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Sex Differences in Stroke Incidence, Prevalence, Mortality and DALYs: Results from the Global Burden of Disease Study 2013

A full list of authors and affiliations appears at the end of the article.

Abstract

Background—Accurate information on stroke burden in men and women are important for evidence-based health care planning and resource allocation. Previously, limited research suggested that the absolute number of deaths from stroke in women was greater than in men, but the incidence and mortality rates were greater in men. However, sex differences in various metrics of stroke burden on a global scale have not been a subject of comprehensive and comparable assessment for most regions of the world, nor have sex differences in stroke burden been examined for trends over time.

Corresponding author: Suzanne Barker-Collo, PhD, School of Psychology, level 6, 10 Symonds Street, The University of Auckland, Private Bag 92019, Auckland, New Zealand. s.barker-collo@auckland.ac.nz.

*GBD Stroke Expert Writing Group members listed at the end of the paper

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GBD Stroke Expert Writing Group members (in alphabetical order by country)

Argentina (Maria Cecilia Bahit); **Australia** (Amanda Thrift, Atte Meretoja, Bill Stavreski, Craig Anderson, Edwin Pearse, Geoffrey Donnan, Graeme Hankey, Mark T. Mackay, Stephen Davis, Zanfina Ademi); **Austria** (Michael Brainin); **Azerbaijan** (Tural Guliyev); **Bahrain** (Randah R. Hamadeh); **Barbados** (Heather Harewood, Karen Springer); **Brazil** (Iuri da Costa Leite, Jefferson Gomes Fernandes, Norberto Cabral, Paulo Lotufo); **Bulgaria** (Klara Dokova); **Canada** (Farshad Pourmalek, Luciano A. Sposato, M. Patrice Lindsay, Patricia Riccio); **Chile** (Pablo M. Lavados); **China** (Bin Li, Chuanhua Yu, Guohong Jiang, Jixiang Ma, Maigeng Zhou, Ming Liu, Shankuan Zhu, Wenzhi Wang, Xiaofeng Liang, XXX Deji, Yong Zhang); **Colombia** (Gabriel Alcalá-Cerra, Gabrielle DeVeber); **Denmark** (Hanne Christensen, Thomas Truelsen); **Egypt** (Foad Abd-Allah); **Ethiopia** (Awoke Temesgen, Berhe Weldearegawi Sahle, Semaw Abera, Yohannes Adama Melaku); **Fiji** (Devina Nand); **France** (Maurice Giroud); **Germany** (Jost B. Jonas, Matthias Endres, Ronny Westerman); **Greece** (Konstantinos Stroumpoulis); **India** (Dorairaj Prabhakaran, Jeyaraj Durai Pandian, Man Mohan Mehndiratta, Nobhojit Roy, Panniyammakal Jeemon, Rajeev Gupta, Vasanthan Rajagopalan); **Indonesia** (Soewarta Kosen, Tati Suryati Warouw); **Iran** (Reza Malekzadeh); **Ireland** (Martin O'Donnell); **Israel** (David Tanne, Natan Bornstein); **Italy** (Stefano Ricci, Valeria Caso); **Japan** (Yoshihiro Kokubo, Yukito Shinohara); **Jordan** (Majed Asad); **Kenya** (Vitalis Kizito Bwire); **Korea** (Sun Ha Jee, Young-Ho Khang); **Malaysia** (Kim Yunjin, Ramesh Sahathevan); **Morocco** (Fortune Gankpe); **Myanmar** (Chaw Yin Myint); **New Zealand** (Priya Parmar, Rita Krishnamurthi, Suzanne Barker-Collo, Valery Feigin); **Nigeria** (Rufus Olusola Akinyemi); **Norway** (Ole Norheim); **Qatar** (Shams Eldin Khalifa); **Russia** (Michael Kravchenko, Michael Piradov, Nicolay Shalamov, Vasilij Vlassov, Yuri Varakin); **Rwanda** (Jean De Dieu Ndirabega, Jean Pierre Nyemazi, Marie Aimee Muhimpundu); **Saudi Arabia** (Mohammad Saeedi, Neeraj Bedi); **Singapore** (Narayanaswamy Venketasubramanian); **South Africa** (Andre Pascal Kengne); **Spain** (David Rojas-Rueda, Ferrán Catalá-López); **Sri Lanka** (Samath Dharmaratne); **Sweden** (Bo Norrving, Rasmus Havmoeller); **The Netherlands** (Johanna M. Geleijnse); **Uganda** (Leo Atwine); **United Kingdom** (Amitava Banerjee, Charles Wolfe, Derrick Bennett, Finbar O'Callaghan, Ivy Shiuie, Julia Critchley, Majid Ezzati, Michael Soljak, Myles Connor, Peter Rothwell, Rajiv Chowdhury, Rustam Al-Shahi Salman, William Whiteley, Zhengming Chen); **Uruguay** (Mercedes Colomar); **USA** (Adnan Durrani, Anand Dayama, Andrew Moran, Awoke Misganaw, Brett Kissela, Catherine Amlie-Lefond, Catherine O. Johnson, Cheng Huang, Chugh Sumeet, Daniel Kim, David Cundiff, David Lawrence Tirschwell, Dhruv Kazi, Dima Qato, Edmond Kabagambe, Eric Ding, Gene Bukhman, Gene Kwan, George Mensah, George Thurston, Grant Nguyen, Gregory A. Roth, Ismael Campos-Nonato, Josef Coresh, Kate Lefondulq, Kevin Sheth, Matthew Corriere, Mohammad H. Forouzanfar, Mohsen Naghavi, Nana Mainoo, Norman Beauchamp, Ralph Sacco, Richard Gillum, Sanjay Basu, Stephen Schwartz, Sumeet Chugh, Teresa Fung, Tim Byers, Uchechukwu K.A. Sampson, Walter Rocca, Warren Lo).

Conflict of interest

All the authors declare that they have no conflict of interest.

Methods—Stroke incidence, prevalence, mortality, disability-adjusted life-years (DALYs) and healthy years lost due to disability (YLDs) were estimated as part of the Global Burden of Disease (GBD) 2013 Study. Data inputs included all available information on stroke incidence, prevalence, and death and case fatality rates. Analysis was performed separately by sex and 5-year age categories for 188 countries. Statistical models were employed to produce globally comprehensive results over time. All rates were age-standardized to a global population and 95% uncertainty intervals (UI) were computed.

Findings—In 2013 global ischaemic stroke (IS) and haemorrhagic stroke (HS) incidence (per 100 000) in men (IS 132.77 [95% UI, 125.34-142.77]; HS 64.89 [95% UI 59.82-68.85]) exceeded those of women (IS 98.85 [95%UI, 92.11 - 106.62]; HS 45.48 [95% UI, 42.43-48.53]). IS incidence rates were lower in 2013 compared with 1990 rates for both sexes (1990 male IS incidence 147.40 [95% UI, 137.87-157.66]; 1990 female IS incidence 113.31 [95% UI, 103.52 – 123.40]), but the only significant change in IS incidence was among women. Changes in global HS incidence were not statistically significant for males (1990 = 65.31 [95% UI, 61.63 – 69.0], 2013 = 64.89[95% UI, 59.82-68.85]), but was significant for females (1990= 64.892 [95% UI, 59.82-68.85], 2013= 45.48 [95% UI, 42.427-48.53]). The number of DALYs related to IS rose from 1990 (male = 16.62 [95% UI, 13.27-19.62] female = 17.53 [95% UI, 14.08-20.33]) to 2013 (male = 25.22 [95% UI, 20.57-29.13], female = 22.21 [95% UI, 17.71 – 25.50]). The number of DALYs associated with HS also rose steadily and was higher than DALYs for IS at each time point (male₁₉₉₀ = 29.91[95% UI, 25.66-34.54], male₂₀₁₃ = 37.27 [95% UI, 32.29-45.12]; female₁₉₉₀= 26.05 [95% UI, 21.70- 30.90], female₂₀₁₃= 28.18 [95% UI, 23.68-33.80]).

Interpretation—Globally, men continue to have a higher incidence of IS than women while significant sex differences in the incidence of HS were not observed. The total health loss due to stroke as measured by DALYs was similar for men and women for both stroke subtypes in 2013, with HS higher than IS. Both IS and HS DALYs show an increasing trend for both men and women since 1990 which is statistically significant only for IS among men. Ongoing monitoring of sex differences in the burden of stroke will be needed to determine if disease rates among men and women continue to diverge. Sex disparities related to stroke will have important clinical and policy implications that can guide funding and resource allocation for national, regional and global health programs.

Keywords

sex differences; stroke; epidemiology; burden; global

Introduction

Evidence before this study

The burden of stroke in women was often underestimated until the early 1980's.[1] Although once considered primarily a disease of men, stroke is now recognized as a major public health problem for women as well.[2] Recent data has shown that 60,000 more women than men have a stroke each year in the US. [3] Globally, more women than men die of stroke.[4]

Although there is also increasing evidence of sex-specific differences in stroke symptoms, diagnosis, peri-procedural risk, treatment and preventive interventions,[5-11] controversies

regarding differences in stroke epidemiology between men and women continue, [12-17] making this an area worthy of further investigation.

Knowledge gap

The data on sex-specific stroke burden have remained scarce. [18-20] In the Greater Cincinnati–Northern Kentucky Stroke Study (GCNKSS)[21], apart from higher incidence in women aged < 34 years, incidence rates were lower for women aged 45–74 years, but higher in those aged > 75 years. This is possibly a reflection of the open-ended age category. Projections of GCNKSS rates to the 2000 US population gave an estimated 82,000 incident stroke events in women and 49,000 events in men, and in 2050, an estimated 198,000 events in women compared with 129,000 events in men.[22] Total number of deaths were higher for women but the cause-specific mortality rates were lower, possibly because women tend to be more affected by multimorbidity.

Other authors have reported lower incidence rates of stroke in women than in men except in older age (75+ years) where women's' incidence exceeded that of men. [23, 24] Petrea and colleagues' examination of the Framingham Study data showed that stroke incidence increased with each decade of life in both women and men with no significant sex difference in stroke subtypes, severity or case fatality rates.[25] Data from the Framingham Study further suggested that one in five women and one in six men reaching the age of 55 years free of stroke will develop a stroke event during their remaining lifetime.[26] The major methodological limitations of the literature available are the lack of national representativeness in terms of generalizability, as well as potential bias issues, such as study population selection and study time periods.[7] Epidemiologic studies reveal a clear age-sex interaction in stroke with premenopausal women experiencing fewer strokes than similarly aged men but having higher rates in postmenopausal women than similarly aged men.[27] Generally any data on stroke epidemiology is scarce in developing countries.

Study Aim

While the above provides an indication of sex differences in stroke epidemiology, comprehensive and comparable assessments of stroke incidence, prevalence, mortality, and disability trends over time have not been produced by sex for most regions of the world. Our aim was to estimate the global incidence, prevalence, years lived with disability, disability adjusted life years, and mortality of stroke in men and women as part of the 2013 Global Burden of Disease study (GBD 2013).

Methods

Methods for determining incidence, all-cause mortality, cause-specific mortality, disability, and disease prevalence in the GBD 2013 study have been previously described, [28, 29] including the approach to stroke disease modelling.[30] Briefly, all available mortality data were compiled. Non-specific cause codes were redistributed based on expert opinion and statistical methods. The total for all cause-specific deaths was fit to an envelope for all-cause mortality. Deaths were compiled into 240 causes, including ischaemic stroke (IS) and haemorrhagic stroke (HS). Stroke was defined based on the WHO clinical criteria.[31] For

stroke death estimates, GBD defined stroke ICD-10 codes as IS, HS, or nonspecific as to type. The parent category of cerebrovascular disease was based on the mapping of the detailed causes. Deaths coded as due to G45 (transient ischaemic attack) were coded as IS and deaths coded as due to unruptured aneurysms (ICD code I67.0) were coded as HS. Nonspecific codes, including I64, I67.9, I68.8, I69.4-I69.9, were redistributed to IS or HS using a regression model. An ensemble model was used to estimate a continuous time-series for mortality by age, sex, country, and year. Country-level covariates were incorporated into the model and out-of-sample validity testing was used to assess model performance. Uncertainty intervals (UI) were estimated using 1000 draws from the posterior distribution for each age-sex-country group, with the interval taken as the 2.5 and 97.5 percentiles of the resulting distribution. Disease prevalence was estimated using DisMod-MR disease modeling software[32]. All available estimates of stroke incidence, prevalence and case fatality from systematic reviews of the scientific literature, population surveys, and stroke registries were used. IS and HS were modeled separately. Adjustments were made to account for incidence estimates specifying first-ever or any stroke. Disability due to acute stroke was considered to last for up to 28-30 days while chronic stroke lasted from 30 days until death.[33] Years lived with disability (YLDs) were calculated as the product of a disability weight and prevalent cases of stroke. Disability-adjusted life years (DALYs) were calculated as the sum of years of life lost prematurely, based on maximum observed global longevity, and YLDs. Countries were stratified by development status (i.e., developed, developing).

Results

Incidence and Prevalence

Table 1 shows overall trends in the number of women and men with stroke by stroke type in 1990 and 2013. While the number of women and men with IS was similar in 1990 and increased over time, this increase was more marked for men. Non-overlapping 95% uncertainty intervals (UIs) show the increase over time in numbers of incident IS and HS was significant for both women and men. The number of women with HS was lower than that of men, though with a similar proportional increase over time to men.

Figure 1 presents the incidence rates of HS and IS broken down into 5 year age bands for men and women in 1990 and 2013. The age related patterns of incidence for men and women remain relatively similar across time and stroke types. The global age-adjusted incidence of IS showed a trend to decline in both men and women, but no significant change was detected as UI overlapped between 1990 and 2013 (table 2). For HS, there was little change detected in incidence over time.

Stroke prevalence rates for both stroke types were significantly higher for men compared with women in both 1990 and remained so in 2013. The increase in number of prevalent cases of stroke between 1990 and 2013 despite significant declines in incident stroke are consistent with change due to population growth, population ageing, and, for some regions, decreases in stroke-related mortality (table 3). Therefore, there were no detectable change in age-standardized prevalence rates for IS from 1990-2013. In contrast to IS rates, HS age-standardized prevalence rates increased overtime for both sexes.

Mortality, DALYs, and YLDs

The age-standardized death rate (Table 4) from IS declined at a similar rate for men and women, although absolute values were higher in men. Mortality due to HS also declined over time in both sexes. While mortality in women with HS was slightly lower than that of men in 1990, it was higher than that of men in 2013 with no overlap of UIs.

DALYs due to ischemic stroke in men rose significantly from 1990 to 2013 while among women the trend towards an increase was not significant (Table 4). DALYs related to HS were higher in men than women, though increases from 1990 to 2013 were not significant for either sex.

YLDs related to IS remained similar for females and for males over time. While YLDs also remained stable over time for women with HS, there was a significant rise in YLD for men from 1990 to 2013.

The number of deaths DALYs and YLDs increased, while the age-standardized rates of deaths and DALYs per 100,000 decreased (table 3). The increase in number of IS stroke deaths was significantly greater among men than women. There was a trend towards a greater increase among men for HS though the UI in percentage change overlapped.

Current Country Specific DALYs, YLDs, and Mortality

Web Appendix A shows country-specific stroke burden in 1990 and 2013 for women and men; whilst Web Appendix B presents this information by stroke type (IS and HS). Overall death rates in 2013 ranged from a low of 28.6 per 100,000 (95% UI 19.9, 34.4) in Israel, to 357.9 (95% UI 297.8, 432.0) in Madagascar. Death rates for males exceeded those of females in the majority (n=138, 73.8%) of countries. Overall DALYs for 2013 ranged from a low of 380.7 (95% UI 288.0, 443.8) in Israel to a high of 6559.5 per 100,000 (95% UI 5243.0, 8169.3) in Madagascar.

Of those countries where women had higher death rates than men, listed in parentheses, many of which (indicated with *) also had higher DALYs in females than in males (Afghanistan*, Algeria*, Australia, Bahrain*, Bangladesh*, Belize, Brunei, Burundi*, Central African Republic*, Canada, Chad*, Comoros, Democratic Republic of Congo, Djibouti*, Eritrea*, Ethiopia*, Guatemala*, Guinea*, Haiti*, Indonesia, Iran*, Iraq*, Israel, Jamaica*, Jordan, Kuwait*, Laos, Lebanon*, Libya*, Malawi*, Maldives, Mali*, Mauritania*, Morocco*, New Zealand, Niger*, Nigeria*, Pakistan*, United Arab Emirates, United Kingdom, Uganda*, Tunisia*, The Gambia*, Somalia*, Senegal*, Saint Vincent and the Grenadines, Qatar*, Uzbekistan, Yemen*, Zimbabwe*, Zambia*). Aside from Canada, New Zealand, and the United Kingdom where the difference in death rate between males and females was minimal (in the order of 3 to 5 per 100 000), the majority of these countries are developing and/or have recent negative historical events (e.g., warfare, natural disaster). YLDs ranged from a low of 2.3 (895% UI 1.5, 3.3) in Libya to a high of 127.5 (95% UI 90.0, 178.4) in Canada. Males had higher YLD than females in all countries.

Discussion

Main Findings

Over time, the global burden of stroke has been increasing for both men and women but the increases have been greater among men. There is a trend towards a decreased incidence of IS in women from 1990 to 2013 with no significant change detected for men. Improved vascular risk factor control and better health care interventions are likely explanations for reductions in stroke incidence over this period seen for both sexes. It is possible that differences between men and women in the extent of improvement are partly explained by women in some countries being more sensitive to health information, having better health seeking behaviour, and having better access to primary prevention.[34, 35] An alternative explanation is that neuro-vascular risk factors are more frequent and severe in men and have declined faster in women, for example tobacco.[36, 37]

Comparison with previous research—These findings are in contrast to those previously reported in which the reduction in incidence rates was more marked in men than in women. For example, in a review of 56 population-based studies, data from high-income countries revealed a 42% decrease overall in worldwide stroke incidence rates from 163 per 100,000 person-years in the period 1970-79 to 94 per 100,000 person-years in the period 2000-08, [38] a faster decline was observed for men. One explanation for difference between those findings and the present are that they were from a relatively smaller study catchment. Our inclusion of all countries leads to greater uncertainty intervals which blunts our ability to detect trends in some subgroups. Our uncertainty for prevalence and incidence was considerably greater than for mortality because there is data on deaths from almost all countries but data on incidence and prevalence from a limited number of countries. In their 2008 comprehensive review of literature, Reeves et al. [28] showed that women have more stroke events than men but age-specific stroke rates are higher in men and there were little sex differences in stroke subtypes (except subarachnoid haemorrhage). Our findings demonstrated that the risk (rate of stroke) and absolute number of ischaemic and haemorrhagic stroke events (both incident and prevalent strokes) in 2013 was significantly greater in men than in women, suggesting changes in the sex distribution of stroke burden in the world.

Similarly, sex-specific data from the Framingham Heart Study showed decreases in stroke incidence of 30.3% for men and 17.8% for women from 1950 to 2004,[39] though the study periods are not the same. One possible contributing factor is the increase in the ‘smoking epidemic’ in women which, according to Lopez et al[40], occurs 10 to 20 years later than for men.

The decline in IS incidence and mortality rates over the past decades represents a major improvement in population health and is observed for both sexes and across age groups.[41] These significant improvements are concurrent with cardiovascular risk factor control interventions. An American study concluded that efforts in arterial hypertension control initiated in the 1970s appeared to have had the most substantial influence on the accelerated decline in stroke risk and mortality. Although implemented later, control of diabetes mellitus and dyslipidaemia and smoking cessation programs, particularly in combination with

treatment of hypertension, were also implicated in contributing to the decline in stroke incidence and mortality.[41] A history of hypertension, current smoking, waist-to-hip ratio, diet, physical activity, diabetes mellitus, alcohol intake, psychosocial stress and depression, cardiac causes and ratio of apolipoproteins B to A1 was estimated to account for 88.1% of the population attributable risk for all stroke.[42] However, sex interacts with these risk factors. For example, women with diabetes have a higher risk of death from cardiovascular disease than men with diabetes, and after menopause blood pressure and cholesterol levels rise drastically.[43]

In contrast to IS, there were no major changes in HS incidence for women or men. Prior studies suggested the risk for intracerebral haemorrhage (ICH) to be marginally greater in men than in women. This differential risk by sex might be driven by an excess of deep haemorrhage in men, [44, 45] although it is well known that the risk of subarachnoid haemorrhage (about 5% of all HS) is much greater in women than in men. HS incidence rates are reportedly slightly higher in Eastern Asia, where ICH has historically accounted for a larger percentage of all strokes than in Western populations possibly due to the increased prevalence of hypertension.[46-49] Studies of incidence trends for HS in recent decades have produced mixed results. There was a trend toward a reduced ICH incidence in Oxfordshire between 1981 and 2006,[50] and during the 1990s in several Chinese cities.[46] Other studies observed a decline of HS only in women aged < 60 years in the period between 1985 and 2005, [51] or do not report such declines. [52, 53] Also, ICH has a high mortality rate especially with increased age. There are some reports to suggest that withdrawal of aggressive care practices may be different between sexes (this may also vary by region and culture), and this may account for some of the mortality differences in sex in ICH.[54] Women with strokes have also been found to present more often than men with non-traditional stroke symptoms.[55] Delays in presentation, evaluation, diagnosis, and treatment of women with ICH may contribute to the association between female sex and more severe stroke.

The increasing global population over time, even in the context of declining incident stroke rate, will lead to an increasing number of strokes. Population ageing will also increase the number of strokes, and this has implications for burden faced by health care systems. The number of deaths, DALYs and YLDs all increased for both men and women since 1990 for both stroke subtypes, with these increases being much higher in men. [56]

In 2013, women had higher number of deaths and DALYs, which in examining country level statistics, seems to be driven by developing countries and countries with recent histories of adversity (e.g., war, natural disaster). Otherwise men have greater deaths, YLDs, and DALYs both as absolute numbers and rates. One possible explanation for this is the differential smoking rate, with men having a much greater prevalence of smoking than women.[57] Although the overall number of adult smokers has decreased during the last 20 years, the number of women in their teens and 20s who smoke has increased. This increases the risk of stroke in young women. It must also be noted here that there is no data from some of countries, so the results are purely modelled by the geospatial model. As such any conclusions drawn about these particular data points must be tentative at best. It is also possible that women from some countries might be 'outside the statistics' because they are

not admitted to hospital, though this is more likely when there is no National healthcare system.

Alternatively, this may have a direct relationship to accessing care. More specifically, it is possible that the global trends in IS for women, especially in the Middle East, where the rates did not mirror global rates may be due to ascertainment and diagnosis patterns that may be different in men compared to women. For example, an Egyptian study of acute myocardial infarction found significant sex differences in presentation and treatment with women less likely to receive aspirin upon admission or aspirin or statins at discharge, and had poorer in-hospital mortality rates.[58] Similarly, stroke mortality rate may also be influenced by access to emergency services, with elderly women possibly living alone and thus potentially having more difficulty accessing emergency medical services.

The World Health Organization (WHO) assessed sex-specific mortality rates across 39 countries in Europe and Central Asia,[59] and reported an excess of total deaths because of stroke among women compared with men, of which 60% occurred in those over 75 years and 4% among those younger than 55 years. The Centers for Disease Control and Prevention WONDER database in the United States, suggests that men and women under 45 years of age show similar stroke mortality rates. While women aged 45 to 74 years have lower stroke mortality compared with age-matched men, this advantage declines with advancing age.[22] A strong sex-by-age interaction was also reported by WHO, as the male/female stroke mortality rate was greater in men than women aged less than 65 years but greater in women than men among those aged ≥ 75 years, possibly reflecting compounding disability in the older age range.

Strengths and Limitations—There are limitations to the GBD methods. These include the extrapolation of data from subnational regions to the whole country and missing data overall, in particular from low-income countries. Strengths include the use of consistent methods to enable comparison between subtypes of stroke and between diseases, the ability to highlight regions where stroke is a particular problem. This highlights the importance of studies being clear on how stroke and its subtypes are defined (e.g., TOAST criteria[60]) and if they were confirmed using gold standard methods such as by CT scans

Implications for research, policy, and practice—While age-adjusted incidence and death rates from stroke have been declining since the late 20th century, the global stroke burden measured as the absolute numbers of people affected by stroke, disabled due to stroke, or deaths from stroke are increasing for both men and women, with larger increases in men. This increasing burden is a reflection of population growth and ageing and lifestyle and environmental changes. That women tend to survive longer and experience stroke at an older age suggests that in the future, alongside the aging of the population, we can expect a dramatic increase of stroke in older women. To combat this it is important that preventive efforts and guidelines for treatment reflect sex differences in the profile of stroke.

Specifically, women have strokes associated with a higher prevalence of arterial hypertension, atrial fibrillation, and pre-stroke disability; but having a lower prevalence of heart disease, peripheral vascular disease, smoking and alcohol use than men, and these will

need to be taken into account.[22] In terms of treatment women are less likely to receive intravenous alteplase treatment and lipid testing while in hospital in some countries. [22] These disparities suggest the need to explore whether differential strategies are required to target primary and secondary prevention of stroke in women, and to determine if treatment protocols must also accommodate sex differences. Further strategies are particularly needed to lower high case fatality. These could include investment in pre-hospital and acute care in some regions, and could perhaps include better home care provided in treatment and monitoring of blood pressure. Also, with extension of the average length of life, ratios of atrial fibrillation increase, the prevalence of atrial fibrillation is increasing especially in developed countries, and atrial fibrillation is a strong risk factor for ischemic stroke.[61, 62] The anticoagulant warfarin has been conventionally used for prophylaxis of cerebral infarction with atrial fibrillation. The prescription rate of warfarin increased after 2000 in particular. Recently, new oral anticoagulants have been used as alternatives to warfarin anticoagulation in non-valvular atrial fibrillation. There is a particular need to focus future efforts on obtaining data by sex from undeveloped regions.

Conclusion—Age-adjusted incidence rates for IS appear to be declining worldwide at a faster rate in women than in men. The reasons for this decline may reflect better risk factor control and health care. Despite the reduction in the occurrence of stroke, burden is still increasing. In line with the World Stroke Organization's initiative 'I am woman-stroke affects me' that was launched at the World Stroke Congress in Istanbul (22-25 October, 2014) more research on stroke epidemiology, including both indices of occurrence and burden, is required to provide better estimates, particularly for developing countries where the data remains sparse. Countries whose estimates were entirely based on statistical modelling should be a focus of efforts to improve data availability by designing, implementing and reporting population-based studies of chronic disease including stroke. Guidelines for achieving good quality studies in stroke epidemiology are recently available. [63]

Research into factors that potentially contribute to the causes of sex differences in risk and outcomes is also required. In addition, there is adequate evidence of differences in stroke incidence and burden between the sexes to support the need for well-designed stroke intervention trials which are equally powered for men and women to examine effectiveness of primary care, risk factor management strategies, and hospital services.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Authors

Suzanne L. Barker-Collo, PhD,
School of Psychology, level 6, 10 Symonds Street, The University of Auckland,
Private Bag 92019, Auckland, New Zealand.

Derrick A. Bennett,

Clinical Trial Service Unit and Epidemiological Studies Unit, Nuffield Department of Population Health, University of Oxford, Oxford, UK

Rita Krishnamurthi, PhD,
National Institute for Stroke and Applied Neurosciences, Faculty of Health and Environmental Studies, AUT University, Private Bag 92006, Auckland, New Zealand

Priya Parmar,
National Institute for Stroke and Applied Neurosciences, Faculty of Health and Environmental Studies, AUT University, Private Bag 92006, Auckland, New Zealand

Valery L Feigin, MD, MSc, PhD, FAAN [**Professor of Epidemiology and Neurology**],
National Institute for Stroke and Applied Neurosciences, Faculty of Health and Environmental Studies, AUT University, Private Bag 92006, Auckland, New Zealand

Mohsen Naghavi,
Department of Global Health, School of Medicine and Public Health, University of Washington

Mohammad H. Forouzanfar,
Institute for Health metrics and Evaluation. University of Washington, Seattle, Washington, USA.

Catherine Johnson,
Institute for Health Metrics and Evaluation. University of Washington, Seattle, Washington, USA.

Grant Nguyen,
Institute for Health Metrics and Evaluation. University of Washington, Seattle, Washington, USA.

George A. Mensah,
Center for Translation Research and Implementation Science (CTRIS), National Heart, Lung, and Blood Institute, National Institutes of Health, Bethesda, Maryland, USA.

Theo Vos,
Department of Global Health, School of Medicine and Public Health, University of Washington, Seattle, Washington, USA.

Christopher Murray,
Department of Global Health, School of Medicine and Public Health, University of Washington, Seattle, Washington, USA

Gregory A. Roth,
Institute for Health Metrics and Evaluation and the Division of Cardiology, School of Medicine, University of Washington, Seattle, Washington, USA.

Foad Abd-Allah,
Department of Neurology, Cairo University, Cairo, Egypt.

Semaw Ferede Abera,
Department of Epidemiology and Biostatistics, School of Public Health, College of Health Sciences, Mekelle University, Ethiopia

Rufus, O. Akinyemi,
Institute for Advanced Medical Research and Training, College of Medicine, University of Ibadan, Nigeria

Cecilia Bahit,
Department of Cardiology INECO Neurociencias Oroño, Rosario, Santa Fe. New Mexico, USA.

Amitava Banerjee,
Farr Institute of Health Informatics Research, University College London, London, UK.

Sanjay Basu,
School of Medicine, Stanford University, Stanford, California, USA.

Michael Brainin,
Department of Clinical Neurology, Danube University Krems and Karl Landsteiner University, Krems, Austria

Natan M. Bornstein,
Tel-Aviv Sourasky Medical Center, Sackler School of Medicine, Tel-Aviv University, Tel-Aviv, Israel.

Valeria Caso,
Stroke Unit, University of Perugia, Perugia, Italy

Ferrán Catalá-López,
Department of Medicine, University of Valencia, Valencia, Spain

Rajiv Chowdhury,
Department of Public Health and Primary Care, School of Clinical Medicine, University of Cambridge, Cambridge, UK.

Hanne Christensen,
University of Copenhagen and Bispebjerg Hospital, Denmark

Merceded Colomar,
Unidad de Investigacion Clinica y Epidemiologica Montevideo, Uruguay

Stephen Davis [**Professor of Translational Neuroscience**],
University of Melbourne Parkville, Australia.

Gabrielle deVeber, MD,
Children's Stroke Program, Division of Neurology Hospital for Sick Children Senior Scientist, Research Institute, Hospital for Sick Children, Toronto, Ontario, Canada.

Samath D. Dharmaratne,

Department of Community Medicine, Faculty of Medicine, University of Peradeniya and Institute for Health Metrics and Evaluation, Department of Global Health, School of Public Health, University of Washington, USA.

Geoffrey Donnan,
The Florey Institute of Neuroscience and Mental Health and School of Neurology,
University of Melbourne, Melbourne, Australia.

Prabhakaran Dorairaj,
Centre for Chronic Conditions and Injuries and Public Health Foundation of India,
Delhi, India.

Klara Dokova,
Department of Social Medicine and Health Care Organization Faculty of Public
Health, Medical University of Varna, Varna, Bulgaria

Matthias Endres,
Klinik und Hochschulambulanz für Neurologie, Charité-Universitätsmedizin Berlin,
Germany.

Jefferson G Fernandes,
School of Health Education and Sciences German Hospital Oswaldo Cruz São
Paulo, Brazil.

J. Marianne Geleijnse,
Division of Human Nutrition / Epidemiology, Wageningen University, The
Netherlands.

Richard F. Gillum,
Department of Internal Medicine and Department of Community and Family
Medicine, Howard University College of Medicine, Washington, DC. USA

Maurice Giroud,
Dijon Stroke Registry, Service de Neurologie, Dijon, France.

Jiang Guohong,
Tianjin Centers for Diseases Control and Prevention, School of Public Health,
Tianjin Medical University, and School of Public Health, Tongji Medical University,
Hubei, China.

Randah R. Hamadeh,
Department of Family and Community Medicine, College of Medicine and Medical
Sciences, Arabian Gulf University, Bahrain.

Graeme J. Hankey,
School of Medicine and Pharmacology, The University of Western Australia.

Panniyammakal Jeemon,
Centre for Control of Chronic Conditions, Public Health Foundation of India and
Centre for Chronic Disease Control, New Delhi.

Kim Yun Jin,

Faculty of Chinese Medicine Southern University College, Johor. Malaysia

Jost B. Jonas,
Department of Ophthalmology, Medical Faculty Mannheim of the University of
Heidelberg, Mannheim Germany.

Yogesh Kalkonde,
Society for Education, Action & Research in Community Health, District of
Gadchiroli, India.

Andre P Kengne,
South African Medical Research Council, Francie van Zijl Drive, Parrow Valley,
Cape Town, South Africa.

Daniel Kim,
Department of Health Sciences, Northeastern University, Boston, USA

Brett M. Kissela,
Department of Neurology and Rehabilitation Medicine, University of Cincinnati,
USA.

Yoshihiro Kokubo,
Department of Preventive Cardiology, National Cerebral and Cardiovascular
Center, Suita, Japan.

Pablo Lavados,
Servicio de Neurología, Departamento de Medicina, Clínica Alemana de Santiago-
Universidad del Desarrollo. Santiago, Chile.

Patrice Lindsay,
Stroke Heart and Stroke Foundation, Fondation des maladies du cœur et de l'AVC,
Ontario, Canada.

Paulo A Lotufo,
Centre for Clinical and Epidemiological Research, University of Sao Paulo, Sao
Paulo, Brazil.

Mark T. Mackay,
Department of Neurology, Royal Children's Hospital Melbourne and Murdoch
Childrens Research Institute, Parkville Australia.

Reza Malekzadeh,
Digestive Disease Research Institute, Tehran University of Medical Sciences,
Shariati Hospital, Tehran, Iran.

Man Mohan Mehndiratta,
Janakpuri Super Speciality Hospital, New Delhi, India

Devina Nand,
Health Information Unit, Dinem Hous, Toorak, Suva, Republic of Fiji

Bo Norrving,
Department of Clinical Sciences, Neurology, Lund University, Sweden.

Jeyaraj Durai Pandian,
Department of Neurology Christian Medical College, Ludhiana, Punjab, India.

Harry Perkins,
Institute of Medical Research, QEII Medical Centre, Perth, Western Australia

Farshad Pourmalek,
School of Population and Public Health, University of British Columbia

Stefano Ricci,
UO Neurologia, Umbria edi di Città di Castello e Branca.

Patricia M. Riccio,
Department of Clinical Neurological Sciences. London Health Sciences Centre.
Western University. London, ON. Canada.

David Rojas-Rueda,
Centre for Research in Environmental Epidemiology, ISGlobal, Barcelona, Spain.

Nobhojit Roy,
Environmental health resource hub, School of Habitat studies, Tata Institute of
Social sciences, Mumbai, India

Ralph, L. Sacco,
University of Miami Miller School of Medicine, Department of Neurology, Miami,
Florida, USA.

Ramesh Sahathevan,
Universiti Kebangsaan Malaysia Medical Centre, Jalan Yaacob Latiff, Bandar Tun
Razak Kuala Lumpur, Malaysia; and Calvary Healthcare Bruce, ACT, Australia

Kevin N. Sheth,
Division of Neurocritical Care and Emergency Department of Neurology
Neurosciences Intensive Care Unit, Yale School of Medicine & Yale New Haven
Hospital, New York, USA.

Ivy Shiue,
Faculty of Health and Life Sciences, Northumbria University, Newcastle upon Tyne,
UK.

Luciano A. Sposato,
Department of Clinical Neurological Sciences. London Health Sciences Centre.
Western University. London, Ontario. Canada.

David Tanne,
Chaim Sheba Medical Center and Tel-Aviv University, Israel.

Amanda Thrift,
Stroke and Ageing Research (STARAC), Department of Medicine, School of Clinical
Sciences at Monash Health, Monash University, Clayton, Vic., Australia

George Thurston,

Department of Population Health and Environmental Medicine, Tuxedo, New York, USA.

David Tirschwell,
University of Washington School of Medicine, UW Medicine Comprehensive Stroke Center, Harborview Medical Center, Seattle Washington, USA.

Narayanaswamy Venketasubramanian,
Raffles Neuroscience Centre, Raffles Hospital, Singapore.

Vasily Vlassov,
National Research University Higher School of Economics, Moscow, Russia.

Ronny Westerman, and
Competence Center Mortality-Follow-Up of the German National Cohort, Federal Institute for Population Research, Wiesbaden, Germany

Charles Wolfe
Division of Health and Social Care Research, King's College London, London, United Kingdom; and National Institute for Health Research Comprehensive Biomedical Research Centre, Guy's & St. Thomas' NHS Foundation Trust and King's College London, London, UK

on behalf of the GBD 2013 Stroke Panel Experts Group*

Affiliations

School of Psychology, level 6, 10 Symonds Street, The University of Auckland, Private Bag 92019, Auckland, New Zealand.

Clinical Trial Service Unit and Epidemiological Studies Unit, Nuffield Department of Population Health, University of Oxford, Oxford, UK

National Institute for Stroke and Applied Neurosciences, Faculty of Health and Environmental Studies, AUT University, Private Bag 92006, Auckland, New Zealand

National Institute for Stroke and Applied Neurosciences, Faculty of Health and Environmental Studies, AUT University, Private Bag 92006, Auckland, New Zealand

National Institute for Stroke and Applied Neurosciences, Faculty of Health and Environmental Studies, AUT University, Private Bag 92006, Auckland, New Zealand

Department of Global Health, School of Medicine and Public Health, University of Washington

Institute for Health metrics and Evaluation. University of Washington, Seattle, Washington, USA.

Institute for Health Metrics and Evaluation. University of Washington, Seattle, Washington, USA.

Institute for Health Metrics and Evaluation. University of Washington, Seattle, Washington, USA.

Center for Translation Research and Implementation Science (CTRIS), National Heart, Lung, and Blood Institute, National Institutes of Health, Bethesda, Maryland, USA.

Department of Global Health, School of Medicine and Public Health, University of Washington, Seattle, Washington, USA.

Department of Global Health, School of Medicine and Public Health, University of Washington, Seattle, Washington, USA

Institute for Health Metrics and Evaluation and the Division of Cardiology, School of Medicine, University of Washington, Seattle, Washington, USA.

Department of Neurology, Cairo University, Cairo, Egypt.

Department of Epidemiology and Biostatistics, School of Public Health, College of Health Sciences, Mekelle University, Ethiopia

Institute for Advanced Medical Research and Training, College of Medicine, University of Ibadan, Nigeria

Department of Cardiology INECO Neurociencias Oroño, Rosario, Santa Fe. New Mexico, USA.

Farr Institute of Health Informatics Research, University College London, London, UK.

School of Medicine, Stanford University, Stanford, California, USA.

Department of Clinical Neurology, Danube University Krems and Karl Landsteiner University, Krems, Austria

Tel-Aviv Sourasky Medical Center, Sackler School of Medicine, Tel-Aviv University, Tel-Aviv, Israel.

Stroke Unit, University of Perugia, Perugia, Italy

Department of Medicine, University of Valencia, Valencia, Spain

Department of Public Health and Primary Care, School of Clinical Medicine, University of Cambridge, Cambridge, UK.

University of Copenhagen and Bispebjerg Hospital, Denmark

Unidad de Investigacion Clinica y Epidemiologica Montevideo, Uruguay

University of Melbourne Parkville, Australia.

Children's Stroke Program, Division of Neurology Hospital for Sick Children Senior Scientist, Research Institute, Hospital for Sick Children, Toronto, Ontario, Canada.

Department of Community Medicine, Faculty of Medicine, University of Peradeniya and Institute for Health Metrics and Evaluation, Department of Global Health, School of Public Health, University of Washington, USA.

The Florey Institute of Neuroscience and Mental Health and School of Neurology, University of Melbourne, Melbourne, Australia.

Centre for Chronic Conditions and Injuries and Public Health Foundation of India, Delhi, India.

Department of Social Medicine and Health Care Organization Faculty of Public Health, Medical University of Varna, Varna, Bulgaria

Klinik und Hochschulambulanz für Neurologie, Charité-Universitätsmedizin Berlin, Germany.

School of Health Education and Sciences German Hospital Oswaldo Cruz São Paulo, Brazil.

Division of Human Nutrition / Epidemiology, Wageningen University, The Netherlands.

Department of Internal Medicine and Department of Community and Family Medicine, Howard University College of Medicine, Washington, DC. USA

Dijon Stroke Registry, Service de Neurologie, Dijon, France.

Tianjin Centers for Diseases Control and Prevention, School of Public Health, Tianjin Medical University, and School of Public Health, Tongji Medical University, Hubei, China.

Department of Family and Community Medicine, College of Medicine and Medical Sciences, Arabian Gulf University, Bahrain.

School of Medicine and Pharmacology, The University of Western Australia.

Centre for Control of Chronic Conditions, Public Health Foundation of India and Centre for Chronic Disease Control, New Delhi.

Faculty of Chinese Medicine Southern University College, Johor. Malaysia

Department of Ophthalmology, Medical Faculty Mannheim of the University of Heidelberg, Mannheim Germany.

Society for Education, Action & Research in Community Health, District of Gadchiroli, India.

South African Medical Research Council, Francie van Zijl Drive, Parrow Valley, Cape Town, South Africa.

Department of Health Sciences, Northeastern University, Boston, USA

Department of Neurology and Rehabilitation Medicine, University of Cincinnati, USA.

Department of Preventive Cardiology, National Cerebral and Cardiovascular Center, Suita, Japan.

Servicio de Neurología, Departamento de Medicina, Clínica Alemana de Santiago-Universidad del Desarrollo. Santiago, Chile.

Stroke Heart and Stroke Foundation, Fondation des maladies du cœur et de l'AVC, Ontario, Canada.

Centre for Clinical and Epidemiological Research, University of Sao Paulo, Sao Paulo, Brazil.

Department of Neurology, Royal Children's Hospital Melbourne and Murdoch Childrens Research Institute, Parkville Australia.

Digestive Disease Research Institute, Tehran University of Medical Sciences, Shariati Hospital, Tehran, Iran.

Janakpuri Super Speciality Hospital, New Delhi, India

Health Information Unit, Dinem Hous, Toorak, Suva, Republic of Fiji

Department of Clinical Sciences, Neurology, Lund University, Sweden.

Department of Neurology Christian Medical College, Ludhiana, Punjab, India.

Institute of Medical Research, QEII Medical Centre, Perth, Western Australia

School of Population and Public Health, University of British Columbia

UO Neurologia, Umbria edi di Città di Castello e Branca.

Department of Clinical Neurological Sciences. Londe Health Sciences Centre. Western University. London, ON. Canada.

Centre for Research in Environmental Epidemiology, ISGlobal, Barcelona, Spain.

Environmental health resource hub, School of Habitat studies, Tata Institute of Social sciences, Mumbai, India

University of Miami Miller School of Medicine, Department of Neurology, Miami, Florida, USA.

Universiti Kebangsaan Malaysia Medical Centre, Jalan Yaacob Latiff, Bandar Tun Razak Kuala Lumpur, Malaysia; and Calvary Healthcare Bruce, ACT, Australia

Division of Neurocritical Care and Emergency Department of Neurology Neurosciences Intensive Care Unit, Yale School of Medicine & Yale New Haven Hospital, New York, USA.

Faculty of Health and Life Sciences, Northumbria University, Newcastle upon Tyne, UK.

Department of Clinical Neurological Sciences. London Health Sciences Centre. Western University. London, Ontario. Canada.

Chaim Sheba Medical Center and Tel-Aviv University, Israel.

Stroke and Ageing Research (STARAC), Department of Medicine, School of Clinical Sciences at Monash Health, Monash University, Clayton, Vic., Australia

Department of Population Health and Environmental Medicine, Tuxedo, New York, USA.

University of Washington School of Medicine, UW Medicine Comprehensive Stroke Center, Harborview Medical Center, Seattle Washington, USA.

Raffles Neuroscience Centre, Raffles Hospital, Singapore.

National Research University Higher School of Economics, Moscow, Russia.

Competence Center Mortality-Follow-Up of the German National Cohort, Federal Institute for Population Research, Wiesbaden, Germany

Division of Health and Social Care Research, King's College London, London, United Kingdom; and National Institute for Health Research Comprehensive Biomedical Research Centre, Guy's & St. Thomas' NHS Foundation Trust and King's College London, London, UK

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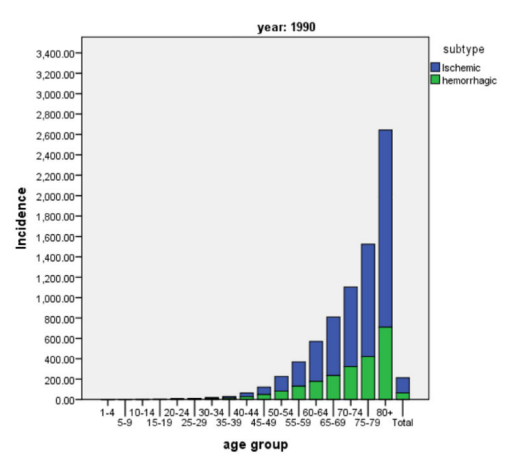
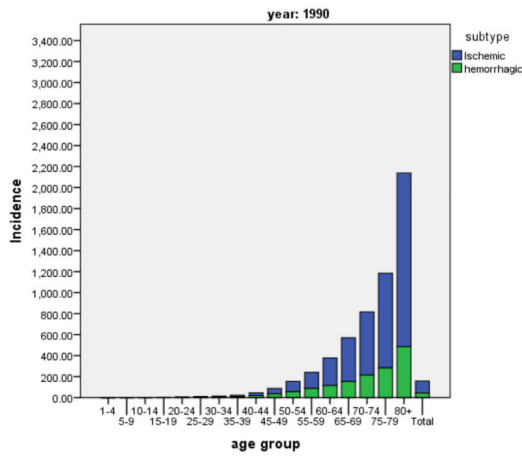
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Females

Males

1990



2013

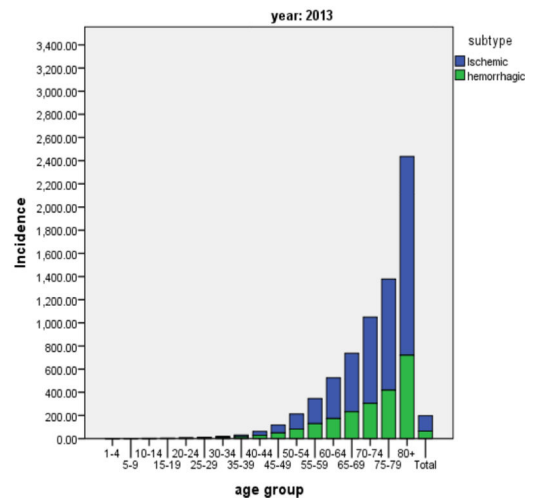
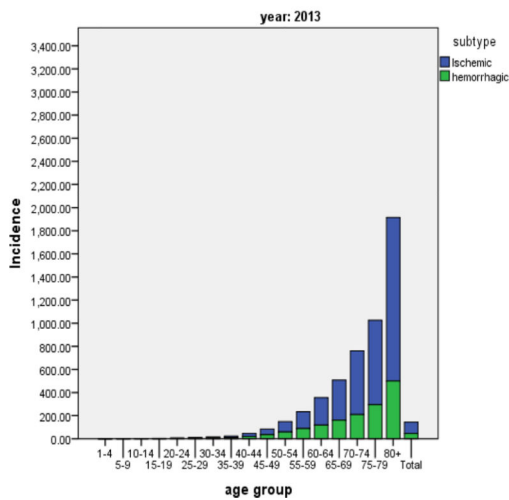


Figure 1. Incidence per 100,000 of ischemic and haemorrhagic stroke in females and males by 5-year age bands in 1990 and 2013.

Global number of women and men with stroke (in millions) by stroke type in 1990 and 2013 (95% uncertainty limits are in brackets).

Table 1

		1990	2013	1990	2013
Ischaemic stroke	Incident	2.14 (1.96- 2.33)	3.28 (3.06- 3.52)	2.17 (2.05 – 2.33)	3.62 (3.43 – 3.85)
	Prevalent	4.86 (4.56- 5.19)	8.66 (8.32- 9.00)	5.18 (4.93 – 5.46)	9.65 (9.27 – 10.05)
Haemorrhagic stroke	Incident	0.86 (0.79 – 0.92)	1.53 (1.42- 1.63)	1.03 (0.96 – 1.09)	1.84 (1.72 – 1.94)
	Prevalent	1.78 (1.67 – 1.87)	3.36 (3.23- 3.51)	2.11 (2.02 – 2.22)	4.00 (3.81- 4.17)

Table 2

Age-standardized incidence and prevalence rates per 100 000 persons by sex in 1990 and 2013 globally (95% uncertainty limits are in brackets), with prevalence rates by country development status

		1990	2013	1990	2013
Global					
Ischaemic stroke	Incidence	113.31 (103.52 – 123.40)	98.85 (92.11 - 106.62)	147.40 (137.87-157.66)	132.77 (125.34-142.77)
	Prevalence	253.60 (237.19-271.50)	260.40 (249.97-271.03)	339.02 (322.03- 357.88)	346.08 (332.43-360.57)
Haemorrhagic stroke	Incidence	44.25 (40.78-47.36)	45.48 (42.43-48.53)	65.31 (61.63 – 69.8)	64.89 (59.82-68.85)
	Prevalence	89.18 (83.63-93.97)	99.90 (95.98- 104.26)	126.37 (120.51-132.72)	136.65 (130.41-142.37)
Developed					
Ischaemic stroke	Prevalence	396.74 (364.28-437.18)	500.62 (474.62-526.94)	585.87 (546.56-629.74)	678.544 (646.93-713.21)
Haemorrhagic stroke	Prevalence	84.02 (74.60-93.41)	125.64 (116.01-135.80)	108.03 (97.18-119.15)	134.15 (122.03-145.32)
Developing					
Ischaemic stroke	Prevalence	131.706 (125.238-138.710)	130.494 (122.616-139.06)	182.34 (171.30-192.00)	185.15 (173.51-197.20)
Haemorrhagic stroke	Prevalence	93.51 (88.72-97.53)	91.57 (87.55-96.13)	136.65 (130.00-143.40)	139.87 (133.10- 146.74)

Table 3

change in number and age-standardized rate per 100 000 persons for deaths, disability adjusted life years (DALYs) and years lived from 1990 to 2013 by stroke type and sex.

	Number		Rate		Number		Rate		Number		Rate		Number		Rate	
	% Change	95% UI	% Change	95% UI	% Change	95% UI	% Change	95% UI	% Change	95% UI	% Change	95% UI	% Change	95% UI	% Change	95% UI
Male	51.6	1.1, 36.8	-16.3	-6.5, -24.2	64.0	4.4, 48.4	-15.4	-5.6, -22.8	86.1	9.5, 73.2	2.8	9.9, -4.7	85.9	98.8, 73.9	2.2	9.3, -5.0
Female	27.4	5.7, 15.3	-26.0	-21.5, -32.8	39.8	9.5, 28.7	-23.2	-17.8, -29.3	78.0	9.4, 64.1	3.3	12.7, -4.9	77.7	93.7, 63.4	2.6	12.1, -6.0
Male	23.9	2.1, 12.3	-25.6	-13.8, -32.5	38.3	6.4, 25.1	-23.0	-8.1, -30.6	88.7	10.1, 75.5	8.5	16.4, 0.9	89.3	101.6, 77.0	8.1	15.6, 1.1
Female	7.9	0.0, -0.9	-33.8	-26.2, -39.2	23.1	4.4, 13.3	-29.1	-18.5, -34.8	88.1	10.3, 76.5	12.1	21.4, 5.1	88.4	103.4, 77.4	1.7	20.7, 5.0

Age-standardized DALY, YLD and death rates per 100 000 persons with 95% uncertainty intervals by stroke type and sex in 1990 and 2013.

Table 4

		1990		2013		1990		2013	
Ischemic Stroke	DALYs	919.3 (740.1 to 1,063.2)	675.8 (539.2 to 774.9)	1,101.5 (894.3 to 1,288.4)	922.1 (758.1 to 1,061.5)	Haemorrhagic Stroke	DALYs	1,259.7 (1,041.5 to 1,500.3)	835.8 (703.9 to 1,001.4)
	YLD	36.3 (25.3 to 48.4)	37.5 (26.3 to 49.6)	48.5 (33.9 to 63.7)	49.8 (35.4 to 65.3)		YLD	13.1 (9.2 to 17.4)	14.8 (10.3 to 19.5)
	Mortality	69.0 (55.7 to 78.7)	52.9 (42.5 to 60.3)	73.4 (60.6 to 85.3)	62.1 (51.1 to 71.7)		Mortality	63.9 (52.2 to 76.1)	45.7 (39.0 to 56.6)
				18.6 (12.8 to 24.6)	61.0 (52.4 to 75.3)				
				77.9 (64.9 to 90.6)	20.2 (13.8 to 26.5)				