

Stroke Prevention, Treatment, and Trends

Resource Sheet

2018

Overview

This resource sheet was curated by the Global Health Education and Learning Incubator at Harvard University to support an upcoming Forum at Harvard T.H. Chan School of Public Health, “[Stroke: Successes and Setbacks with a Notorious Killer](#).” The multidisciplinary materials are suitable for educators and learners seeking an introductory snapshot of stroke prevention, treatment, and trends. The event description is as follows:

Stroke prevention and treatment is a remarkable success story — but strides appear to be stalling in some populations. Evidence suggests a dramatic increase in stroke incidence in people in their 30s and 40s. Disparities persist among race/ethnicities, and declines in stroke death have stalled in three out of every four states. This Forum will examine stroke — from prevention and treatment through recovery. What is the latest information about the impacts of healthy lifestyles? What are the debates about current medications, such as TPA? What are some new treatments, including interventions in the so-called “golden period” of recovery, and the promise of basic science? What do policy changes, such as the 2018 blood pressure guidelines, mean? And how can we transform success from previous stroke prevention efforts for this new era to save even more lives and prevent disability?

[The Forum at Harvard T.H. Chan School of Public Health](#) is a live webcasting series that provides decisionmakers with a global platform to discuss policy choices and scientific controversies across the world.

This resource sheet was originally developed by the Global Health Education and Learning Incubator at Harvard University in 2018. It is used and distributed with permission by the Global Health Education and Learning Incubator at Harvard University. The Incubator’s educational materials are not intended to serve as endorsements or sources of primary data, and do not necessarily reflect the views of Harvard University.

Selected Resources – At a Glance

ARTICLES AND PERSPECTIVES	
	Perspective. Bakris G, Sorrentino M. Redefining Hypertension — Assessing the New Blood-Pressure Guidelines. <i>The New England Journal of Medicine</i> 2018; 378(6): 497–499. DOI: http://doi.org/10.1056/NEJMp1716193 .
	Article. Ritchey MD et al. Vital Signs: State-Level Variation in Nonfatal and Fatal Cardiovascular Events Targeted for Prevention by Million Hearts 2022. <i>Morbidity and Mortality Weekly Report</i> 2018; 67(35): 974–982. https://www.cdc.gov/mmwr/volumes/67/wr/mm6735a3.htm .
*	Article. Bertram MY et al. Investing in Non-Communicable Diseases: An Estimation of the Return on Investment for Prevention and Treatment Services. <i>The Lancet</i> 2018. https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(18)30665-2/fulltext .
	Article Series. Stroke. <i>The Lancet</i> 2018; 392(10154). https://www.thelancet.com/series/stroke .
	Article. Gorelick PB et al. Defining Optimal Brain Health in Adults: A Presidential Advisory from the American Heart Association/American Stroke Association. <i>Stroke</i> 2017; 48(10): e284–e303. DOI: https://doi.org/10.1161%2FSTR.000000000000148 .
	Article. Smith EE et al. Prevention of Stroke in Patients With Silent Cerebrovascular Disease: A Scientific Statement for Healthcare Professionals From the American Heart Association/American Stroke Association. <i>Stroke</i> 2017; 48(2): e44–e71. DOI: http://www.doi.org/10.1161/STR.000000000000116 .
	Article. Thrift AG et al. Global Stroke Statistics. <i>International Journal of Stroke</i> 2017; 12(1): 13–32. DOI: http://doi.org/10.1177/1747493016676285 .
	Article. Feigin VL et al. Global Burden of Stroke Risk Factors in 188 Countries, During 1990–2013: A Systematic Analysis for the Global Burden of Disease Study 2013. <i>The Lancet Neurology</i> 2016; 15(9): 913–924. DOI: https://doi.org/10.1016/S1474-4422(16)30073-4 .
	Perspective. Perneczky R et al. Is the Time Ripe for New Diagnostic Criteria of Cognitive Impairment Due to Cerebrovascular Disease? Consensus Report of the International Congress on Vascular Dementia Working Group. <i>BMC Medicine</i> 2016; 14(162): 1–10. DOI: https://doi.org/10.1186/s12916-016-0719-y .
	Article. Hotamisligil GS. Inflammation and Metabolic Disorders. <i>Nature</i> 2006; 444: 860–867. DOI: http://doi.org/10.1038/nature05485 .
REPORTS, BRIEFS, AND FACT SHEETS	
	Fact Sheet. Preventing 1 Million Heart Attacks and Strokes. Centers for Disease Control and Prevention 2018. https://www.cdc.gov/vitalsigns/million-hearts .
	Report. The Atlas of Heart Disease and Stroke. World Health Organization 2018. http://www.who.int/cardiovascular_diseases/resources/atlas/en .
*	Report. The Global Action Plan on Physical Activity 2018 – 2030. World Health Organization 2018. http://www.who.int/ncds/prevention/physical-activity/gappa .
*	Report. Nishtar S et al. Time to Deliver: Report of the WHO Independent High-Level Commission on NCDs. <i>The Lancet</i> 2018. https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(18)31258-3/fulltext .
	Fact Sheet. Cardiovascular Diseases. World Health Organization 2017. http://www.who.int/en/news-room/fact-sheets/detail/cardiovascular-diseases-(cvds) .
	Brief. Preventing Stroke: Uneven Progress. <i>The Economist</i> 2017. https://perspectives.eiu.com/healthcare/policy-approaches-stroke-prevention .

DATA AND TOPIC PORTALS	
*	Topic Portal. Stroke, Cardiovascular Accident. World Health Organization 2018. http://www.who.int/topics/cerebrovascular_accident/en .
	Data Portal. Heart Disease and Stroke Maps and Data. Centers for Disease Control and Prevention, Division for Heart Disease and Stroke Prevention 2017. https://www.cdc.gov/dhdsp/maps/index.htm .
	Topic Portal. Stroke Risk. Centers for Disease Control and Prevention 2017. https://www.cdc.gov/stroke/index.htm .

*indicates resource listed in GHELI's online Repository

Annotated Bibliography

ARTICLES AND PERSPECTIVES

Redefining Hypertension — Assessing the New Blood-Pressure Guidelines

Perspective. Bakris G, Sorrentino M. Redefining Hypertension — Assessing the New Blood-Pressure Guidelines. *The New England Journal of Medicine* 2018; 378(6): 497–499. DOI: <http://doi.org/10.1056/NEJMp1716193>. This opinion piece in the *New England Journal of Medicine* addresses the new Guideline for the Prevention, Detection, Evaluation, and Management of High Blood Pressure in Adults from the American Heart Association and American College of Cardiology. It summarizes the new guideline, highlighting the emphasis placed on the monitoring of blood-pressure at home using proper techniques and the recommendation of combination medications for patients above designated blood pressure thresholds. The threshold for hypertension (high blood-pressure) has also been lowered, meaning that more people will now fall into this category. The authors go on to argue that these additional people who are now classified as having hypertension may now receive treatment for this condition even if they are not at high risk of experiencing adverse cardiovascular events. They also address the recommended change in the use of beta-blockers, lament the lack of clear evidence for some of the new recommendations, and advocate for adherence to the previous threshold for the classification of high-risk patients.

Vital Signs: State-Level Variation in Nonfatal and Fatal Cardiovascular Events Targeted for Prevention by Million Hearts 2022

Article. Ritchey MD et al. Vital Signs: State-Level Variation in Nonfatal and Fatal Cardiovascular Events Targeted for Prevention by Million Hearts 2022. *Morbidity and Mortality Weekly Report* 2018; 67(35); 974–982. <https://www.cdc.gov/mmwr/volumes/67/wr/mm6735a3.htm>.

This study in the *Morbidity and Mortality Weekly Report* examines the burden of cardiovascular events in the United States that have been given special attention by the Million Hearts 2022 initiative—a national initiative that supports implementation of an evidence-based set of clinical and public health strategies to prevent these events. Using data on emergency hospital visits, hospitalizations, and vital statistics, it finds that there were 2.2 million hospitalizations and 415,480 deaths in the country in 2016, resulting in \$32.7 billion in costs. Furthermore, these rates were higher in men and non-Hispanic blacks and varied positively with age, meaning that older people experienced more cardiovascular events than young people. The article also includes comparisons in outcomes between individual states. Its authors conclude that the Million Hearts initiative has strong potential to reduce economic burden on the country and that, using coordinated efforts, many adverse cardiovascular events can be prevented.

Investing in Non-Communicable Diseases: An Estimation of the Return on Investment for Prevention and Treatment Services

Article. Bertram MY et al. Investing in Non-Communicable Diseases: An Estimation of the Return on Investment for Prevention and Treatment Services. *The Lancet* 2018. [https://www.thelancet.com/journals/lancet/article/PIIS0140-6736\(18\)30665-2/fulltext](https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(18)30665-2/fulltext).

GHELI repository link: <http://repository.gheli.harvard.edu/repository/12436>

This article from *The Lancet* uses the NCD impact module of the OneHealth Tool to estimate the economic benefits of increasing investments in non-communicable diseases (NCDs) prevention. The OneHealth Tool calculates the health benefits of scaling up interventions, estimates their health care costs, and applies a monetary value to social benefits of increased years of healthy lives. Projections based on this tool estimate that 7-8 million people will die from cardiovascular disease alone by 2025 in 20 low- and middle- income countries facing the greatest burden of NCDs. This suggests that strong action is needed to reduce mortality from NCDs by 30 percent to meet benchmarks set by the Sustainable Development Goals (SDGs).

Interventions that are included in the analyses focus on decreasing exposure to tobacco, sodium reduction, and drug therapies, as they illustrate effects of treatment and prevention programs. Results suggest that scaling these interventions could prevent up to 13 million incidents of stroke and 8 million incidents of ischemic heart disease in a 15-year period. In turn, this would increase human capital and productivity. Drug therapies have been shown to be the most effective interventions but are difficult to scale up in comparison to cost-effective preventative interventions. The

authors recommend significant investment in these interventions along with strengthening health systems through interdisciplinary action. Ultimately, the authors suggest that the OneHealth Tool should be utilized at the country level to increase accuracy of the calculations when exploring investment cases.

This article is fifth in a *Lancet* [series](#) of five papers on NCDs and economics that describes the extent to which socioeconomic factors drive trends in NCDs, the equity impacts of health policies designed to reduce disease burden, and the ways in which NCD control can result in improved economic growth.

Lancet Series: Stroke

Article Series. Stroke. The Lancet 2018; 392(10154). <https://www.thelancet.com/series/stroke>.

This article series from *The Lancet* points out that stroke is the second leading cause of death and top cause of disability in the world. Given recent changes to the treatment of stroke, this series examines changes in the diagnosis and management of ischemic and hemorrhagic stroke. Its articles also address ways of reducing stroke risk, especially in lower and middle income countries.

Articles in the series:

- [Current Practice and Future Directions in the Diagnosis and Acute Treatment of Ischaemic Stroke](#)
- [Intracerebral Haemorrhage: Current Approaches to Acute Management](#)
- [Prevention of Stroke: A Global Perspective](#)

Defining Optimal Brain Health in Adults: a Presidential Advisory from the American Heart Association/American Stroke Association

Article. Gorelick PB et al. Defining Optimal Brain Health in Adults: a Presidential Advisory from the American Heart Association/American Stroke Association. Stroke 2017; 48(10): e284–e303.

DOI: <https://doi.org/10.1161%2FSTR.000000000000148>.

This presidential advisory from the American Heart Association (AHA), published in *Stroke*, addresses the issue of brain health in aging populations. It points out that cardiovascular risks have been shown to cause cognitive impairment and dementia and that modifying these risks could lead to better cognitive health. The article attempts to identify metrics to define optimal brain health, pointing to seven metrics: nonsmoking, physical activity levels, healthy diet, body mass index, untreated blood pressure, untreated total cholesterol, and fasting blood glucose. The authors adhere to previously-established guidelines for the management of cardiovascular risks and also recommend additional strategies to achieve this. They advocate for the AHA and American Stroke Association to include considerations of optimal brain health in their strategies for the near future.

Prevention of Stroke in Patients With Silent Cerebrovascular Disease: A Scientific Statement for Healthcare Professionals From the American Heart Association/American Stroke Association

Article. Smith EE et al. Prevention of Stroke in Patients With Silent Cerebrovascular Disease: A Scientific Statement for Healthcare Professionals From the American Heart Association/American Stroke Association. Stroke 2017; 48(2): e44–e71. DOI: <http://www.doi.org/10.1161/STR.000000000000116>.

This article in *Stroke* points to evidence showing that silent cerebrovascular disease is widespread and also correlated with risk for dementia and stroke. It reports that the writing committee put together by the Stroke Council of the American Heart Association found that silent brain infarcts and white matter hyperintensities are commonly observed during the aging process and are associated with stroke risk in the future. There were also no medical trials that specifically investigated silent cerebrovascular disease to reduce stroke risk. Other recommendations include the use of primary stroke prevention in those who experience certain silent cerebrovascular events and adoption of stand terms, and definitions for these events to allow for more effective diagnosis going forward.

Global Stroke Statistics

Article. Thrift AG et al. Global Stroke Statistics. International Journal of Stroke 2017; 12(1): 13–32.

DOI: <http://doi.org/10.1177/1747493016676285>.

This article attempts to produce updated estimates of the incidence of and mortality due to strokes at the country level. Using a combination of literature review and data from the World Health Organization (WHO), it finds that new incidence studies were available in 12 countries, showing incidence rates in countries such as Australia (76 per 100,000 population in 2009–2010) and New Zealand (119 per 100,000 population in 2011–2012). The authors point out that many

countries do not report data on incidence, but 128 countries do report mortality information to the WHO, among which Kazakhstan, Bulgaria, and Greece had the highest rates. They conclude by highlighting the pattern of national clinical registries reporting estimates instead of true community-level incidence numbers.

Global Burden of Stroke Risk Factors in 188 Countries, During 1990–2013: a Systematic Analysis for the Global Burden of Disease Study 2013

Article. Feigin VL et al. Global Burden of Stroke Risk Factors in 188 Countries, During 1990–2013: a Systematic Analysis for the Global Burden of Disease Study 2013. *The Lancet Neurology* 2016; 15(9): 913–924.

DOI: [https://doi.org/10.1016/S1474-4422\(16\)30073-4](https://doi.org/10.1016/S1474-4422(16)30073-4).

This article in *The Lancet* uses data from the Global Burden of Disease (GBD) study from 2013 to provide estimates on stroke-related disability adjusted life years (DALYs) associated with a number of risk factors in multiple population sub-groups worldwide between 1990 and 2013 in 188 countries. More specifically, risk factors analyzed included air pollution and other environmental influences, dietary factors, physical activity, tobacco use and smoke, and biological measures such as body mass index and blood pressure. The study finds that 90.5 percent of the DALYs due to stroke were due to modifiable risk factors that were examined and 74.2 percent were due to behavioral risks such as smoking, diet, and lack of exercise. Metabolic and environmental risks were the second and third highest causes of DALYs, respectively. The authors point out that a substantial portion of the global stroke burden could be eliminated if behavioral and metabolic risk factors were better controlled. They also add that air pollution is a significant contributor to the global burden in lower and middle income countries, the reduction of which should be highly prioritized.

Is the Time Ripe for New Diagnostic Criteria of Cognitive Impairment Due to Cerebrovascular Disease? Consensus Report of the International Congress on Vascular Dementia Working Group

Perspective. Pernecky R et al. Is the Time Ripe for New Diagnostic Criteria of Cognitive Impairment Due to Cerebrovascular Disease? Consensus Report of the International Congress on Vascular Dementia Working Group. *BMC Medicine* 2016; 14(162): 1–10. DOI: <https://doi.org/10.1186/s12916-016-0719-y>.

This article describes the recommendations and findings of the Diagnostic Criteria Working Group of the 9th International Congress on Vascular Dementia in 2015. It addresses diagnostic criteria for vascular dementia and similar health conditions, including the content of *The Diagnostic and Statistical Manual of Mental Disorders (DSM-V)* of the American Psychiatric Association and the uncertainty surrounding some of these criteria. The authors advocate for additional work towards understanding the mechanisms of vascular cognitive impairment, consolidating siloed research programs at the international level, conducting tests to determine if risk factors are modifiable through interventions, and aligning the pre-dementia and pre-clinical stages of vascular cognitive impairment with impairment due to Alzheimer's disease.

Inflammation and Metabolic Disorders

Article. Hotamisligil GS. Inflammation and Metabolic Disorders. *Nature* 2006; 444: 860–867.

DOI: <http://doi.org/10.1038/nature05485>.

This article in *Nature* discusses the homeostatic relationship between metabolic regulation and immune response. Disruption of this relationship can lead to chronic metabolic disorders such as obesity, Type II diabetes, and cardiovascular disease (CVD). The article unpacks the biological mechanisms of obesity, inflammation, and metabolic syndromes, and suggests opportunities to create therapeutics through manipulation of biological response pathways.

REPORTS, BRIEFS, AND FACT SHEETS

Preventing 1 Million Heart Attacks and Strokes

Fact Sheet. Preventing 1 Million Heart Attacks and Strokes. Centers for Disease Control and Prevention 2018.

<https://www.cdc.gov/vitalsigns/million-hearts>.

This fact sheet from the Centers for Disease Control and Prevention (CDC) summarizes the dangers posed by heart disease, highlighting the fact that many heart attacks and strokes are preventable. It describes the national initiative that promotes making small changes to prevent one million heart attacks, strokes, and cardiovascular events by 2022. This goal can be reached with collaborative action from the federal government, healthcare systems, state and local health departments, employers, and individuals.

The Atlas of Heart Disease and Stroke

Report. The Atlas of Heart Disease and Stroke. World Health Organization 2018.

http://www.who.int/cardiovascular_diseases/resources/atlas/en.

This report from the World Health Organization (WHO) breaks down the global burden of heart disease and stroke in six sections: cardiovascular disease types, risk factors, burden, action, the future and the past, and world tables. Beyond preventable mortality, heart diseases also cause high morbidity and economic burden. By discussing current research, organizations, prevention approaches, health education, legislation, and treatment, this resource provides information for future policy development.

The Global Action Plan on Physical Activity 2018 – 2030

Report. The Global Action Plan on Physical Activity 2018 – 2030. World Health Organization 2018.

<http://www.who.int/ncds/prevention/physical-activity/gappa>.

GHELI repository link: <http://repository.gheli.harvard.edu/repository/12490>

This report from the World Health Organization (WHO) outlines the WHO's new global plan to promote physical activity and provides a framework of policy actions to encourage physical activity at all levels. It describes the importance of physical activity in helping to prevent and treat noncommunicable diseases (NCDs) like heart disease, stroke, diabetes, and cancers; prevent risk factors like hypertension, overweight, and obesity; and improve mental health and overall quality of life and well-being. The report also outlines the cost of inactivity to health systems and societies, provides global data on physical activity, and describes the role of physical activity in the 2030 Sustainable Development Agenda. The WHO's Global Action Plan on Physical Activity seeks to reduce the global prevalence of physical inactivity in adolescents and adults by 15 percent by the year 2030, through the application of four strategic objectives: create active societies, create active environments, create active people, and create active systems. It outlines 20 policy actions to meet those objectives, including both "upstream" efforts—aimed at improving the social, cultural, economic and environmental factors that support physical activity—and "downstream", individually focused educational and informational approaches.

Time to Deliver: Report of the WHO Independent High-Level Commission on NCDs

Report. Nishtar S et al. Time to Deliver: Report of the WHO Independent High-Level Commission on NCDs. The Lancet 2018. [https://www.thelancet.com/journals/lancet/article/PIIS0140-6736\(18\)31258-3/fulltext](https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(18)31258-3/fulltext).

GHELI repository link: <http://repository.gheli.harvard.edu/repository/12487>

This Lancet Commission report presents the findings of an Independent High-Level Commission on Noncommunicable Diseases (NCDs), comprising representatives from across government sectors, United Nations agencies, nongovernmental organizations, the private and philanthropic sectors, and academia. The commission was convened at the request of the World Health Organization to identify ways to intensify political action to prevent premature death from cardiovascular diseases (stroke and heart attacks), cancers, diabetes and respiratory disease; to reduce tobacco use, harmful use of alcohol, unhealthy diets, and physical inactivity; and to promote mental health and well-being. The resulting recommendations are designed to help political leaders and policy-makers across government sectors, as well as other stakeholders, to curb NCDs—which make up the world's leading causes of death—and extend life expectancy for millions of people globally.

Fact Sheet: Cardiovascular Diseases

Fact Sheet. Cardiovascular Diseases. World Health Organization 2017. [http://www.who.int/en/news-room/fact-sheets/detail/cardiovascular-diseases-\(cvds\)](http://www.who.int/en/news-room/fact-sheets/detail/cardiovascular-diseases-(cvds)).

This fact sheet from the World Health Organization (WHO) provides key information about cardiovascular diseases (CVDs), which includes coronary heart disease, cerebrovascular disease, peripheral arterial disease, rheumatic heart disease, congenital heart disease, and deep vein thrombosis and pulmonary embolism. The fact sheet includes definitions, risk factors, symptoms, challenges, and responses. In 2016, an estimated 17.9 million people died from cardiovascular diseases—31 percent of global deaths. Of these, 85 percent were due to heart attack and stroke. It highlights that the global action plan for prevention and control of noncommunicable diseases (NCDs) targets CVDs through two goals: reducing blood pressure and increasing drug therapy and counseling to prevent heart attack and strokes.

Preventing Stroke: Uneven Progress

Brief. Preventing Stroke: Uneven Progress. The Economist 2017. <https://perspectives.eiu.com/healthcare/policy-approaches-stroke-prevention>.

This brief from *The Economist's* Intelligence Unit breaks down stroke policy and risk reduction efforts based on scorecard data of 20 countries. 80 percent of strokes are preventable through understanding risk factors and managing modifiable risks. The report explores current policy and stroke prevention strategies, and illustrates the progress that has been made across the world. Progress measured from the stroke prevention scorecard highlights gaps in best practices between countries. The brief makes two recommendations: to increase the efficiency of policy efforts are based on combining population and individual clinical approaches, and to coordinate the different components of stroke prevention.

DATA AND TOPIC PORTALS

Stroke, Cardiovascular Accident

Topic Portal. Stroke, Cardiovascular Accident. World Health Organization 2018. http://www.who.int/topics/cerebrovascular_accident/en.

This topic portal from the World Health Organization (WHO) provides information on strokes through select multimedia, program and activities, technical information, and publication resources. It also includes a link to the global status report on noncommunicable diseases, which shares data on action priorities to reduce cardiovascular disease.

Heart Disease and Stroke Maps and Data

Data Portal. Heart Disease and Stroke Maps and Data. Centers for Disease Control and Prevention, Division for Heart Disease and Stroke Prevention 2017. <https://www.cdc.gov/dhdsp/maps/index.htm>.

This data portal from the Centers for Disease Control and Prevention (CDC) illustrates trends in heart disease data. It shares tools and resources, including interactives, data maps, and embeddable widgets and buttons, that help visualize the prevalence of heart disease and stroke.

Stroke Risk

Topic Portal. Stroke Risk. Centers for Disease Control and Prevention 2017. <https://www.cdc.gov/stroke/index.htm>.

This topic portal from the Centers for Disease Control and Prevention shares key information about stroke risk, prevention, and trends. In the U.S., stroke is the fifth leading cause of death and is also a major cause of disability. Risks for stroke can be related to conditions, behavior, and family history. In addition to curating [maps and data sources](#), the portal shares [survivor stories](#) and [patient education](#) resources.