

# GLOBAL EPIDEMIOLOGY OF STROKE

Jerome H. Chin, MD, PhD, MPH, FAAN

Ischemic heart disease and cerebrovascular disease are now the #1 and #2 causes of premature death and disability globally according to the 2015 findings of the Global Burden of Diseases, Injuries, and Risk Factors (GBD) study (1). In 1990, ischemic heart disease and cerebrovascular disease ranked #4 and #5, behind lower respiratory infection, neonatal preterm birth, and diarrheal diseases (1). This epidemiologic transition can be attributed to improvements in the prevention and treatment of infectious diseases, particularly in neonates and children, combined with an increase in global cardiovascular deaths due to aging and growth of the population (2).

The epidemiology of stroke differs by region, country, income level, age group, and urban and rural residence. The age-specific incidence rates of ischemic stroke are higher in high-income countries (HIC) than in low- and middle-income countries (LMIC) (3). However, the reverse is the case for age-specific incidence rates of hemorrhagic stroke (3). In the Prospective Urban Rural Epidemiologic study, age-standardized incidence rates of major and fatal cardiovascular disease showed a gradient by country income level with the highest rates in low-income countries (4). The burden of stroke, measured in disability-adjusted life years (DALYs), as a proportion of the burden of all health conditions is declining in HIC but rising in LMIC (5). In China, stroke is the #1 cause of death and accounts for 10.1% of total DALYs. In the United States, stroke is the #4 cause of death and accounts for 2.5% of total DALYs.

The marked differences in the relative burden of stroke in LMIC compared to HIC can be attributed in large part to disparities in the awareness, treatment, and control of the leading risk factors for stroke. High systolic blood pressure is the #1 risk factor for stroke in every region of the world (6). However, in most LMIC, the majority of individuals with hypertension are not aware of their condition due to inadequate healthcare services for screening of hypertension and other non-communicable diseases (7). The prevalence rates of hypertension and other top risk factors for stroke (high body mass index, physical inactivity, unhealthy diets, high fasting plasma glucose, and ambient particulate matter pollution) are rising in LMIC with the continued growth of urban populations (8). Age-standardized mortality rates for stroke are higher in LMIC than in HIC (3), a difference attributable to a number of factors including limited availability and affordability of acute stroke treatment services, late presentations of stroke cases to medical facilities, and higher proportions of hemorrhagic stroke. Finally, unique risk factors contributing to the stroke burden in LMIC include sickle cell disease, congenital heart disease, rheumatic heart disease, and HIV (9).

Reducing the burden of stroke in LMIC will require increased multi-sectoral spending for the primordial and primary prevention of stroke. Expanding access to acute stroke treatments should not be prioritized over preventive services. More importantly, universal health coverage is required for the successful implementation of any preventive interventions.

## References

1. Kassebaum NJ, Arora M, Barber RM, et al.; GBD 2015 DALYs and HALE Collaborators. Global, regional, and national disability-adjusted life-years (DALYs) for 315 diseases and injuries and healthy life expectancy (HALE), 1990–2015: a systematic analysis for the Global Burden of Disease Study 2015. *Lancet*. 2016;388:1603-1658.
2. Roth GA, Forouzanfar MH, Moran AE et al. Demographic and Epidemiologic Drivers of Global Cardiovascular Mortality. *N Engl J Med*. 2015;372:1333-1341.
3. Feigin V, Krishnamurthi RV, Parmar P et al. Update on the Global Burden of Ischemic and Hemorrhagic Stroke in 1990–2013: The GBD 2013 Study. *Neuroepidemiology*. 2015;45:161-176.
4. Yusuf S, Rangarajan S, Teo K et al. Cardiovascular Risk and Events in 17 Low-, Middle-, and High-Income Countries. *N Engl J Med*. 2014;371:818-27.

5. IHME: <http://vizhub.healthdata.org/gbd-compare/>
6. Feigin VL, Roth GA, Naghavi M, et al; Global Burden of Diseases, Injuries and Risk Factors Study 2013 and Stroke Experts Writing Group. Global burden of stroke and risk factors in 188 countries, during 1990-2013: a systematic analysis for the Global Burden of Disease Study 2013. *Lancet Neurol.* 2016;15(9):913-924.
7. Chin JH, Bhatt JM, Lloyd-Smith AJ. Hypertension—A Global Neurological Problem. *JAMA Neurol.* Published online February 06, 2017. doi:10.1001/jamaneurol.2016.471
8. Mills KT, Bundy JD, Kelly TN et al. Global Disparities of Hypertension Prevalence and Control. *Circulation.* 2016;134:441-450.
9. Kwan GF, Mayosi BM, Mocumbi AO et al. Endemic Cardiovascular Diseases of the Poorest Billion. *Circulation.* 2016;133:2561-2575.