received case scenarios, 34 answers were received and since 3 were incomplete, only 31 (45.6%) were analysed.

There was heterogeneity in the diagnosis of the 41 doctors (31 GPs and 10 neurologists) on the 16 case scenarios ($Q=67$, $df=40$, $p=0.004$). Moreover there were no significant differences between the two groups ($Q=2.67$, $df=1$, $p>0.1$) as well as within the neurologists group ($Q=6.2$, $df=9$,$p>0.7$), thus the heterogeneity was among the GPs ($Q=58.5$, $df=30$, $p<0.002$).

Using the neurologists diagnosis as golden standard, the GPs sensitivity in diagnosing stroke/TIA is 79.6% [95% CI: 74.4-84.8], ranging from 55.6% to 100% and specificity is 82.5% [95% CI: 76.0-89.9], ranging from 28.6% to 100% (see Appendix 6). Positive predictive value was 85.4%. The overall agreement was k=61.5% [95% CI: 54.0-68.9], ranging from 23.8% to 100%. The proportion of cases diagnosed as of vascular origin by each GP was not significantly different from the “golden standard” (McNemar test, $p> 0.06$ using the binomial distribution).

GP’s sensitivity is higher for cases describing old patients (age ≥ 70 years) with hemiparesis/weakness in one side of the body and markedly HBP in medical exam (3 cases). This sensitivity decreases whenever speech difficulties are described (4 cases) except for one case where the patient has dysphasia, a previous amaurosis fugax and vascular risk factors (case no. 2). In the remaining two cases with less frequent signs as blurred vision, overall weakness, loss of hearing, numbness, headache, vomiting, ataxia, the false negatives increase to more than 25%, reaching 77.4% (Table 2).

GP’s specificity is 100% in the youngest patient (18 years) presenting “positive” neurological symptoms. Specificity decreases in patients aged 32 to 60 years with no or few vascular risk factors, absence of findings in the medical examination (3 cases). For the remaining 3 cases, describing older patients (≥ 62 years) with several vascular risk factors and abnormal neurological examination, false positives increase to more than 25%, reaching 35.5% (see Appendix 7).

Table 2. Analysis of case scenarios sensitivity (false negatives)

Key case No	Failures n (%)	Age gender	Anamnesis	Symptoms/signs	Medical Exam
Stroke 8	0	85, M	HBP Moderate smoker Fatal stroke family history	Weakness in the left hemibody	Anosognosic; Eyes turn to the right; Left hemiparesis involving face Babinski sign Left hemihypesthesia BP: 176/97mmHg
Stroke 5	1 (3.2)	70, F	Uncontrolled HBP	Found at home fallen Loss of urine	Anosognosic; Eyes turn to the right; Homoninous hemianopia Left hemiparesis involving face Left Babinski sign Absence of meningeous sings Absence of trauma signs BP: 206/132mmHg
Stroke 14	2 (6.5)	72, F	HBP Diabetic Alcoholic	Sudden fall Weakness in the right hemibody Abnormalities of speech	Aphasia; eyes turn to the left ; right Hemiparesis; right Babinski sign BP: 176/128 mmHg Arrhythmic pulse 140 bpm
TIA 2	2 (6.5)	69, M	Smoker Heart disease Coronary by-pass 5 years ago Amarouse fugax 2 years ago in the right eye Absence of migraine history	Colourful dark and shining lines seeing in both eyes "Drunk" sensation Abnormalities of speech	Arcus senillis Aphasia BP: 150/76mmHg Left carotidal murmur
Stroke 3	5 (16.1)	68, M	HBP	1st day Occipital and frontal strong headache 2nd day Dizziness Memory difficulties Abnormalities of speech more than 24 Black seeing in the right hemi-space	Brisk osteotendinous reflexes on the right a week after
TIA 16	6 (19.4)	52, F	Smoker Heart disease Valvular prosthesis Anti-coagulated	Loss of balance Right lip numbness Slurred speech	Neurological and exam was normal BP: 110/70 mmHg Normal cardiac prosthesis sounds Arrhythmic pulse
Stroke 11	8 (25.8)	54, M	HBP Heavy smoker Fatal stroke family history	Headache Vomiting Disequilibrium	Abnormal finger-nose test Ataxic gait BP: 200/100mmHg
TIA 1	9 (29.0)	46, M	Diabetic Smoker	Weakness in both arms and legs: some minutes after could lift the left arm without coordination Dysarthria Full recover two hours after	Neurological exam was normal BP: 148/86 mmHg
TIA 4	24 (77.4)	48, M	Alcoholic Smoker History of tinnitus during months	Blurred vision Overall weakness and could sweating Sudden left loss of hearing Right hemibody numbness	Falling to the left with eyes closed Left horizontal nistagmus Osteotendinous hyperreflexia

3.3 Incidence study

Information on stroke and TIA cases within a four-month period, February/March to June 2007, was obtained by hospital inpatient records (n=74), death certificates (n=59) and patients identified by GPs (n=40). After clinical validation a total of 100 neurological attacks were confirmed: 34 included by GP identification (6 were excluded by diagnoses of stroke sequel or dementia), 30 by death

certificates information and 80 by hospital registries search (some of the patients have more than one source of identification). Considering patients firstly observed by the GP (n=33), both the positive predictive value (PPV) and the referral rate were 81.8%, though the referral rate in confirmed diagnosis was higher (92.6%). Overall 55% of patients went directly to the hospital, increasing this percentage to 90.2% in the urban population (Table 3). Rural patients were more likely to seek the GP first (41.7% vs. 7.3%) and to be identified based on death certificate information (28.8% vs. 2.4%) (X^2 =32, df=5, p<0.001).

Table 3. Characteristics of patients and stroke incidence per 1000 person-years

	Rural (n=59)		Urban (n=41)		All (n=100)		Test*	
Characteristics	n	%	n	%	N	%	X^2	p
Entrance "door"							32.2	<0.001
Hospital(H)***	16	27.1	29	70.7	45	45.0		
H – DC	2	3.4	8	19.5	10	10.0		
HC – H	21	35.6	2	4.9	23	23.0		
HC – H – DC	2	3.4	0	0	2	2.0		
Health Centre(HC)	1	2.7	1	2.4	2	2.0		
Death Certificate(DC)	17	28.8	1	2.4	18	18.0		
Gender (% women)	27	45.8	24	58.5	51	51.0	1.6	0.2
Age, y (quartiles)								
All	82	57;58	75	59;60	80	61;62	Z=-2.6	0.01
Men	79	61;63	72	64;65	76	59;63	Z=-1.9	0.6
Women	86	63;66	80	62;67	84	57;58	Z=-2.6	0.009
Diagnostic							2.3	0.5
Ischemic stroke	32	54.2	20	48.8	52	52.0		
Hemorrhagic stroke	8	13.6	10	24.2	18	18.0		
Undetermined stroke	17	28.8	9	22.0	26	26.0		
Transient Ischemic attack	2	3.4	2	4.9	4	4.0		
Patients assessed at onset day*	36	85.7	36	90.0	72	87.8	3.9	0.4
CT scanning	28	47.5	40	97.6	68	68.0	27.9	<0.001

Stroke incidence (age)/ 1000 person-years**	Rate (No)	IC 95%	Rate (No)	IC 95%	Rate (No)	IC 95%
35-44	0.06 (1)	0.02-3.41	0.96 (2)	0.12-3.48	0.81 (3)	0.17-2.36
45-54	0.00	0.00-2.30	1.22 (2)	0.15-4.39	0.62 (2)	0.07-2.22
55-64	2.50 (4)	0.68-6.41	0.75 (1)	0.02-4.18	1.71 (5)	0.55-3.98
65-74	4.54 (8)	1.96-8.94	9.80 (12)	5.07-17.12	6.70 (20)	4.09-10.34
>=75	25.74 (44)	18.70-34.55	18.44 (22)	11.56-27.92	22.74 (66)	17.58-28.93
All	4.22 (57)	3.20-5.47	3.98 (39)	2.00-3.84	3.50 (96)	2.84-4.28
ASER	1.71	1.33-2.16	1.81	1.44-2.28	1.77	1.48-2.05

H: hospital, DC: death certificate, HC: health centre; ASRE: Aged-standardized rate for the European population;

*Excluding 18 patients identified by death certificates

** No patients aged 0-34 years

***7 of these were also identified by GPs but after going to the hospital

Patients lived mostly in rural areas (59%) and 51% were women. Rural patients are older than urban patients (Z=-2.6, p=0.01), specially women (Z=-2.6, p=0.009). Ischemic stroke was diagnosed in 52% of patients, hemorrhagic in 18%, TIA in 4% and in 26% information on stroke type was missing. The majority of patients (87.8%) were examined within 24 hours after the event and CT scanning was performed in 68.0%, 97.6% in urban and 47.5% in rural patients (X^2 =28, df=1, p<0.001).

The crude overall stroke incidence per 1000 person-years was 3.50 (95% CI: 2.84-4.28), 3.62 for men (95% CI: 2.66-4.82) and 3.40 for women (95% CI: 2.51-4.49). Adjusted to the European population it was 1.77 (95%CI: 1.48-2.05), 2.34 (95% CI: 1.88-2.87) and 1.32 (95% CI: 1.00-1.71), respectively. The crude annual incidence was 4.92 (95% CI: 3.34-4.82) in the rural and 2.81 (95% CI: 2.00-3.84) in the urban population. As expected incidence rate increases with age both in rural and urban settings, 1.71 for 55-64 years old to 22.74 after 75 years. There is an abrupt increase in the age specific incidence in the rural population, 5 times higher for ages 75 years or more, compared to those aged 65-74 years, this ratio not reaching 2 in the urban population.

3.4 Clinical pathway

The final patient pathway is drawn with information from the population study, GP's diagnosis of case scenarios and referral practices, assuming that hospital emergency care is the adequate service in acute stroke. Figure 1 shows that action varies according to stroke warning signs both for patients and GPs; however, independently from the warning symptom/signs, when patients first seek the HC the majority goes to the hospital in the same day. In case of hemiparesis/weakness, the majority of patients seeks hospital emergency care (40.6%), but still action fails predominantly by population unawareness (28.2%). When speech difficulties are "felt" failures are equally likely to happen due to GP or population under recognition (24.3% and 25.6% respectively) and when patients first seek the HC, this failure is more likely to happen in GP's referral practice (41.1%). In case of other less recognized warning signs, like numbness, double vision, vertigo/dizziness, failures are also similarly related both to population unawareness and GP under recognition (35.0% and 21.5% respectively). In two critic cases of inaccurate action (speech difficulties), a patient suffered a stroke outside the study period after a TIA and the other a recurrent stroke.

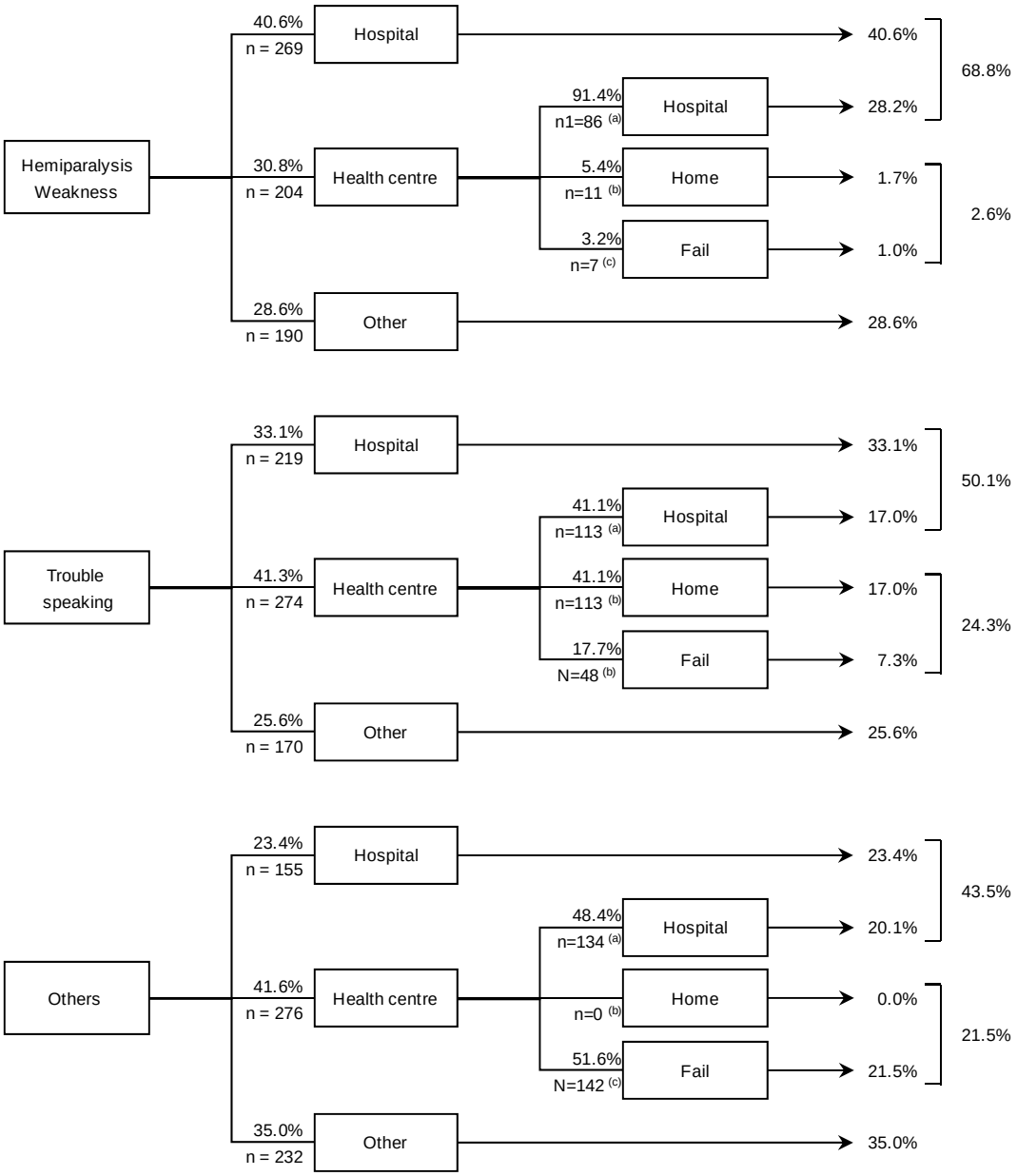


Figure 1. Clinical pathway in acute stroke involving population action and GP recognition/referral practices

(a) Estimated by GP's referral practices (hemiparesis: 17/18; trouble speaking: 3/6; others: 2/2);

(b) Estimated by GP's referral practices (hemiparesis: 1/18; trouble speaking: 3/6; others: 0/2);

(c) Estimated GP's false negatives (hemiparesis: 3/93; trouble speaking: 22/124; others: 32/62)

4 Discussion

This study presents the first evidence on the “stroke care chain” prior to reaching hospital care, pointing out its pitfalls. This chain begins in the population, namely its awareness of risk, knowledge about “what is a stroke” and search for medical help. Since medical help does not always mean “adequate medical care” the patient course within the Portuguese NHS is analyzed, with special emphasis on GP diagnostic skills and referral practices. For drawing this pathway and concluding about its pitfalls multiple sources of information were used: a population survey for knowing about recognition and willingness of action in case of stroke, a study of GP’s accuracy in diagnosing case scenarios of acute neurological symptoms/signs, and a community incidence study for a 4 month-period to know what the community population actually does whenever an incident episode emerges, as well as GP referral practices whenever a patient seeks the HC services. The ascertainment of correct/incorrect clinic pathway follows from matching the population attitude and action in case of specific stroke symptoms/signs together with GP sensitivity and referral practices.

One of the major reasons for undertaking this study in the district of Viana do Castelo was the systematically high mortality rates from cerebrovascular disease compared to all other Portuguese districts. The high incidence of stroke found, 3.50 per 1000 person-years, may explain in part the high mortality rate, but the study showed also that 50% of death certificates stated inaccurately stroke as cause of death. This is probably the major reason for the striking high mortality in the district. The overall incidence was higher than expected in rural areas from the Portuguese Northern region (3.05 per 1000 person-years in ACINrpc[47]), but this might be expected since all incident episodes in the 4-month period were included, while in the ACINrpc study only the first-

ever-in-the-lifetime episodes were registered. This is apparent in the high incidence rate for those 75 years and older in rural populations, 25.7 per 1000 person-years in Viana do Castelo compared to less than 20.2 per 1000 person-years in the ACINrpc rural population. On the other hand, TIA incidence rate (0.15 per 1000 person-years) is lower than expected based on the same study[48] (0.67 per 1000 person years), indicating an under recognition and identification of TIA either by patients or community health services.

Patients residing in rural areas seek more frequently the GP help (41.7% HC services) in case of stroke or TIA than patients residing in the urban area (7.3%). Neither gender, age or even having a previous stroke are associated with this behaviour, indicating that differences in accessibility to hospital services may play an important part in acute stroke care, corroborating results also found in other studies.[44;47;68 48]

Data from the incidence study may be used to compare what people intend to do and what they actually do when symptoms/signs characteristic of stroke are present.

In the population survey 63.8% of participants would go to the hospital/dial the emergency number (112) in a situation of “stroke” compared to 55% of patients who actually sought these services. A similar gap between intended action and actual action is observed for those seeking the GP (HC), 18.4% and 27% respectively, as well as for other action options, 17.8% and 18.0% (considering in this last group those identified only by death certificates in the incidence study). Moreover, the urban population is 3 times more likely to act correctly than the rural population, according both to the population survey and incidence study. The closeness of estimates based on what people intend to do when thinking they have a stroke (independently of its correct meaning) and the actual action when diagnosed with stroke validates answers to the questionnaire. This shows the usefulness of population surveys regarding action in case of stroke, even acknowledging this is merely a hypothetical situation.

Compared with studies undertaken in other countries, action in Portugal is only tailed by 3 studies undertaken in Germany,[33] California[69] and Minnesota[70] with less than 60% of participants seeking hospital in case of stroke (Figure 2). Participants of the Switzerland[36] study act alike Portuguese participants, but in the seven remaining studies involving USA,[32;37;69] Brazil,[38] China[40] and Arab populations,[71] more than 70% of participants act well. In the Portuguese study, as in most studies worldwide, the youngest and highly educated are more likely to act correctly. Access to health literacy, using widespread sources of information (TV, Internet, etc…) may well explain why these population groups “state” a correct action in case of stroke.

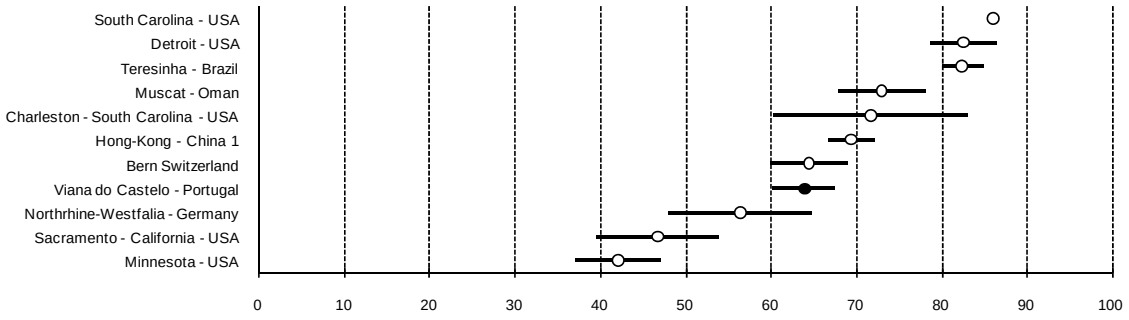


Figure 2. Correct action (hospital/emergency number) in case of "stroke" in worldwide studies using the same methodology

In this study people thinking "inaccurately" that numbness or chest pain are stroke symptoms are more likely to act well in contrast with those that think loss of vision in one eye is a stroke symptom, which indicates an inconsistency between knowledge and intended action. The study undertaken in Minnesota-USA[70] shows the best recognition/knowledge of warning symptoms/signs as well as the worst action since only 42% of participants would dial the emergency number (Figures 2 and 3). Inconsistencies regarding knowledge and action are mentioned in other studies.[70;72] In the Hong-Kong population[72] a timely arrival to hospital was not related to knowledge of stroke symptoms/signs but rather to "impaired consciousness", while a delayed arrival was associated with believing on a long lasting disability as a consequence of stroke.

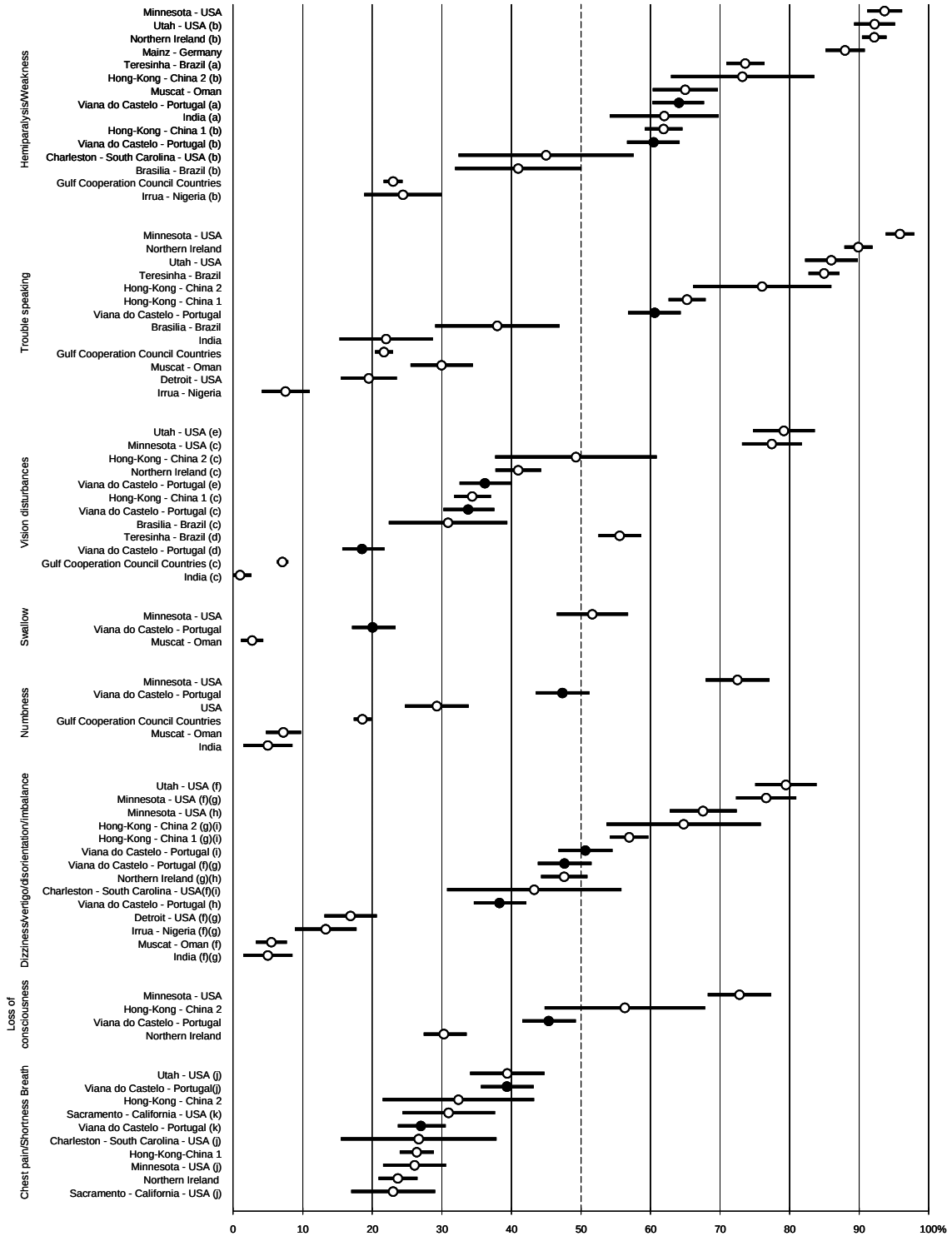
Having in mind that not always a correct action is more likely in knowledgeable persons, together with inconsistencies emerging from the knowledge-action association, we believe that acknowledged correct information and beliefs have an important counterpart in explaining action in stroke.[73] This action might not be associated with a "correct" identification of a symptoms/signs characteristic of stroke but rather with the severity "attributed" by the person to that symptom/sign, even if not acknowledged as resulting from experiencing a stroke.

Although the population survey was not preceded by a public campaign on stroke, 95% of participants mentioned at least one stroke warning symptom/sign. Hemiparesis/weakness and trouble speaking, the most publicized in public campaigns like *FAST*,[35] were recognized by 64.1/60.5 and 60.6%, respectively. These are far the most recognized in worldwide studies, by 93.5% of participants in the Minnesota study,[70] but still most people tend to ignore it, as shown in the study undertaken in Nigeria[74](Figure 3). For trouble speaking (7.6-95.9%), visual disturbances (1.0-79.2%) and vertigo/dizziness/confusion/imbalance (5.0-79.5%) recognition is widely spread. Studies with a consistent well informed population were undertaken in Minnesota-USA,[70] Utah-USA[75] and Northern Ireland[26] while in Irrua-Nigeria,[74] Gulf Cooperation Council Countries,[76] India[21] and Muscat-Oman[71] participants were consistently less well informed. The results mirror the relative importance of stroke in these countries[2] and the consequent emphasis/lack of public health information. Contrasting the overall pattern of responses across studies, Portuguese participants disregard visual disturbances but, on the other hand, emphasise blurred vision (a non-stroke symptom). Most studies used also symptoms/signs not characteristic of stroke to evaluate the

general tendency to mark an excessive number of listed items. In the Portuguese study there was a high correlation (0.60) between the numbers of correct and incorrect symptoms/signs marked, showing the expected tendency. Chest pain and shortness of breath were recognized as a stroke warning symptom/sign by 25 to 40% of participants in the studies reviewed and the Portuguese estimates are near the upper limit (39.4 and 27.0% respectively), only exceeded in the Utah-USA study. The “incorrect” resemblance of acute symptoms of a “heart attack” and stroke is also present when 20.7% of participants indicate the heart as the stroke lesion location compared to 49.9% indicating the brain. This may result from mixing-up terminology, since “infarction” is used both to brain and heart attack, being the last, more frequently and more frequently dealt in public campaigns.

While signs and symptoms may present more specific wording not accessible to specific population strata, vascular risk factors are more generally acknowledged and discussed with GPs or targeted in prevention campaigns. Therefore is not surprising that more than 50.0% of study participants recognized traditional vascular risk factors, such as HBP (86.0%) or high cholesterol level (78.4%). Others are less well known as arrhythmia, sedentarity or stroke family history, only mentioned by less than 41.0% of participants. The recognition of vascular risk factors in worldwide studies follow the pattern described previously for stroke symptoms/signs. HBP is the most recognized, especially by the Utah-USA[26] and Mainz-Germany[26] populations (95.0%), nevertheless only by 23.0% of the Gulf Cooperation Council Countries[76] population. As also happens in other studies[33;38;40;72;75] there is a homogenous over recognition in the Portuguese study while in the Gulf Cooperation Council Countries,[76] there is an homogenous under recognition.

The recognition of stroke risk factors and warning symptoms/signs in this study is independent of gender, education and residential area, but both the number of risk factors and major symptoms/signs identified increased in those aged 65 years or more. Studies showing either high (Minnesota-USA and Northern Ireland) or low recognition levels[71;74;76] reported an indirect relation between recognition and age and/or direct relation to educational level. Other factors as having a more active lifestyle,[75] having a medical career, being confident in community health services or interested in stroke, having previous experience of myocardial infarction[70] as well as previous experience of stroke (personal or in a relative),[26] have been associated to relatively good recognition patterns. The association with gender is inconsistent, usually confounded by education level, since the more informed, either men or women, are as well the more educated.[71;72;74;75] The contrasting age effect in our study compared with the remainder might be related to the high prevalence of vascular risk factors in the Portuguese population. According to the 4th National Health Inquiry 2005/2006, more than 50% of persons aged 75 years or more has HBP and more than 17% has diabetes. HBP is also the main reason for medications prescribed, followed by drugs to lower cholesterol levels.[77]



Legend: (a) hemiparesis, (b) weakness, (c), loss of vision, (d) double vision, (e) blurred vision, (f) dizziness, (g) vertigo, (h) disorientation, (i) imbalance, (j) chest pain, (k) shortness of breath.

Figure 3. Recognition of stroke warning symptoms/signs in worldwide studies using the same methodology

Nevertheless, other studies showed that recognition of vascular risk factors was no better in persons at risk compared with persons not at risk[10;21] and in some studies the reverse pattern was found.[26;74;75] The high awareness of cardiovascular risk factors among the eldest may result from

the constant prescription and information given to patients by health professionals, being this hypothesis supported by the fact that the Minnesota-USA study involving a sample of high risk persons showed a steady high recognition of warning symptoms/signs when compared to other studies in the review (Figure 3). Better knowledge in population strata with the specific risk factor was also found in a study undertaken in Porto, though using open-ended followed by closed-ended questions.[78] Still, recognition of stroke warning symptoms/signs was no better among persons who had a previous experience or family history of stroke,[70] may be because stroke is less known and treatment is not a question of prescribing medication, as for most vascular risk factors.

Since it was shown that correct action - going straight to hospital/dialing emergency number - is not as frequent as desired, knowing the GP expertise in diagnosing stroke/TIA is crucial since his role acquires more importance than could be previously expected. Data on 16 case scenarios classified by GP as of vascular (Stroke/TIA) or non-vascular origin showed that GP sensitivity and specificity was 79.6% and 82.5%, respectively, and overall agreement with diagnosis made by a group of neurologists (unanimity or majority) was 61.5%. Sensitivity was particularly high (93.5 to 96.8%) for typical stroke cases describing an old patient with vascular risk factors presenting weakness/hemiparesis and anosognosia. The sensitivity decreases in cases describing less old patients (<60 years of age) presenting only visual or speech abnormalities, more frequently cases of TIA, reaching values between 71.0 and 80.6%. Other studies assessing the accuracy in diagnosing stroke mentioned that classic symptomatic patients with vascular risk factors and apparent signs present in medical/image examination are the more frequently identified.[79;42] Less frequent symptoms/signs in patient anamnesis are still misdiagnosed by other primary or secondary neurological disorders,[42] conditions that mimic acute stroke as, cerebral tumor, subdural hematoma, seizure and benign paroxysmal posture vertigo. The “sudden” appearance of symptoms/signs is sometimes disregarded and impaired speech and/or visual disturbances are not fully understood in the context of “stroke”.

To our knowledge this is the first study to address formally GP accuracy in diagnosing stroke, although a few studies[42;43] have examined the positive predictive value (PPV) of GP diagnosis and more commonly his referral practices. The estimate of PPV found in the incidence study was 81.8%, slightly lower than pervious reported in a Portuguese study,[42] in which 85.4% of GPs diagnosis were confirmed by neurologists, but higher than the 70.8% found in a UK study.[80] The PPV decreases to 69.2% in studies involving patients referred to hospital with TIA diagnosis.[43] In the two Portuguese studies, the proportions of “suspected” stroke and TIA cases referred to the hospital were 30 and 50% respectively,[42;43] while in this study 81.8% of all “suspected” cases (stroke/TIA) were referred to hospital.

Based on population action and GPs accuracy/ management it was possible to estimate pitfalls in the acute stroke care chain. Both GP and population action are different according to stroke warning symptoms/signs, indicating that recognition of stroke symptoms or their evaluation as being related to a serious medical condition may explain action, even though in the population survey knowledge does not appear as a systematic reason for correct action. Based on the pre-

hospital clinical pathway both the population and GPs are more sensitive to sudden weakness in the hemibody or hemiparesis compared to the other stroke warning symptoms/signs. Whenever one or both are present, 40.6% of the population would go straight to hospital, contrasting with 33.1% and 23.4% in case of speech problems or other warning symptoms/signs respectively. In the same way, GPs would correctly diagnose 96.8% of cases, referring 94.4% of these to hospital. Thus, pitfalls in pre-hospital acute stroke care are more likely in patients presenting symptoms/signs other than weakness/hemiparesis, especially those resolving in less than 24 hours (TIA).

In case of the most important well recognized stroke symptoms/signs (hemiparesis/weakness) the system falls short mainly because 28.8% would be disregarded by the population (fail in recognition), compared with just 2.6% in care delivery. For less acknowledged symptoms/signs as speech problems, GPs practicesplay a more important part since 21.5-24.3% of cases would be inadequately cared and 25.6% would be misrecognized by the population. For other symptoms/signs these proportions are 21.5 and 35.0% respectively.

Study Limitations

Considering the possible limitations of this study, differences in the distribution of registered patients and those of the population residing in the corresponding geographical area are irrelevant, since the National Health Service (NHS) has universal coverage. The under representation of youngest men and the over representation of middle aged women in the sample is a fact, following nevertheless the usual costumers age/gender pattern in general practice.[81;82] The sample also reflects the willingness of voluntary participation, but overall rural/urban characteristics are accordingly represented in the older and less educated rural participants contrasting with the younger and more educated urban participants. The three villages selected represent the rural/urban counterparts existing in this district, though a typical urban setting, as the district capital, has not been included in the study.

The questionnaire design presenting a check list both for risk factors and stroke warning symptoms/signs was chosen because recognition is easier than recall, controlling at the same time for possible memory lapses characteristic of recall bias, especially in older populations. An over-recognition common to tasks with a checklist was expected based in the literature but otherwise the same problems would emerge by a general under recognition.[83] The objective addressed is the existence of a differential recognition bound to emerge by comparison across the risk factors and/or symptoms/signs listed. This contrast emerged in specific items, both in the less common risk factors and confounding symptoms/signs more characteristic of other diseases.

The questionnaire was designed to explore knowledge of more common stroke characteristics, although other relevant questions could be included, as a) whether stroke is a medical emergency, b) whether the person may benefit from an existent treatment, c) whether post-stroke disability is permanent and questions regarding a timely action more characteristic of TIA episodes.

Nevertheless the questionnaire would be quite more extensive and long questionnaires are more prone to frequent missing information and low adhesion.

Case scenario studies and identification of stroke cases in community incidence studies suffer important limitations since they rely heavily on GPs adhesion. GPS willingness for studying case scenarios was low (45.6%), compared to a study undertaken in Australia[79] (60%). Portuguese GPS were rather reluctant, since the case-scenarios questionnaire was anonymous to promote their adhesion and considering that this low number was achieved after the research team organized a meeting for this purpose. Based on the reduced number of patients identified, mainly because of the reduced time-span of the study, estimates of GPs referral practices may be quite misleading. Anyhow referral practices indicate that about 80% of patients are referred to hospital. This was not a specific objective of the study and perhaps a future study addressing this question will obtain more sound results. Possible bias resulting from differences in volunteer/non-volunteer GPs as well as volunteer/non-volunteer persons was not analysed. The non-respondents in the survey were not listed, since information was collected in different ways and by different interviewers and usually non-respondents did not want to provide basic information (age, gender, etc…).

Other information could have been collected in order to estimate the proportion of people who would seek timely hospital treatment (within 4.5 hours after symptom onset). The routine information used in the incidence study (hospital inpatient register) did not mention time from symptom onset and arrival at the Hospital. Overall more reliable results would have been achieved if the study time-span was increased and patients were identified by all medical staff attending the populations surveyed.

Implications

The present study showed pitfalls in the stroke care chain as well as the inconsistency between knowledge and action, either in intended action (population survey) or actual action (incidence study). Moreover there are no factors consistently associated to action, so it is difficult to purpose meaningful strategies on this basis. Perhaps this is why current educational campaigns that focus mainly on knowledge and specific population strata are ineffective. Therefore different strategies to inform people and GPs about stroke must be undertaken. Broadcasted messages should emphasize that there is an effective treatment for stroke inherently dependent on timely action, adding to this message the major warning symptoms/signs. This way we may increase the probability of a successful recovery/rehabilitation.[68] Even if there is a spontaneous recover of symptoms/signs within an hour or even a shorter time period, the high risk of stroke still exists. Medical help in this situation may prevent a more serious condition and immediate preventive actions are advisable.[23;84-86] Since these patients are more likely to seek the GP first, it is important to improve GP skills to recognize these patients and understanding the indications for their emergency referral.[87] To shorten acute stroke care chain, lay population and doctors counterparts are equally important and any action to improve stroke care should not disregard any of them.

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APPENDIXES

Appendix 1

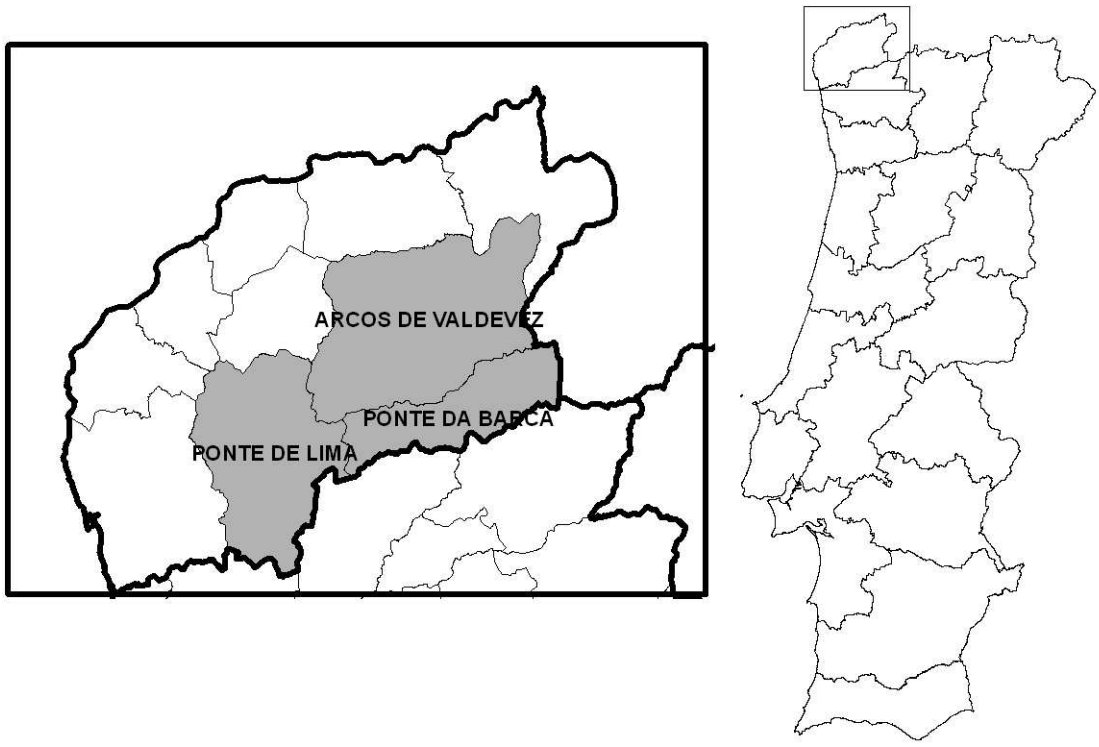

Figure A1. Map of Portugal mainland showing urban and rural areas within Viana do Castelo District

Appendix 2

Questionnaire used in population survey

Nome: .....

Centro de Saúde: .....

Médico de Família: .....

Acidentes Neurológicos

Nº Utente: ☐☐☐ ☐☐☐ ☐☐☐ Código: ☐☐-☐☐☐☐

Data Nascimento: ☐☐/☐☐/☐☐☐☐ Idade: ☐☐ Sexo: ☐ Fem ☐ Masc

Escolaridade Completa (anos): ☐☐

Situação Profissional: ☐ Remunerado Activo ☐ Activo ☐ Desempregado
☐ Doméstica ☐ Reformado ☐ Outro
Qual: .....

Profissão: .....

Data: ☐☐/☐☐/ 2007 Hora: ☐☐:☐☐ Local: .....

POR FAVOR COLOQUE UMA CRUZ NO QUADRADO À DIREITA DAS RESPOSTAS ESCOLHIDAS

Qual é o local do corpo onde se localiza a lesão que provoca o AVC/ a trombose/ o derrame?

☐ Cérebro ☐ Cara, braço, perna ☐ Coração ☐ Outro. Qual? .....

Da lista seguinte de sintomas e sinais, quais podem indicar a ocorrência de um AVC?

☐ Visão enevoada
☐ Visão dupla
☐ Perda de visão num olho (metade do campo visual)
☐ Vertigem/Tontura
☐ Dor/Opressão no peito
☐ Dor sem localização específica
☐ Adormecimento/Formigueiro em qualquer parte do corpo
☐ Falta de ar
☐ Perda de força/dificuldade no movimento dos braços, pernas ou face.
☐ Paralisia em metade do corpo
☐ Paralisia em qualquer parte do corpo
☐ Dificuldade súbita em falar, entender ou escrever
☐ Desequilíbrio no caminhar
☐ Perda de urina ou fezes
☐ Desorientação
☐ Quedas sem saber porquê
☐ Dificuldade em engolir
☐ Perda de sentidos (perda de consciência)
☐ Zumbidos
☐ Não sei

Da lista seguinte de características ou factores, quais aumentam o risco de ocorrência de um AVC?

☐ Hipertensão arterial
☐ Stress
☐ Má alimentação
☐ Ser fumador
☐ Colesterol Elevado
☐ Excesso de peso
☐ Ter familiares com AVC
☐ Falta de exercício físico
☐ Consumo excessivo de álcool
☐ Diabetes
☐ Doença do coração
☐ Arritmia
☐ Vida sedentária
☐ Não sei

O que faria se tivesse um dos sintomas?

	Tonturas Vertigem	Visão Enevoada Visão Dupla	Adormecimento Formigueiro no corpo	Dificuldade na fala	Fraqueza Paralisia	Dor de cabeça
Ia ao médico de família	☐	☐	☐	☐	☐	☐
Ia à consulta de enfermagem	☐	☐	☐	☐	☐	☐
Esperava que desaparecessem	☐	☐	☐	☐	☐	☐
Chamava o 112 ou os bombeiros	☐	☐	☐	☐	☐	☐
Ia à urgência do hospital	☐	☐	☐	☐	☐	☐
Ia à urgência do centro de saúde	☐	☐	☐	☐	☐	☐
Automedicava-me	☐	☐	☐	☐	☐	☐
Não sei	☐	☐	☐	☐	☐	☐

O que faria se suspeitasse que estava a ter um AVC?

- ☐ Ia ao médico de família
- ☐ Ia à consulta de enfermagem
- ☐ Esperava que desaparecesse
- ☐ Chamava o 112 ou os bombeiros
- ☐ Ia à urgência do hospital
- ☐ Ia à urgência do centro de saúde
- ☐ Não sei

No <u>último ano</u> aconteceu a si ou a algum familiar alguma das seguintes situações?
(assinale com um cruz todas as que se aplicam)

	A si próprio	A um familiar
1. Um médico disse que tinha tido um AVC, uma trombose, uma embolia ou um derrame cerebral?	☐	☐
2. Um médico disse que tinha tido um pequeno AVC (mini AVC), um Acidente Isquémico Transitório (AIT) ou um espasmo cerebral?	☐	☐
3. Teve uma paralisia súbita e sem dor num dos lados do corpo?	☐	☐
4. Teve perda de sensibilidade súbita de um lado do corpo ou sentiu um dos lados do corpo como morto ou adormecido?	☐	☐
5. Teve uma perda súbita e sem dor da visão de um ou dos dois olhos?	☐	☐
6. Perdeu subitamente metade da visão?	☐	☐
7. Perdeu subitamente a capacidade de perceber o que as pessoas diziam?	☐	☐
8. Perdeu subitamente a capacidade de falar ou escrever?	☐	☐
9. Ficou desorientado na rua?	☐	☐
10. Teve tonturas/vertigens?	☐	☐
11. Perdeu os sentidos (ficou inconsciente)?	☐	☐

Se esteve em alguma destas situações, recorreu a algum médico? ☐ Sim ☐ Não

Se sim, qual?..... Data: ☐☐/☐☐/☐☐☐☐

Appendix 3

Systematic Review on stroke awareness

Methodology

In order to discuss data from population survey on stroke awareness, a systematic review of indexed articles about population stroke awareness/knowledge was performed. References were identified by searches of PubMed from 1994 until December 2008 using the terms “stroke” AND “awareness” [title] and “stroke” AND “knowledge” [title]. Only articles published in English, Spanish and Portuguese were reviewed. Inclusion criteria covered studies that examined lay people knowledge of stroke concerning symptoms/signs, risk factors, stroke lesion location and hypothetic action towards a stroke or stroke symptoms/signs. In order to compare the frequency of these answers data collection should be performed using a recognition task with closed-ended questions, instead of a naming task with open-ended questions. Exclusion criteria included non-comparable studies concerning: a) the absence of assessment of the issues stated in inclusion criteria, b) assessment of stroke awareness through observation of behaviour instead of knowledge, c) open-ended collecting data strategies, d) inclusion of children in the sample, e) comparison of two or more groups without a global frequency of answers, f) non comparable values concerning the frequency of answers (e.g. scores). Following the literature search, relevant articles were identified and retrieved and data was extracted. Assessments of the quality of studies were undertaken, using a structured approach by adopting the quality criteria used in systematic review methodology and criteria concerning the presence of numeric values of stroke symptoms/signs, risk factors recognition as well as action towards a situation named “stroke” and towards some stroke symptoms/signs. Decisions were reviewed in a process of critical scrutiny. Disagreement was resolved by discussion. The initial search concerning terms and articles references yielded 100 studies, although only 21 were found to meet the inclusion criteria. The selected studies ranged from 1999 to 2008 (Table A1). Out of the 21 studies, 7 were from the United States of America and published in 2008. One study was an intervention study that described the efficacy of a public education campaign.[33] Data from this study referred to pre-test. In the two studies that compared data from hospital patients and community groups, data was selected from community screening samples.[32;88] A total of 50032 persons included the overall studies of the review, increasing to 50695 with the present study’s data.

Table A1. Characteristics of the studies included in the systematic review

City - Country, Year	N	Age		% Women	RF†	WS†	Action†
		Mean	SD				
Hong-Kong-China1, 1999[40]	1238	37.7	---	49.4	X	X	X
Northrhine-Westfalia - Germany, 2000[39]	133	65.3	11.2	43.2			X
Hong-Kong - China2, 2001[72]	108	71.5	9.3	40.0	X	X	
United Kingdom, 2002[89]	410	78.0	9.2	48.5	X		
Sacramento-California - USA, 2003[32]	186**	---	---	---			X
Detroit - USA, 2003 [37]	379	64.2	10.3	73.1			X
Utah - USA, 2003 [75]	322	---	---	39.1		X	
Northern-Ireland, 2003 [26]	892	---	---	58.6	X	X	
Minnesota - USA, 2003 [70]	364	51.6	---	53.0	X	X	X
Muscat - Oman, 2006 [71]	400	57.0	9.5	47.5	X	X	X
India, 2007 [21]	147	59.7	14.1	33.3	X	X	
Bern - Switzerland, 2007 [36]	422	45.0*	---	58.0			X
Teresinha - Brazil, 2007 [38]	991	56.7	11.9	69.0	X	X	X
Germany, 2007 [34]	1483	47.0	---	43.2	X		
Irrua - Nigeria, 2008 [74]	225	58.0	11.7	57.3		X	
Gulf Cooperation Council Countries, 2008 [76]	3750	---	---	50.5	X	X	
South Carolina - USA, 2008 [90]	36150	---	---	7.3			X
Mainz - Germany, 2008*** [33]	507	53.1	15.0	55.6		X	
Charleston - South Carolina - USA, 2008 [69]	60	29.0	7.6	42.0		X	X
Brasilia - Brazil, 2008**** [88]	113	49.0	---	44.3	X	X	
New York - USA, 2008***** [91]	1789	---	---	65.0			X

RF – risk factors; WS – warning symptoms/signs

† Only comparable items, using closed-ended question design

*Median

**Community screening sample

***Pre-test sample

**** Park Group

***** Asks action in case of specific stroke symptoms/sings; not comparable

Appendix 4

Table A2. Recognition of stroke risk factors

	Identification		
Risk Factors	n	%	95% IC
High blood pressure(HBP)	570	86.0	83.3-88.6
High cholesterol	520	78.4	75.3-81.6
Overweight	441	66.5	62.9-70.1
Excessive alcohol intake	430	64.9	61.2-68.5
Smoking	409	61.7	58.0-65.4
Insufficient exercising	392	59.1	55.4-62.9
Heart disease	376	56.7	52.9-60.5
Stress	375	56.6	52.8-60.3
Diabetes	370	55.8	52.0-59.6
Unhealthy diet	300	45.3	41.4-49.0
Stroke family history	270	40.7	37.0-44.5
Sedentary	244	36.8	33.1-40.5
Arrhythmia	222	33.5	29.9-37.1

Table A3. Recognition of stroke warning symptoms/signs

	Knowledge		
Symptoms/signs	n	%	95% IC
Stroke symptoms/signs			
Paralysis in hemibody	425	64.1	60.3-67.7
Sudden difficulty in speaking, understanding, writing	402	60.6	56.8-64.4
Weakness/difficulty in movement of arm, leg, face	401	60.5	56.6-64.2
Imbalance in walking	336	50.7	46.8-54.6
Paralysis in any part of the body	332	50.1	46.2-53.9
Dizziness, Vertigo	316	47.7	43.8-51.5
Numbness in a part of the body	314	47.4	43.5-51.2
Loss of consciousness	301	45.4	41.6-49.3
Disorientation	254	38.3	34.6-42.1
Loss of vision in one eye	224	33.8	30.2-37.6
Difficulty in swallowing	133	20.1	17.1-23.4
Double vision	123	18.6	15.7-21.8
Other symptoms/signs			
Chest pain	261	39.4	35.7-43.2
Blurred vision	240	36.2	32.6-40.0
Unexplained falls	199	30.0	26.5-33.5
Shortness of breath	179	27.0	23.7-30.6
Loss of urine or faeces	110	16.6	13.9-19.7
Pain without a specific location	106	16.0	13.3-19.1
Tinnitus	93	14.0	11.4-16.7

Appendix 5

Table A4. Correct Action in stroke occurrence

	Correct action – Dial 112 or hospital emergency			
	Univariate model		Multivariate model	
Socio-cultural factors and Recognition of symptoms/signs	Odds ratio	95% CI	Odds ratio	95% CI
Gender				
Female vs. Male	**1.46**	1.03 to 2.07	1.13	0.76 to 1.68
Age (years)				
18-44 vs. ≥ 65	**2.13**	1.38 to 3.29	**1.93**	1.16 to 3.23
45-64 vs. ≥ 65	1.24	0.80 to 1.92	1.28	0.78 to 2.10
Education (years)				
6-11 vs. <6	**1.93**	1.33 to 2.80		
≥ 12 vs. <6	**2.02**	1.19 to 3.46		
Health centre (predominant area)				
Urban vs. Rural	**3.27**	2.32 to 4.61	**3.47**	2.37 to 5.07
Previous Stroke/AIT experience				
Yes vs. No	1.36	0.80 to 2.28	1.22	0.69 to 2.15
Stroke lesion location				
Brain vs. Others	**1.41**	1.02 to 1.96	1.37	0.93 to 2.01
Stroke warning signs[(a)]				
Paralysis in hemibody	**1.68**	1.20 to 2.35	1.51	0.96 to 2.37
Difficulty in speaking, understanding, writing	**1.78**	1.28 to 2.48	1.37	0.87 to 2.15
Weakness/difficulty in moving arm, leg, face	1.25	0.90 to 1.74	0.88	0.56 to 1.38
Imbalance in walking	1.25	0.90 to 1.73	0.99	0.63 to 1.55
Paralysis in any part of the body	1.27	0.92 to 1.76	0.88	0.59 to 1.32
Dizziness, vertigo	1.17	0.84 to 1.62	0.89	0.58 to 1.34
Numbness in a part of the body	**1.85**	1.33 to 2.59	**1.84**	1.22 to 2.78
Loss of consciousness	1.35	0.97 to 1.88	1.21	0.80 to 1.84
Disorientation	1.29	0.92 to 1.81	1.20	0.76 to 1.91
Loss of vision in one eye	0.78	0.56 to 1.10	**0.52**	0.34 to 0.80
Difficulty in swallowing	1.18	0.78 to 1.78	1.22	0.71 to 2.10
Double vision	1.43	0.92 to 2.23	1.24	0.72 to 2.13
Other symptoms/signs[(a)]				
Chest pain	**1.51**	1.07 to 2.12	**1.71**	1.13 to 2.60
Blurred vision	1.24	0.88 to 1.75	1.05	0.69 to 1.62
Unexplained falls	1.14	0.80 to 1.63	0.90	0.56 to 1.44
Shortness of breath	0.98	0.68 to 1.42	0.65	0.41 to 1.04
Loss of urine or faeces	1.07	0.69 to 1.66	0.93	0.55 to 1.59
Pain without a specific location	1.56	0.97 to 2.50	1.64	0.94 to 2.87
Tinnitus	1.18	0.73 to 1.92	0.93	0.50 to 1.74

[(a)] Odds of correct action in those indicating that is a stroke symptom vs. those not indicating

Appendix 6

Table A5. Comparison between the golden standard and GPs diagnosis

GPs Diagnosis	Golden Standard				All	
	Vascular		Non-vascular			
	n	%	n	%	N	%
Vascular	222	79.6	38	17.5	260	52.4
Non-vascular	57	20.4	179	82.5	236	47.6
All	279		217		496	

Statistic	Value	95% CI
Kappa	0.62	0.54 to 0.68
Sensitivity	0.80	0.76 to 0.83
Specificity	0.83	0.78 to 0.86
Predictive value positive[†]	0.85	0.82 to 0.89
Predictive value negative[†]	0.79	0.72 to 0.79

[†]Admitting the rate of an acute neurological condition seen by the GP is 7/9=0.78

Appendix 7

Table A6. Analysis of case scenarios specificity (false positives)

Key Case No	Failures n	(%)	Age gender	Anamnesis	Symptoms/signs	Medical Exam
Migraine with aura 15	0		18, F	Headache history without visual or sensitive complaints	Visual changes: things shaking and shinning lights in right hemicamp seeing Right hemiface and right arm and leg numbness Biparietal "vibrating "headache during 24 hours with nausea and fonophotophobia	Five days after the event Neurological exam was normal
Seizure 13	1	(3.2)	57, F	Smoker	Multiple attacks in two weeks and half : - Left shoulder and left mouth side numbness during maximum 1 minute each attack Absence of muscle weakness	Neurological exam was normal BP: 160/9 mmHg
Seizure 12	3	(9.7)	55, F	Absence of vascular disease history	Three attacks: - First: loss of consciousness while driving followed by aphasia during 30 minutes. Only remembers laying near the car after the accident. Some hours after, strong headache. - Second and third: dissociation from environment sensation followed by dysphasia, during 10 to 20 minutes	Neurological and overall medical exam was normal
Partial Seizure 10	5	(16.1)	33, M	Smoker Unknown history of diseases	While being in the toilet, felt shrinkage of left arm sensation, followed by amnesia during 3h30m (interacts with others but shows confusion)	Seven days after the event Neurological and overall medical exam was normal
Isolated vertigo 6	8	(25.8)	62, M	Smoker Previous vascular surgery Intermittent claudication	Four attacks while driving: strong vertigo during 10 to 20 seconds (unrelated to neck movements)	Absence of neurological focal symptoms/signs BP: 146/68mmHg
Partial Seizure 9	10	(32.3)	66, M	Systolic HBP Ischemic cardiac disease Peripheral vascular disease	While rising from the chair: strong right arm shaking during seconds, followed by loss of consciousness with recovery Absence of tongue biting or incontinence	Acute left and soft right carotidal murmurs Bilateral femoral murmurs Regular pulse BP: 215/88mmHg in both arms
Cerebral Hypoperfusion 7	11	(35.5)	70, F	Smoker Diabetic Myocardial infarction two weeks before Stroke in vertebrobasilar territory 6 years before	12 attacks: Gelatine sensation in all body while standing, followed by imbalance and dysphasia. Sensations unrelated to neck nor head position or arm movement	Absence of neurological focal symptoms/signs Regular pulse, not diminishing in orthostatic position Soft systolic, bilateral carotidal and subclavius murmurs Left femoral murmur BP: 180/70mmHg diminishing to 160mmHg while staring