Enhancing primary stroke prevention: a combination approach

Kiran Bam, Muideen T Olaiya, Dominique A Cadilhac, Geoffrey A Donnan, Lisa Murphy, Monique F Kilkenny

Stroke can be prevented through effective management of risk factors. However, current primary stroke prevention approaches are insufficient and often fragmented. Primary stroke prevention strategies are predominantly targeted at behavioural (eg, smoking cessation and lifestyle modifications) and pharmacological interventions (ie, prevention medications). There is also a need to consider interrelating structural factors that support, or hinder, prevention actions and behaviours of individuals. Without addressing these structural factors, it is impossible to maximise the benefits of behavioural and pharmacological interventions at the population level. We propose a tripartite approach to primary stroke prevention, comprising behavioural, pharmacological, and structural interventions, which is superimposed on the socioecological model. This approach could minimise the current fragmentation and inefficiency of primary stroke prevention.

Lancet Public Health 2022; 7: e721–24

Stroke and Ageing Research, Department of Medicine, School of Clinical Sciences at Monash Health, Monash University, Melbourne, VIC, Australia (K Bam MPH, M T Olaiya PhD, Prof D A Cadilhac PhD, M F Kilkenny PhD)**; The Florey Institute of Neuroscience and Mental Health, Heidelberg, VIC, Australia** (Prof D A Cadilhac, M F Kilkenny)**; Melbourne Brain Centre at the Royal Melbourne Hospital, University of Melbourne, Melbourne, VIC, Australia** (Prof G A Donnan MD)**; Stroke Services, Stroke Foundation, Melbourne, VIC, Australia** (L Murphy MBBS)

Correspondence to: Assoc Prof Monique Kilkenny, Stroke and Ageing Research, Department of Medicine, School of Clinical Sciences at Monash Health, Monash University, Melbourne, VIC 3168, Australia **monique.kilkenny@monash.edu**

Introduction

Globally, advancements in behavioural and pharmacological interventions have led to a decline in the incidence of stroke.[1] However, incidence continues to rise in people aged 70 years or younger in low-income and middle-income countries.[1] Despite the growing burden of stroke, current interventions for primary stroke prevention are suboptimal and often fragmented.[2,3] A 2021 survey further reaffirmed that primary stroke prevention interventions are insufficiently implemented.[4] To address current gaps in primary stroke prevention, Owolabi and colleagues[3] recommended designing and implementing primary stroke prevention interventions using an integrated approach, comprising individual and population-wide measures. They also suggested that such interventions should be facilitated through appropriate health policy and advocacy.

Current strategies for primary stroke prevention often comprise behavioural and pharmacological interventions that are implemented at the individual level. Behavioural interventions include activities aimed at improving awareness of risk reduction at an individual level (eg, reducing alcohol intake and increasing physical activity). Pharmacological interventions include optimising the use of medications for stroke prevention.

The World Stroke Organization has issued a global policy agenda on the guiding principles for stroke prevention that includes reducing exposure to stroke risk factors, implementing and promoting motivational mobile technologies, facilitating access to low-dose combination medications in one polypill for specific groups, and investing in the training and deployment of community health workers for implementation.[5] However, when designing and implementing prevention interventions, there is also a need to consider interrelating structural factors[6] that support, or hinder, prevention actions and behaviours of individuals. These structural factors can be modifiable or non-modifiable, such as socioeconomic and cultural conditions, political will (eg, collaborations, commitments, and funding), government priorities or policies, and environmental conditions (eg, reduction of air pollution). Addressing these structural factors could improve the uptake of behavioural and pharmacological interventions for stroke prevention.[7]

Significance of structural interventions in primary stroke prevention

The consideration of interventions for addressing structural factors from a broader policy perspective will ensure the prioritisation of primary stroke prevention through action and accountability.[5] For example, interventions that improve healthy eating or physical activity are unlikely to be successful if there is poor access to healthy foods or few spaces for physical activity. Similarly, interventions aimed at improving the availability and affordability of essential medicines, or reduction of the amounts of salt and sugar in processed foods, are often driven by policy decisions. However, policy decisions are usually intensive of time and resources, and require a multidisciplinary team to implement.[7] Although policy support mechanisms are often effective in high-income countries, they are too often inadequately monitored in many low-income and middle-income countries. Inadequate monitoring is mainly due to budget constraints, which limits capacity for planning and coordination.[8] Use of affordable digital technology could facilitate real-time monitoring and feedback to individuals, service providers, and policy makers.[9] Therefore, to address structural and other barriers for primary stroke prevention, policy support mechanisms should be facilitated as advocated by international organisations, such as the World Stroke Organization. These mechanisms could involve existing frameworks developed by global stroke experts and patient groups to guide policy decisions for stroke prevention.[5]

Proposed tripartite combination approach for primary stroke prevention

There is an urgent need to integrate interventions[10] aimed at addressing structural factors into existing primary

Downloaded for Anonymous User (n/a) at James Cook University from ClinicalKey.com.au by Elsevier on November 18, 2026. For personal use only. No other uses without permission. Copyright ©2026. Elsevier Inc. All rights reserved.

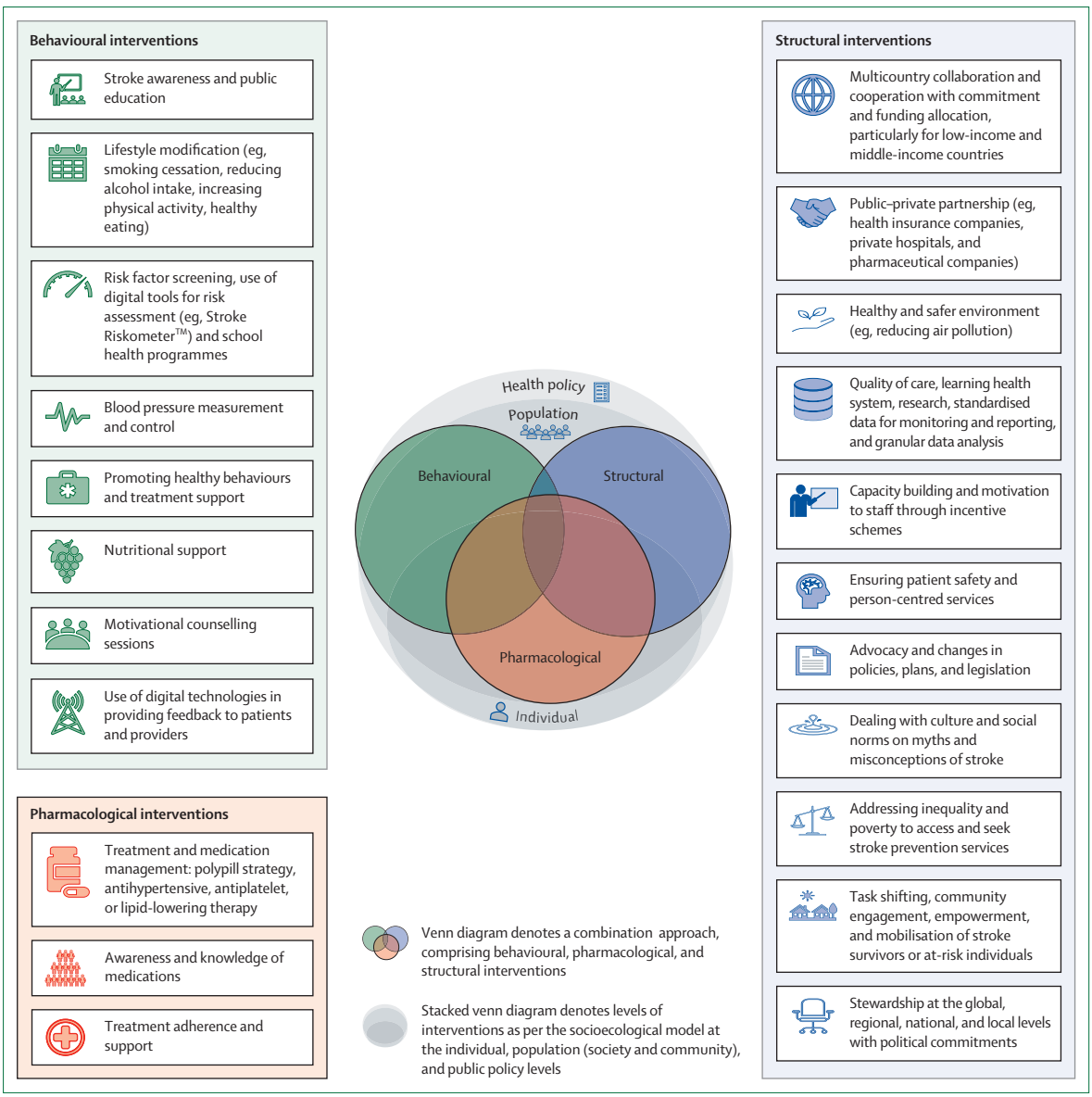

Figure: **Proposed tripartite combination approach for primary stroke prevention**
Integrated tripartite combination approach, superimposed on a socioecological model comprising behavioural, pharmacological, and structural interventions for primary stroke prevention.

stroke prevention interventions. We propose a broader combination of behavioural, pharmacological, and structural interventions for primary stroke prevention (figure). This tripartite approach is superimposed on the socioecological model, which conceptualises health broadly, encompassing multiple levels of influence and interplay across individual, community, sociocultural, and policy contexts.[11,12] The tripartite approach enables interventions aimed at individuals and entire populations to be facilitated through strong health policy and advocacy.[6]

Consistent with recommendations by Owolabi and colleagues,[3] our approach includes a broad policy structure as a key part of the overall intervention. This integration will guide the development and implementation of a tailored, population-wide approach. This holistic, targeted design of interventions has been proven to be effective in managing communicable chronic conditions, such as HIV.[11,13] However, such an approach has not been seriously considered for the management of non-communicable chronic conditions, such as stroke.

Proposed toolbox for implementing and monitoring primary stroke prevention

Our proposed approach (figure) includes a comprehensive toolbox, comprising sets of specific interventions for each

Downloaded for Anonymous User (n/a) at James Cook University from ClinicalKey.com.au by Elsevier on November 18, 2026. For personal use only. No other uses without permission. Copyright ©2026. Elsevier Inc. All rights reserved.

aspect of primary stroke prevention. Political support and ensuing health policy are important drivers of success for this approach. The design should have evaluation and feedback loops to further inform current and future primary stroke prevention strategies.

Implementing behavioural and pharmacological interventions at the individual level will ultimately be limited by the community and the policies to which they are subject. At the individual and community levels, structural interventions must be implemented to ensure patient safety (eg, avoiding detrimental errors related to diagnosis or prescription of medications),[14] prevention of adverse events,[15] and ultimately improving the quality of care.[16] In addition, public and private partnerships (eg, health insurance companies, private hospitals, and pharmaceutical companies), plus the active engagement of other stakeholders, are essential at the policy level for implementing primary stroke prevention interventions. Such partnerships would be particularly valuable in countries that have mixed insurance models for health care, and in low-income and middle-income countries.

The structural component of interventions could also strengthen country stewardship and international partnership for efficient use of resources. Therefore, there is a need for standardised monitoring, reporting, and granular analysis of data at country level on structural interventions for improving primary prevention of stroke, and other cardiovascular or chronic conditions that share multiple risk factors. Structural interventions are harder to implement and require careful planning, political support, participatory leadership, a conducive legal environment, and tailored and actionable health policy. Therefore, governments and advocacy bodies need to work together to prioritise approaches with tangible action plans and realistic timelines that can most readily be implemented in the short, medium, and longer terms.

Owolabi and colleagues[3] further emphasised the need for accountability of governments to design and effectively implement plans for primary stroke prevention. It is also important that policy makers at national, regional, and international levels are accountable for implementing these plans. Such implementation could be facilitated through capacity building, motivation of staff through incentive schemes, and introducing an effective learning health system framework, as part of continuous quality improvement cycles that permit adaptation based on evidence for the setting in which they are implemented.[17,18] The toolkit in our proposed approach could serve as a checklist for the country-specific, or localised, application and review of primary stroke prevention in their strategic plans.

Conclusion

An integrated and comprehensive approach that covers structural, population, and individual level strategies has the potential to improve stroke prevention. This approach could reduce the current fragmentation and inefficiency of primary stroke prevention, particularly for low-income and middle-income countries, and support the periodic review of combination approaches needed for effective prevention of stroke.

Contributors

KB was the lead author, responsible for the conceptualisation and writing of the original draft. MTO, DAC, and MFK were responsible for supervision. MTO, DAC, GAD, and LM were responsible for reviewing and editing the manuscript for intellectual content. All authors reviewed and approved the final version of the manuscript.

Declaration of interests

We declare no competing interests.

Acknowledgments

KB received the Monash International Tuition Scholarship and Monash Graduate Scholarship support from Monash University (Melbourne, VIC, Australia). DAC received research fellowship support from the National Health and Medical Research Council of Australia (1154273). MFK received fellowship support from the National Heart Foundation of Australia (105737). No specific funding was received for this project.

References

1 GBD 2019 Stroke Collaborators. Global, regional, and national burden of stroke and its risk factors, 1990–2019: a systematic analysis for the Global Burden of Disease Study 2019. *Lancet Neurol* 2021; **20:** 795–820.

2 Brainin M, Sliwa K. WSO and WHF joint position statement on population-wide prevention strategies. *Lancet* 2020; **396:** 533–34.

3 Owolabi MO, Thrift AG, Mahal A, et al. Primary stroke prevention worldwide: translating evidence into action. *Lancet Public Health* 2022; **7:** e74–85.

4 Owolabi MO, Thrift AG, Martins S, et al. The state of stroke services across the globe: report of World Stroke Organization–World Health Organization surveys. *Int J Stroke* 2021; **16:** 889–901.

5 World Stroke Organization. A Life Free from stroke—World Stroke Organization's global policy agenda. 2022. https://www.world-stroke.org/assets/downloads/Advocacy_priorities_online.pdf (accessed June 3, 2022).

6 Bronfenbrenner U. Toward an experimental ecology of human development. *Am Psychol* 1977; **32:** 513–31.

7 Brown AF, Ma GX, Miranda J, et al. Structural interventions to reduce and eliminate health disparities. *Am J Public Health* 2019; **109:** S72–78.

8 Lane J, Andrews G, Orange E, et al. Strengthening health policy development and management systems in low- and middle-income countries: South Africa's approach. *Health Policy OPEN* 2020; **1:** 100010.

9 Feigin VL, Owolabi M, Hankey GJ, Pandian J, Martins SC. Digital health in primordial and primary stroke prevention: a systematic review. *Stroke* 2022; **53:** 1008–19.

10 Pandian JD, Sebastian IA. Integrated approach to stroke burden: are we doing enough? *Lancet Neurol* 2021; **20:** 774–75.

11 Bekker L-G, Johnson L, Cowan F, et al. Combination HIV prevention for female sex workers: what is the evidence? *Lancet* 2015; **385:** 72–87.

12 Centre for Disease Control and Prevention. The social-ecological model: a framework for prevention. 2015. https://www.cdc.gov/violenceprevention/about/social-ecologicalmodel.html (accessed March 6, 2022).

13 Firestone R, Rivas J, Lungo S, et al. Effectiveness of a combination prevention strategy for HIV risk reduction with men who have sex with men in Central America: a mid-term evaluation. *BMC Public Health* 2014; **14:** 1244.

14 Auraaen A, Slawomirski L, Klazinga N. The economics of patient safety in primary and ambulatory care: flying blind. 2018. https://www.oecd.org/health/health-systems/The-Economics-of-Patient-Safety-in-Primary-and-Ambulatory-Care-April2018.pdf (accessed May 31, 2022).

Downloaded for Anonymous User (n/a) at James Cook University from ClinicalKey.com.au by Elsevier on November 18, 2026. For personal use only. No other uses without permission. Copyright ©2026. Elsevier Inc. All rights reserved.

15 Ranasinghe I, Hossain S, Ali A, et al. SAFety, Effectiveness of care and Resource use among Australian Hospitals (SAFER Hospitals): a protocol for a population-wide cohort study of outcomes of hospital care. *BMJ Open* 2020; **10:** e035446.
16 Rattray NA, Flanagan ME, Militello LG, et al. "Do you know what I know?": how communication norms and recipient design shape the content and effectiveness of patient handoffs. *J Gen Intern Med* 2019; **34:** 264–71.
17 Kilkenny MF, Bravata DM. Quality Improvement. *Stroke* 2021; **52:** 1866–70.
18 Menear M, Blanchette M-A, Demers-Payette O, Roy D. A framework for value-creating learning health systems. *Health Res Policy Syst* 2019; **17:** 79.

Copyright © 2022 The Author(s). Published by Elsevier Ltd. This is an Open Access article under the CC BY-NC-ND 4.0 license.

Downloaded for Anonymous User (n/a) at James Cook University from ClinicalKey.com.au by Elsevier on November 18, 2026. For personal use only. No other uses without permission. Copyright ©2026. Elsevier Inc. All rights reserved.