



Development-assistance Strategies for Stroke in Low- and Middle-income Countries

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While communicable diseases still pose a serious health threat in developing countries, previously neglected health issues caused by non-communicable diseases such as stroke are rapidly becoming a major burden to these countries. In this review we will discuss the features and current status of stroke in low- and middle-income countries (LMICs). Overall the global burden of hemorrhagic stroke is larger than ischemic stroke, with a disproportionately greater burden, measured in incidence and disability-adjusted life-years, regionally localized in LMICs. Patients in poorer countries suffer due to insufficient primary care needed to control risk factors such as hypertension, and inadequate emergency care systems through which sudden events should be managed. In light of these situations, we emphasize two strategic points for development assistance. First, assistance should be provided for bolstering, integrating, and coordinating both the primary health and emergency care systems, in order to prevent stroke and strengthen stroke management, respectively. Second, the assistance needs to focus on programs at the community level, to reduce life-style risks of stroke in a more sustainable manner, and to improve stroke outcomes more effectively.

Keywords: Cerebrovascular Disorder; Global Health Burden; Non-communicable Diseases; Primary Health Care; Emergency Care System; Community-based Approach

GLOBAL AND REGIONAL BURDEN OF STROKE

Stroke is the second highest cause of death worldwide and the third highest cause of disability-adjusted life-years (DALYs) (1) and its regional burden is escalating. A meta-analysis and review of 56 population-based studies published over four decades (1970 to 2008) showed that in ten low-income and middle-income countries (LMICs) the age-adjusted incidence of stroke more than doubled when comparing the years between 1970 to 1979 and 2000 to 2008, while the incidence in 18 high-income countries almost halved during the same period (2). In fact, the incidence of stroke in LMICs exceeded that in high-income countries by 20% for the first time in 2000-08. Moreover, decreasing stroke fatalities have led to a global trend of increasing stroke survivor rates and DALYs lost due to stroke, with most of the burden now in LMICs. Although this study might be subject to selection or sampling bias (1), it clearly shows a divergent pattern in the incidence of stroke when comparing countries based on income stratification.

One of the major findings in a previously published systematic analysis, the Global Burden of Disease Study 2010 (3) is that most of the burden of stroke, independent from whether it is ischemic or hemorrhagic, is in low-income and middle-income countries, with the average age of incidence and fatality being 6

yr younger than in high-income countries (HICs) leading to greater DALYs lost. A focused analysis of first-ever ischemic and hemorrhagic strokes in the same database (4) specifically demonstrated that 1) most of the burden of ischemic and hemorrhagic stroke is in low-income and middle-income countries, which bear 63% of the incident ischemic strokes and 80% of hemorrhagic strokes, 57% of deaths due to ischemic stroke and 84% due to hemorrhagic stroke, and 64% of DALYs lost due to ischemic stroke and 86% due to hemorrhagic stroke (1). 2) While all other age-standardized rates have decreased over the past two decades, the incidence of hemorrhagic stroke in low-income and middle-income countries is the only one rate that has continued to increase [22% increase, 95% confidence interval (CI) 5-30], particularly in people younger than 75 yr (19% increase, 95% CI 5-30), over the same period (4). When compared to high-income countries, low- and middle-income ones in fact had a 40% higher incidence, 77% higher mortality, and 65% higher DALY rates of hemorrhagic stroke (4).

These data clearly indicate that priorities in the quest to reduce the global and regional burden of stroke need to focus on the prevention of hemorrhagic stroke particularly in LMICs and in people younger than 75 yr (4). Given that most hemorrhagic strokes can be attributed to hypertension and an unhealthy life-style (e.g., physical inactivity, obesity, unhealthy diet, excessive

alcohol intake, and smoking) (5,6), population-based mass strategies for improving education and the environment to reduce the consumption of salt, calories, alcohol, and tobacco, along with strategies for identifying those at high risk of stroke are urgently needed in LMICs.

A particular emphasis should be put on the reduction of blood pressure in women in these countries, since the global burden of blood pressure-related diseases is escalating faster among women than men (7). In recent years, the age-adjusted mortality rate among women has actually increased, likely due to the underestimation of cardiovascular risks and suboptimal therapy (7).

A peculiar fact regarding the distribution of the global burden of vascular disorders is that the proportions of ischemic heart disease and stroke within the category of cardiovascular disease vary significantly across countries (8). While most European and Arab countries show an extreme predominance of ischemic cardiac diseases over stroke, people in Asian countries exhibit the exact opposite pattern that is, an extremely high incidence and burden of stroke relative to a rather low incidence and burden of ischemic heart disease.

IMPORTANCE OF NON-COMMUNICABLE DISEASES FOR DEVELOPMENT ASSISTANCE IN HEALTH (DAH)

Traditionally development assistance in the health sector has mainly focused on infectious diseases. This has many underlying historical and practical reasons. The concern of the spread of diseases across national boundaries and the acute and prominent deaths caused by infectious diseases are more publically noticeable and easily evoke alarm. The relatively simple underlying causal association exhibited by infectious diseases perhaps makes it easier for donors to contribute when deciding to give assistance. Also the relatively short-term and measurable outcomes expected once the assistance is implemented also contribute to the relatively larger attraction to infectious diseases over non-communicable diseases (NCDs). Recently the increasing awareness of the importance of NCDs as major health problems facing LMICs is a belated but certainly welcomed improvement in global health.

While NCDs including stroke pose a serious burden globally, the impact of the burden is particularly worse in LMICs for the following reasons:

First, LMICs suffer from double burdens in that NCDs are rising rapidly, while infectious diseases are still rampant in vulnerable populations, posing significant threats to already overburdened medical services and infrastructure that are being poorly managed due to a lack of expertise, skills, and resources in the public health sectors in these countries.

Second, LMICs' usual inequality in economic development

introduces health problems related to over- and under-nutrition or malnutrition concurrently. Some in the population become obese from rapidly westernizing dietary patterns, while others in the same population are continuously threatened by malnutrition and even starvation.

Third, the poor medical care delivery system makes the outcome of NCDs worse in LMICs. Access to medical information and resources for managing risk factors is extremely limited in these countries, such that risk factors that would be easily controlled in high-income countries are left untreated. When complications do occur from NCDs, appropriate medical care is often inadequate leading to shamefully high morbidity and mortality rates.

THE DUAL NATURE OF STROKE AND NCD PROBLEMS FOR LMICS

Factors determining the incidence, severity and outcome of first-ever strokes include uncontrolled high blood pressure (5), inadequate use of anti-platelet treatment in patients at risk for stroke (9), and low cholesterol (10). These factors certainly are more prevalent in LMICs than in high-income countries because of low public awareness regarding these issues, weak medical surveillance, and the poor nutritional status of people in LMICs. For these reasons, compared to HICs, stroke in LMICs is poorly managed in terms of both its prevention, including the control of risk factors, and medical care when stroke events do occur.

Stroke is a prototypical example of an NCD against which dual-track strategies are required. Most NCDs have risk factors related to lifestyle factors, such as dietary habits, the consumption of hazardous items like tobacco and alcohol, and a lack of physical activity. Therefore, to intervene and disrupt the causal link between risk factors and NCDs including stroke, changes in lifestyle need to occur. The means to induce lifestyle changes, such as education, supervision of behavior, and improvement of social and cultural environments, are all long-term strategies, which require weeks to decades of investment.

On the other hand, NCDs, stroke in particular, are characterized by sudden and abrupt crises. These events develop over a very short period of time, within seconds or minutes, and worsen if not responded to properly in a timely manner. The occurrence of each crisis is stochastic in nature and unpredictable in time and place, requiring a wide deployment of human and physical resources for a proper response in case the events occur. Furthermore, the seriousness of these events is also unpredictable at the onset, and urgent interventions are critical to curtail the probability of progressive worsening and to improve the chances of a better ultimate outcome.

According to the American Stroke Association, the only FDA approved treatment for ischemic strokes is tissue plasminogen activator (tPA) which acts by dissolving the clot obstructing blood

flow to part of the brain. If administered within 3 hr (up to 4.5 hr in eligible patients), tPA may improve the chances of recovering from a stroke. However, a significant number of stroke victims do not arrive at the hospital in time for tPA treatment; this is why it is imperative to identify symptoms and signs of stroke immediately. This is also why the neurologist is now an essential member of the emergency care team in developed countries, whereas this benefit of early detection and treatment for stroke is scarcely attainable in LMICs.

The dual nature of stroke and NCD problems is difficult to manage, especially in LMICs where setting priorities for resource distribution tends to neglect long-term planning against stroke, and the lack of fundamental infrastructure hinders the transportation of patients to adequate medical service facilities, let alone the provision of urgently needed thrombolytic therapy.

COMMUNITY-BASED APPROACH TO PREVENT AND MANAGE STROKES IN LMICs

Given the dual-nature of stroke, the most beneficial strategies for development assistance in LMICs should be focused at the level of the community, as opposed to individual patients or hospitals. Advantages of the community-based approach over hospital-based or individual-directed ones are many and not limited to the following:

First, planning and management are more likely to be sustained over longer periods of time at the community level if based on consensus building and democratic decision-making. Stakeholders would be more easily identifiable, and their responsibility and participation in the making and execution of health-related policies would be more prominent and inducible at the level of the local community than, for example, for individual patients or at the national level. This is particularly important for stroke detection, because stroke victims often need assistance from neighbors or passers-by in the local community, and widely spreading the public awareness of “stroke attacks” takes time and effort on a long-term basis.

Second, lifestyle changes require a comprehensive approach that involves the improvement in neighborhoods as well as the behavioral correction of individuals. This point has been clearly illustrated by a study on the effects of neighborhood allocation on extreme obesity and diabetes: The opportunity to move from a neighborhood with a high level of poverty to one with a lower level of poverty was associated with modest but potentially important reductions in the prevalence of extreme obesity and diabetes (11). The mechanisms underlying these associations need further investigation, given their potential to guide the design of community-level interventions intended to improve health. Another example in this regard is the finding that lower perceived neighborhood crime, indicative of greater neighborhood walkability, was associated with a lower risk of symptoms of de-

pression (12), indicating that community-level approaches may be beneficial for other NCDs as well.

Third, the limited resources in LMICs will be best utilized and mobilized when deployed at the community level. Information on health, sanitation, and the environment needs to be provided for and made continuously available to the whole community. Comprehensive, community based primary health care programs, such as the Family Health Program in Brazil, that act by promoting cardiovascular disease prevention, care, and follow-up, were negatively associated with mortality rates from cerebrovascular and heart diseases (ambulatory care-sensitive conditions) in both unadjusted models and models adjusted for demographic, social, and economic confounders (13). Moreover, the program coverage increased the number of health education activities, domiciliary visits, and medical consultations and reduced hospitalization rates for cerebrovascular and heart disease, demonstrating the propensity of community-based activities to reach beyond the confines of their originally-targeted diseases and crossing over to beneficially impact many other health-related aspects.

CONCLUSIONS

Future directions in DAH need to achieve paradigm shifts in theory and practice to tackle the ever-increasing burden of NCDs in developing countries. A couple of suggestions are worth drawing from the above review on the current burden and potential strategies for stroke in LMICs.

First, development assistance must recognize the dual-nature of the problems related to stroke and non-communicable diseases. Plans against these problems should include specific strategies for building both primary health and emergency care systems. Primary health strategies are needed to reduce the underlying causes of NCDs by changing risky life-style behaviors of individuals. At the same time, build-up strategies should be put in place to strengthen emergency medical care and transport to properly respond to unpredictable, critical events, such as brain and heart attacks. The two branches of medical services should be supplemented and coordinated by an integrated system of information delivery and emergency management. Also modern science and technology must be brought into the scene for event prediction and the rational distribution of limited resources according to such predictions.

Second, the current and most typical practice of DAH in providing treatment to individual stroke patients at the level of clinics and hospitals should be changed to an approach focusing these efforts at the community level. This will involve paying closer attention to the social, cultural, and environmental determinants of health and disease in LMICs. Assistance should be planned and coordinated in a multi-sectorial fashion, consisting of activities in economic development, education and

training of human resources, and environmental protection and preservation, as well as in the health sector. The main aim of this effort should be the collective empowerment of the community to take responsibility into their own hands and continue to work for the betterment of their lives for the long run.

AUTHOR CONTRIBUTION

Conception and design of the study: Lee KM. Manuscript preparation: Lee KM, Nam YS, Lee H. Revision and approval of final manuscript: all authors.

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