Stroke Prevention Worldwide – What Could Make It Work?

Bo Norrving^a Stephen M. Davis^b Valery L. Feigin^c George A. Mensah^d
Ralph L. Sacco^e Cherian Varghese^f

^aDepartment of Clinical Sciences, Neurology, Lund University, Lund, Sweden; ^bMelbourne Brain Centre, Royal Melbourne Hospital and University of Melbourne, Parkville, Vic., Australia; ^cNational Institute for Stroke and Applied Neurosciences, Faculty of Health and Environmental Studies, Auckland University of Technology, Auckland, New Zealand; ^dCenter for Translation Research and Implementation Science and Division of Cardiovascular Sciences; National Heart, Lung, and Blood Institute; National Institutes of Health, Bethesda, Md., and ^eJackson Memorial Hospital, Executive Director, Evelyn McKnight Brain Institute, Miller Professor of Neurology, Epidemiology, and Human Genetics, University of Miami, Miami, Fla., USA; ^fManagement of Noncommunicable Diseases, World Health Organization, Geneva, Switzerland

Key Words

Stroke · Epidemiology · Prevention · Public health

Abstract

The global burden of stroke is of continual major importance for global health. The present report addresses some of the core principles that could make stroke prevention work. The prevention of stroke shares many common features with other non-communicable diseases (NCDs); stroke prevention should therefore be part of the joint actions on NCD led by the WHO and member states. Stroke prevention is an integral part of both the 2011 UN declaration on actions on NCDs and the UN Post-2015 Sustainable Developmental Goals. Stroke prevention requires an intersectoral approach, with important responsibilities on the part of governmental bodies, non-government organizations and the health sector as well as communities, industries and individuals. Although official development assistance will need to be provided for the lowest income countries, financing will need to be raised for most countries by reallocation of resources

within the country. Stroke is a prototype NCD in that there is overwhelming scientific evidence that with actions taken to reduce risk factors, the risk of stroke can be substantially reduced. Prevention of stroke will also have beneficial effects on cognitive decline and dementia. As most strokes do not lead to death, stroke statistics should not only focus on mortality, but also on disability and quality of life. All preventive actions should start early in life and continue during the life cycle. Prevention of stroke is a complex medical and a political issue with many challenges. Upscaling of efforts to prevent stroke are urgently needed in all regions, and the opportunity to act is now.

© 2015 S. Karger AG, Basel

Introduction

The present special issue of Neuroepidemiology extends on previous publications from the Global Burden of Disease study [1–3], and provides updates and further details on important aspects on stroke. Although

some perspectives are modified by the new data, the bottom line unfortunately has not changed: the global burden of stroke is of continual major importance for global health, alarmingly high rates in many regions remain, and there are persisting inequalities. There is a virtual global stroke pandemic that is particularly pronounced in low- and middle-income countries, where the stroke incidence is steadily rising [1, 2]. Given their close linkage, an increasing stroke incidence will also inevitably lead to increased rates of cognitive impairment and dementia. The message is clear: upscaled efforts to prevent stroke are urgently needed in all regions, as there is still no country in the world where stroke burden, as expressed in absolute numbers, is decreasing. However, the difficult question is – what could make stroke prevention work? How can current statistics be changed so that predictions for the future are blunted?

The present short report will address some of the core principles in this field, and aims to set the GBD data into a broader context of preventive actions for stroke and beyond.

Stroke Prevention Is Part of the Global NCD Action Plan

Whereas stroke is a specific disease of the nervous system, requiring specific therapies and many other specific treatment and management actions, the prevention of stroke shares many common features with other non-communicable diseases (NCDs). Four major modifiable behavioral or lifestyle risk factors (tobacco use, unhealthy diet, physical inactivity and harmful use of alcohol) are of major importance for stroke, as for coronary heart disease, cancer, diabetes and pulmonary heart disease. This cluster of diseases and risk factors are prioritized by the WHO in its Global Action Plan on NCDs [4], and also features in the WHO ‘4 by 4’ principle (4 major NCDs – cardiovascular disease/cancer/diabetes/pulmonary diseases; 4 major life style risk factors) and the ‘best buy’ principle (mass actions on the life style risk factors are the most cost effective means of prevention) [5]. Similarly, other major risk factors for stroke (hypertension is twice as important for stroke as for coronary heart disease [6]; atrial fibrillation) are also included in the WHO Global Action Plan on NCDs. Stroke prevention should therefore not be a stand-alone silo, but is part of the common actions now in progress on major NCD risk factors. Only by joining forces with other initiatives for NCDs preven-

tion will stroke prevention have its full impact. Major principles in prevention are similar for stroke and other types of cardiovascular disease [7].

Stroke Prevention Is Part of the 2011 UN NCD Declaration and the UN Post-2015 Sustainable Development Goals

Stroke and other NCDs pose a serious threat not only to public health but also to socioeconomic development of the society. There are close and reciprocal links between NCDs and poverty. As trade is global, failing economies in low- and middle-income countries will have wide spread effects in high-income countries also. NCDs including stroke definitively entered the global political arena with the adoption by the United Nations (UN) declaration on NCDs in September 2011, which is only the 2nd time in the history of the UN that the General Assembly addressed a medical topic [8]. WHO was given the leading role in the implementation and monitoring of the commitments of the UN declaration. The declaration called for a 25% relative reduction in premature mortality from NCDs, including stroke, by the year 2025. The WHO set a variety of global targets for lifestyle, risk factor and health system improvements to help achieve this overall goal.

As this issue of Neuroepidemiology goes to press, the UN prepares for the landmark September 2015 UN summit to adopt the Post-2015 Development Agenda, which will include 17 Sustainable Development Goals (SDGs), one of which is targeting health and calls for greater efforts toward tackling NCDs. The SDGs also recognize the close interplay between health and several environmental and economic factors, for example, between NCDs and pollution, climate change and poverty.

Stroke is an integral part of both the 2011 UN political declaration and the Post-2015 SDGs. Stroke prevention requires an intersectoral approach, beyond the health sector.

Stroke Prevention Is a Task Both for Governmental Bodies and for the Health Sector

Stroke prevention has often been thought of as mainly being a task by the health sector (primary care, hospitals). However, NCD prevention is a multisectoral task, with important responsibilities both for governmental bodies, non-government organizations and the health sector, as well as for communities, industries and individuals.

Governmental bodies have the power to influence life style factors through legislation and taxation of tobacco, alcohol and food contents (salt, sugar, saturated fats), that is, installing an epidemiological mass effect on population behaviors. The effects of such actions, in particular tobacco taxation, have been well documented and have immediate effects both on consumption and health [5]. Governments may redirect incomes from increased taxes to other health sectors that need financial support. Governments also have a responsibility in facilitating physical activity, directly or indirectly, through transportation, access to safe recreational areas, physical activity and nutritional systems. Links between health and socio-economics, employment rates, climate and other environmental factors are also well established. Furthermore, ministries of health have the core responsibility for provision of adequate health services and installment of universal healthcare to cover primary and secondary prevention.

The health system has the responsibility to identify risk factors that requires medical contacts for their detection and treatment (e.g. hypertension, atrial fibrillation) to influence risk factors for the substantial part of the population that already have an NCD or a risk factor that requires regular medical contacts, and to ensure proper secondary prevention for those affected by stroke or transient ischemic attack. It should be recalled that about a third of all strokes occur among people who have had a previous cerebrovascular event (transient ischemic attack or stroke). Availability of low-cost essential medicines (antihypertensives, lipid lowering, antithrombotics) remains a major challenge in low- and middle-income countries where drug usage levels are alarmingly low, particularly in rural areas [9].

All preventive actions should start early in life and continue during through the life cycle (a life course approach). Many life style habits are set early in life. Data also indicate that stroke in the young and middle aged are not decreasing or may even be increasing [1, 2], likely due to increase in metabolic risk factors, including obesity and diabetes, among the young [10, 11]. Education about healthy lifestyles should be incorporated into standardized educational curricula and started early with reinforcement across the lifespan. Use of technological advances, such as the Stroke Riskometer app, to recognize a person's own risk factors, calculate the future risk of stroke and provide targeted advice on how to lower the risk, is another important approach for stroke prevention [12, 13].

Country Actions for Stroke and NCD Prevention Are the Key

Whereas WHO and UN agreements on NCD actions (analogous to climate actions) are made in a global perspective, member states are autonomous in implementing the actions within their own country. There is substantial variation in the social, economic and public health infrastructure of various member states to achieve these goals. The July 2014 UN meeting reviewed the progress achieved in the prevention and control of NCDs, following the political declaration of September 2011 called for increased country efforts to integrate NCDs into health planning and national development plans, set national NCD targets and develop national NCD multisectoral plans by 2015 and to implement policies and interventions to reduce NCD risk factors and reorient health systems to address NCDs through people-centered primary health care and universal health coverage by 2016 [14]. The 2014 Global Status report [15] found that at December 2013, only 70 countries had at least one operational national plan in line with the Global Action Plan on NCDs. Just 56 countries had a plan to reduce physical inactivity; only 60 countries had national plans to reduce unhealthy diets; 69 countries had a plan to reduce tobacco use; 66 countries had a plan to reduce the harmful use of alcohol, and just 42 countries had monitoring systems to report on the 9 global targets.

With Effective Actions on Risk Factors, a High Proportion of Strokes Are Preventable

Stroke is a prototype NCD in that there is overwhelming scientific evidence that with actions taken on risk factors, the risk of stroke can be substantially reduced [16]. It has been estimated that with effective actions on common life style factors, about half of all strokes may be prevented [17]. This estimate does not include the effects of hypertension and stroke prevention in atrial fibrillation, the effects of which are additive. Achieving many of the WHO targets for cost-effective primary prevention of NCDs would have a major impact on reducing stroke incidence. Moreover, primary and secondary prevention of stroke will also have beneficial effects on cognitive decline and dementia.

It should be recognized that it is uncertain whether the preventive effect demonstrated in high- and middle-income countries applies equally to low-income countries. Causes of stroke may be substantially different in such regions, warranting further research.

For Stroke, Reduction of Mortality Is Not the Single Important Measure

In both the Global Action Plan and the draft for the Post-2015 SDGs, the target is to reduce premature (<70 years of age) mortality from NCDs. Whereas mortality rates are the most easily measureable and widely available epidemiological data globally, the fact that most stroke do not lead to death should be recognized. Stroke is a leading cause of adult disability, and the prevalence of long-term stroke survivors (many of whom have disabilities) is alarmingly high in low-, middle- and high-income countries and gradually increasing, putting extra strain on the health systems [1, 2]. Disability, handicap and decrements in quality of life are the more robust outcomes in the assessment of the global public health impact of stroke.

For stroke, the fact from the GBD studies is also that stroke should no longer be regarded as a disease of the elderly: two-thirds of all strokes occur among persons younger than 70 years of age [1, 2].

Preventing new events and disability from stroke can be achieved by reducing stroke incidence – but the effects of effective therapies in the acute phase (stroke unit management, thrombolytic and other reperfusion therapies), as well as rehabilitation and long-term follow-up efforts, to prevent stroke recurrence and improve functional outcomes should be recognized as important measures to substantially reduce the burden of stroke in people who have developed and/or survived stroke. The world's 1st global stroke guidelines (The World Stroke Organization Global Stroke Services Guidelines and Action Plan) has recently been published and provides a listing of essential components of care at different levels of services [18].

Data on Epidemiology, Risk Factors and Provision of Services Are Needed

Collection of follow-up data within the framework of the WHO Global Action Plan are planned, and is the mandate of the WHO and member countries. The Global Action Plan also emphasizes the importance of monitoring the trends and determinants of NCDs including collection of data on gender differences and social determinants. However, it is anticipated that many data items will be challenging to collect, including those data related to stroke.

Academic health centers that host major clinical and public health programs, such as the GBD project, play an

important role in providing data on the epidemiological distribution and development of diseases, including country specific data on the core epidemiological indices (incidence, mortality, prevalence, disability) as well as data on risk factors. Matching data on the status of the health system and availability of essential services would be much desirable but are currently not available from most parts of the world. Such a project has recently been initiated by the World Stroke Organization. Overall, academia and civil society play important roles in providing adequate scientific input and advice to governmental bodies as a basis for decisions.

Financing Is a Challenge, But Is Possible

Strengthening the health services comes at a cost, as does action to influence environmental factors that indirectly affect stroke. The cost issue of the Post-2015 SDGs was recently discussed at the UN meeting in Addis Ababa. Although official development assistance will be provided for the lowest income countries, financing will need to be raised for most countries by reallocation of resources within the country. The fact that health is featured more prominently among the SDGs should provide more impetus for prioritization of resources to address these issues. Numerous economic analyses have demonstrated the dire long-term consequences of inadequately addressing these health threats. A major possibility to raise funds for the changes in the health sector was proposed to be drastically increased tobacco taxes, which would reach levels that would be sufficient for most of the changes needed.

Stroke Prevention Worldwide – The Opportunity to Act Is Now

Stroke prevention has entered a new era, with stroke being identified as one of the prioritized NCD in the WHO and UN actions on NCDs. These initiatives provide the platform for major opportunities to prevent stroke, improve stroke outcomes and reduce collateral issues, such as cognitive decline and dementia, along with other NCDs. Despite the tremendous opportunities, many challenges have been identified. Active multisectoral engagement and involvement of academia (like the GBD project) and civil society (like the World Stroke Organization, regional and national stroke societies) in this process are essential. Prevention of stroke

is a complex medical and a political issue – but there is ample evidence that prevention of stroke works, and now is the opportunity to scale up the actions. ‘Leave no one behind’ is one of the mottos of the Post-2015 SDG work – if you have a stroke today or if you at risk for stroke, you are certainly likely to be left behind in many parts of the world. There has never been a better chance for global change for stroke prevention and care, and we must seize the opportunity and act now.

References

- 1 Feigin VL, Forouzanfar MH, Krishnamurthi R, Mensah GA, Connor M, Bennett DA, Moran AE, Sacco RL, Anderson L, Truelsen T, O'Donnell M, Venketasubramanian N, Barker-Collo S, Lawes CM, Wang W, Shino-hara Y, Witt E, Ezzati M, Naghavi M, Murray C; Global Burden of Diseases, Injuries, and Risk Factors Study 2010 (GBD 2010) and the GBD Stroke Experts Group: Global and regional burden of stroke during 1990–2010: findings from the Global Burden of Disease study 2010. *Lancet* 2014;383:245–254.
- 2 Krishnamurthi RV, Feigin VL, Forouzanfar MH, Mensah GA, Connor M, Bennett DA, Moran AE, Sacco RL, Anderson LM, Truelsen T, O'Donnell M, Venketasubramanian N, Barker-Collo S, Lawes CM, Wang W, Shino-hara Y, Witt E, Ezzati M, Naghavi M, Murray C; Global Burden of Diseases, Injuries, Risk Factors Study 2010 (GBD 2010); GBD Stroke Experts Group: Global and regional burden of first-ever ischaemic and haemorrhagic stroke during 1990–2010: findings from the Global Burden of Disease study 2010. *Lancet Glob Health* 2013;1:e259–e281.
- 3 Krishnamurthi RV, Moran AE, Forouzanfar MH, Bennett DA, Mensah GA, Lawes CM, Barker-Collo S, Connor M, Roth GA, Sacco R, Ezzati M, Naghavi M, Murray CJ, Feigin VL; Global Burden of Diseases, Injuries, and Risk Factors 2010 Study Stroke Expert Group: The global burden of hemorrhagic stroke: a summary of findings from the GBD 2010 study. *Glob Heart* 2014;9:101–106.
- 4 WHO Global Action Plan for the prevention and control of noncommunicable diseases 2013–2020. who.int/iris/bitstream/10665/94384/1/9789241506236_eng.pdf?ua=1 (accessed August 10, 2015).
- 5 Beaglehole R, Bonita R, Horton R, Adams C, Alleyne G, Asaria P, Baugh V, Bekedam H, Billo N, Casswell S, Cecchini M, Colagiuri R, Colagiuri S, Collins T, Ebrahim S, Engellau M, Galea G, Gaziano T, Geneau R, Haines A, Hospedales J, Jha P, Keeling A, Leeder S, Lincoln P, McKee M, Mackay J, Magnusson R, Moodie R, Mwatsama M, Nishtar S, Norrving B, Patterson D, Piot P, Ralston J, Rani M, Reddy KS, Sassi F, Sheron N, Stuckler D, Suh I, Torode J, Varghese C, Watt J; Lancet NCD Action Group; NCD Alliance: Priority actions for the non-communicable disease crisis. *Lancet* 2011;377:1438–1447.
- 6 O'Donnell MJ, Xavier D, Liu L, Zhang H, Chin SL, Rao-Melacini P, Rangarajan S, Islam S, Pais P, McQueen MJ, Mondo C, Damasceno A, Lopez-Jaramillo P, Hankey GJ, Dans AL, Yusuf K, Truelsen T, Diener HC, Sacco RL, Ryglewicz D, Czlonkowska A, Weimar C, Wang X, Yusuf S; INTERSTROKE Investigators: Risk factors for ischaemic and intracerebral haemorrhagic stroke in 22 countries (the INTERSTROKE study): a case-control study. *Lancet* 2010;376:112–123.
- 7 Yusuf S, Wood D, Ralston J, Reddy KS: The world heart federation's vision for worldwide cardiovascular disease prevention. *Lancet* 2015;386:399–402.
- 8 United Nations General Assembly: Resolution Adopted by the General Assembly: 66/2: Political Declaration of the High-Level Meeting of the General Assembly on the Prevention and Control of Non-Communicable Diseases, 2012 (adopted September 19, 2011; published January 24, 2012).
- 9 Yusuf S, Islam S, Chow CK, Rangarajan S, Dagenais G, Diaz R, Gupta R, Kelishadi R, Iqbal R, Avezum A, Kruger A, Kutty R, Lanus F, Lisheng L, Wei L, Lopez-Jaramillo P, Oguz A, Rahman O, Swidan H, Yusuf K, Zatonski W, Rosengren A, Teo KK; Prospective Urban Rural Epidemiology (PURE) Study Investigators: Use of secondary prevention drugs for cardiovascular disease in the community in high-income, middle-income, and low-income countries (the PURE Study): a prospective epidemiological survey. *Lancet* 2011;378:1231–1243.
- 10 Kissela BM, Khoury JC, Alwell K, Moomaw CJ, Woo D, Adeoye O, Flaherty ML, Khatir P, Ferioli S, De Los Rios La Rosa F, Broderick JP, Kleindorfer DO: Age at stroke: temporal trends in stroke incidence in a large, biracial population. *Neurology* 2012;79:1781–1787.
- 11 Giang KW, Björck L, Nielsen S, Novak M, Sandström TZ, Jern C, Torén K, Rosengren A: Twenty-year trends in long-term mortality risk in 17,149 survivors of ischemic stroke less than 55 years of age. *Stroke* 2013;44:3338–3343.
- 12 Parmar P, Krishnamurthi R, Ikram MA, Hofman A, Mirza SS, Varakin Y, Kravchenko M, Piradov M, Thrift AG, Norrving B, Wang W, Mandal DK, Barker-Collo S, Sahathevan R, Davis S, Saposnik G, Kivipelto M, Sindi S, Bornstein NM, Giroud M, Béjot Y, Brainin M, Poulton R, Narayan KM, Correia M, Freire A, Kokubo Y, Wiebers D, Mensah G, BinDhim NF, Barber PA, Pandian JD, Hankey GJ, Mehndiratta MM, Azhagammal S, Ibrahim NM, Abbott M, Rush E, Hume P, Hussein T, Bhattacharjee R, Purohit M, Feigin VL; Stroke RiskometerTM Collaboration Writing Group: The Stroke Riskometer(TM) app: validation of a data collection tool and stroke risk predictor. *Int J Stroke* 2015;10:231–244.
- 13 Feigin VL, Krishnamurthi R, Bhattacharjee R, Parmar P, Theadom A, Hussein T, Purohit M, Hume P, Abbott M, Rush E, Kasabov N, Crezee I, Frielick S, Barker-Collo S, Barber PA, Arroll B, Poulton R, Ratnasabath Y, Tobias M, Cabral N, Martins SC, Furtado LE, Lindsay P, Saposnik G, Giroud M, Béjot Y, Hacke W, Mehndiratta MM, Pandian JD, Gupta S, Padma V, Mandal DK, Kokubo Y, Ibrahim NM, Sahathevan R, Fu H, Wang W, Liu L, Hou ZG, Goncalves AF, Correia M, Varakin Y, Kravchenko M, Piradov M, Saadah M, Thrift AG, Cadilhac D, Davis S, Donnan G, Lopez AD, Hankey GJ, Maujean A, Kendall E, Brainin M, Abd-Allah F, Bornstein NM, Caso V, Marquez-Romero JM, Akinyemi RO, Bin Dhim NF, Norrving B, Sindi S, Kivipelto M, Mendis S, Ikram MA, Hofman A, Mirza SS, Rothwell PM, Sandercock P, Shakir R, Sacco RL, Culebras A, Roth GA, Moradi-Lakeh M, Murray C, Narayan KM, Mensah GA, Wiebers D, Moran AE; RIBURST Study Collaboration Writing Group: New strategy to reduce the global burden of stroke. *Stroke* 2015;46:1740–1747.

Disclosure Statement

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

Disclaimer

The views expressed in this article are those of the authors and do not necessarily represent the views of the National Heart, Lung, and Blood Institute; National Institutes of Health, the US Department of Health and Human Services or the WHO.

- 14 United Nations General Assembly: Outcome document of the high-level meeting of the General Assembly on the comprehensive review and assessment of the progress achieved in the prevention and control of non-communicable diseases, June 10–11, 2014. <http://www.who.int/nmh/events/2014/outcome-document.pdf?ua=1> (accessed August 10, 2015).
- 15 WHO global status report on noncommunicable diseases 2014. http://apps.who.int/iris/bitstream/10665/148114/1/9789241564854_eng.pdf?ua=1 (accessed August 10, 2015).
- 16 Meschia JF, Bushnell C, Boden-Albala B, Braun LT, Bravata DM, Chaturvedi S, Creager MA, Eckel RH, Elkind MS, Fornage M, Goldstein LB, Greenberg SM, Horvath SE, Iadecola C, Jauch EC, Moore WS, Wilson JA; American Heart Association Stroke Council; Council on Cardiovascular and Stroke Nursing; Council on Clinical Cardiology; Council on Functional Genomics and Translational Biology; Council on Hypertension: AHA/ASA guideline guidelines for the primary prevention of stroke. A statement for healthcare professionals from the American Heart Association/American Stroke Association. *Stroke* 2014;45:3754–3832.
- 17 Tikk K, Sookthai D, Monni S, Gross ML, Lichy C, Kloss M, Kaaks R: Primary preventive potential for stroke by avoidance of major lifestyle risk factors: the European Prospective Investigation into Cancer and Nutrition-Heidelberg cohort. *Stroke* 2014;45:2041–2046.
- 18 Lindsay P, Furie KL, Davis SM, Donnan GA, Norrving B: World Stroke Organization global stroke services guidelines and action plan. *Int J Stroke* 2014;9(suppl A100):4–13.