

PROTOCOL

Open Access



Mapping research evidence on implementation of the WHO 'best buys' and other interventions for the prevention and control of non-communicable diseases in sub-Saharan Africa: a scoping review protocol

Adjei Kadiri^{1,2}, Monica Ansu-Mensah³, Vitalis Bawontuo⁴ and Desmond Kuupiel^{3*} 

Abstract

Background: The rising burden of non-communicable diseases (NCDs) is a global health concern. To reduce the burden of morbidity, mortality and disability due to NCDs, the World Health Organization (WHO) developed 'best buys' and other interventions for the prevention and control of NCDs by member countries. However, their extent of implementation especially in sub-Saharan African countries (SSA) is not known. Therefore, this scoping review aims to map and describe research evidence on implementation of the WHO's 'best buys' and other interventions for reducing unhealthy diets in SSA.

Methods: This review will be guided by the enhanced version of Arksey and O'Malley's framework and the recent Joanna Briggs Institute guidelines for scoping reviews. To identify the relevant published literature for this review, a comprehensive keyword search will be conducted in PubMed, SCOPUS, EBSCOhost (CINAHL, Health Resource and PsycINFO) and Cochrane Library from 2017 to 2021. Boolean terms ('AND' and 'OR'), as well as Medical Subject Heading terms, will be included where essential. Government websites of SSA countries, the WHO's website and Google Scholar will be consulted for grey literature such as governmental policies/strategies focus on reducing unhealthy diets. Moreover, the reference list of included evidence sources will be searched for additional literature. Two reviewers will independently screen the articles at the abstract and full-text screening phases guided by the review eligibility criteria. Also, all relevant data will be extracted independently by two reviewers, analysed thematically and the findings reported qualitatively.

Discussion: The evidence produced by this review will help identify implementation and policy gaps to inform future implementation research/interventions studies using a variety of evidence-based strategies towards the prevention and control of NCDs due to unhealthy diets in the WHO Africa Region. Platforms such as peer review journals, policy briefs and conferences will be used to disseminate this review's findings.

Keywords: Non-communicable diseases, NCDs, 'Best buys', Unhealthy diet, Salt, Nutrition, Prevention and control, Sub-Saharan Africa

*Correspondence: desmondkuupiel98@hotmail.com; dkuupiel@sun.ac.za

³ Department of Public Health Medicine, School of Nursing and Public Health, University of KwaZulu-Natal, Durban 4001, South Africa
Full list of author information is available at the end of the article



© The Author(s) 2022. **Open Access** This article is licensed under a Creative Commons Attribution 4.0 International License, which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if changes were made. The images or other third party material in this article are included in the article's Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit <http://creativecommons.org/licenses/by/4.0/>. The Creative Commons Public Domain Dedication waiver (<http://creativecommons.org/publicdomain/zero/1.0/>) applies to the data made available in this article, unless otherwise stated in a credit line to the data.

Background

Globally, the burden and threat of non-communicable diseases (NCDs) remain one of the major challenges of public health in the twenty-first century [1–4]. NCDs are chronic diseases or conditions that tend to have a long duration due to a combination of genetic, physiological, environmental and behavioural factors [5]. NCDs including heart disease, stroke, cancer, diabetes and chronic lung disease is ranked first among the causes of deaths and collectively responsible for over 71% of all deaths globally [5, 6]. Approximately two thirds of all NCD deaths and 82% of the 16 million people who died prematurely, or before reaching the age of 70 years, occur in low- and middle-income countries (LMICs) [5]. There is also a greater risk of premature death from NCDs in the WHO African region (22%) compared to the regions of the Americas (15%), European (17%) and the Western Pacific (16%) regions [4].

Worldwide, mortality due to NCDs is projected to reach 52 million by 2030 with 27% in the Africa region with the highest mortality occurring in sub-Saharan Africa (SSA) [7]. Moreover, deaths due to NCDs among populations between the ages of 10 and 60 years are predominant in SSA [8, 9], and also, there has been a substantial increase (67.0%) in disability-adjusted life years (DALYs) due to NCDs in SSA from 90.6 million in 1990 to 151.3 million in 2017 [10, 11].

The rising burden of NCDs in SSA is partially due to weak healthcare systems, resource constraints, low investment, limited infrastructure and capacity, combined with the already overwhelming burden of communicable, maternal, neonatal and nutritional (CMNN) diseases as well as low political commitment [6, 12, 13]. Given this, there has been increased global advocacy to prioritise and address the growing burden of NCDs in SSA [14]. These culminated into the United Nations General Assembly declarations in 2011 (resolution A/RES/66/2), 2014 (A/RES/68/300) and 2018 (A/RES/73/2) to strengthen global and national responses to prevent and control NCDs [1, 15, 16]. Then, the WHO in 2017 recommended a set of interventions referred to as ‘Best buys’ which are considered cost-effective, affordable, feasible and evidence-based for implementation particularly in LMICs [17].

The ‘best buys’ are measures to reduce the four common risk factors of NCDs including tobacco use, unhealthy diet, physical inactivity and harmful use of alcohol in four disease areas of cardiovascular, diabetes, cancer and chronic respiratory diseases [2, 17]. Knowledge on the extent of adoption and implementation of the WHO ‘best buys’ is unknown, particularly in SSA, yet no previous scoping review has been previously conducted

to examine the range of evidence and identify research gaps.

A scoping review is considered useful in mapping key concepts underpinning a research area, examining and clarifying broad areas to identify gaps in the evidence and reporting on the types of evidence that address and inform policy and practice in an area of study [18]. A scoping methodology is also considered a useful approach for preliminary mapping of evidence that will form the basis for determining the value of undertaking a full systematic review [18]. Therefore, we will conduct a scoping review to systematically map and describe research evidence on implementation of the WHO ‘best buys’ and other interventions for prevention and control of NCDs focusing on ‘unhealthy diet’ (Table 1) in SSA. We hope the results of this study will facilitate a better understanding of the practical application of the ‘best buys’ and other interventions to reduce the risk of NCDs and reveal knowledge gaps for future research in SSA. Moreover, this review may influence further research to inform policy as well as implementation research which may collectively contribute towards the attainment of the WHO 25 by 25 target and the Sustainable Development Goal target 3.4 which aims at reducing by 25% and one-third, the risk of premature mortality from non-communicable diseases by 2025 and 2030 respectively [2, 19, 20].

Methods

This protocol was developing following the preferred reporting items for systematic reviews and meta-analysis extension for protocols (PRISMA-P) (Supplementary file 1). This scoping review will be conducted in keeping with Arksey and O’Malley’s methodological framework (identifying the research question; identifying relevant studies; study selection; charting the data; and collating, summarising and reporting results) [18], bearing in mind Levac et al. recommendations [21] and the Joanna Briggs Institute checklist for scoping reviews [22].

Identifying the research question

The main research question is as follows: for NCDs due to unhealthy diet such as type-2 diabetes, cardiovascular diseases, high cholesterol and some cancers, what research evidence exists on the adoption and implementation of the WHO’s ‘best buys’ and other interventions for their prevention and control in SSA since 2017 to date? Table 2 illustrates this review population, concept and context as part of the eligibility criteria. This scoping review sub-questions will be:

- What evidence exists on the implementation of the ‘best buys’ and other interventions to reduce the risk of NCDs due to unhealthy diets in SSA?

Table 1 WHO best buys and other recommended interventions for unhealthy diet

'Best buys': effective interventions with cost-effectiveness analysis (CEA) \leq \$100 per DALY averted in LMICs	<p>Reduce salt intake through the reformulation of food products to contain less salt and the setting of target levels for the amount of salt in foods and meals</p> <p>Reduce salt intake through the establishment of a supportive environment in public institutions such as hospitals, schools, workplaces and nursing homes, to enable lower sodium options to be provided</p> <p>Reduce salt intake through a behaviour change communication and mass media campaign</p>
Effective interventions with CEA > \$100 per DALY averted in LMICs	<p>Reduce salt intake through the implementation of front-of-pack labelling</p> <p>Eliminate industrial trans fats through the development of legislation to ban their use in the food chain</p> <p>Reduce sugar consumption through effective taxation on sugar-sweetened beverages</p>
Other recommended interventions from WHO guidance (CEA not available)	<p>Promote and support exclusive breastfeeding for the first 6 months of life, including promotion of breastfeeding</p> <p>Implement subsidies to increase the intake of fruits and vegetables</p> <p>Replace trans-fats and saturated fats with unsaturated fats, through reformulation, labelling, fiscal policies or agricultural policies</p> <p>Limiting portion and package size to reduce energy intake and the risk of overweight/obesity</p> <p>Implement nutrition education and counselling in different settings (for example, in preschools, schools, workplaces and hospitals) to increase the intake of fruits and vegetables</p> <p>Implement nutrition labelling to reduce total energy intake (kcal), sugars, sodium and fats</p> <p>Implement mass media campaign on healthy diets, including social marketing to reduce the intake of total fat, saturated fats, sugars and salt and promote the intake of fruits and vegetables</p>

Source: WHO 2017 [17]

- What evidence exists on the barriers/challenges of implementing the 'best buys' and other interventions to reduce the risk of NCDs due to an unhealthy diet in SSA?

Identifying relevant studies

The 'best buys' and other interventions for the prevention and control of NCDs were endorsed by the Seventieth World Health Assembly in May 2017. Given this,

a thorough search for relevant published/grey literature will be conducted in PubMed, Google Scholar, SCOPUS, EBSCOhost (CINAHL, Health Resource, and PsycINFO), and Cochrane Library from June 2017 onwards to the search date. The World Health Organization and Governments/Ministries of Health websites will also be searched for relevant evidence sources. Moreover, the reference list of the included studies will be manually searched for relevant studies/grey literature. A comprehensive search

Table 2 PCC framework for defining the eligibility of the studies for the primary research question

Eligibility criteria	Include	Exclude
Population	All NCDs due to unhealthy diet by the general population such as type-2 diabetes, cardiovascular diseases, high cholesterol and some cancers	NCDs due to physical inactivity, tobacco use and harmful use of alcohol which has no linkage to unhealthy diet, e.g. lung cancer and chronic respiratory diseases
Concept	The WHO 2017 'best buys' and other interventions for unhealthy diet	
Context	Prevention and/control of NCDs in SSA	
Setting	Countries in the WHO African Region [23]	Other WHO regions
Study design	Primary studies/grey literature (policy documents) that focus on the implementation of 'best buys' and other interventions for unhealthy diet.	Reviews that focus on the implementation of 'best buys' and other interventions for physical inactivity, tobacco use and harmful use of alcohol
Time frame	Publications/grey literature within the last 3 years	Publication/grey literature that existed before May 2017
Publication language	All international languages	

strategy will be developed in consultation with an experienced librarian using a combination of the following keywords: 'implementation', 'non-communicable diseases', 'chronic diseases', 'best buys', 'cost-effective, affordable and evidence-based interventions', 'salt intake' food legislation, 'food labelling', 'fruits and vegetables', 'other interventions', 'prevention', 'control', 'unhealthy diet', 'sub-Saharan Africa' and 'all countries in the WHO Africa Region'. Boolean terms, 'AND' and 'OR', will be used to separate keywords. Medical Subject Heading (MeSH) terms and subject heading will be included where essential during the electronic database search. Study designs will be limited to primary studies and policy documents, and date (from June 2017 to 2021), but not language. Each search will be documented appropriately (Table 3), and Mendeley Desktop version 1.19.8 was used to compile and manage all references. The principal investigator (AK) will conduct the search, but a second reviewer will double-check for completeness.

Study selection

Following deduplication of titles from the Mendeley Desktop library created for this review, a screening tool will be developed using this study's inclusion criteria in Google forms. The Google form will be shared with two members of the review team for pre-testing with a random sample of 10 titles and abstracts. The Google form will be amended if needed and, subsequently, use electronically for the study selection. The title and abstract screening (stage 1) will be performed by two reviewers (AK and MAM) independently guided by the inclusion and exclusion criteria. Then, the full text articles will be compiled and again screened (stage 2) by AK and MAM independently using the review eligibility criteria as a guide. A third reviewer will be consulted to resolve any discrepancies at both stages. The Catholic University library will be contacted to provide assistance in cases

where a full article is inaccessible from the database or request will be made directly to authors of such articles via email for the full article. At least, the reviewers will make two attempts to reach the authors for full text articles if not found using other sources. The Preferred Reporting Items for Systematic Reviews and Meta-analysis (PRISMA) flow diagram [24] will be adopted to present the screening results of the study, as shown in Fig. 1.

Charting the data

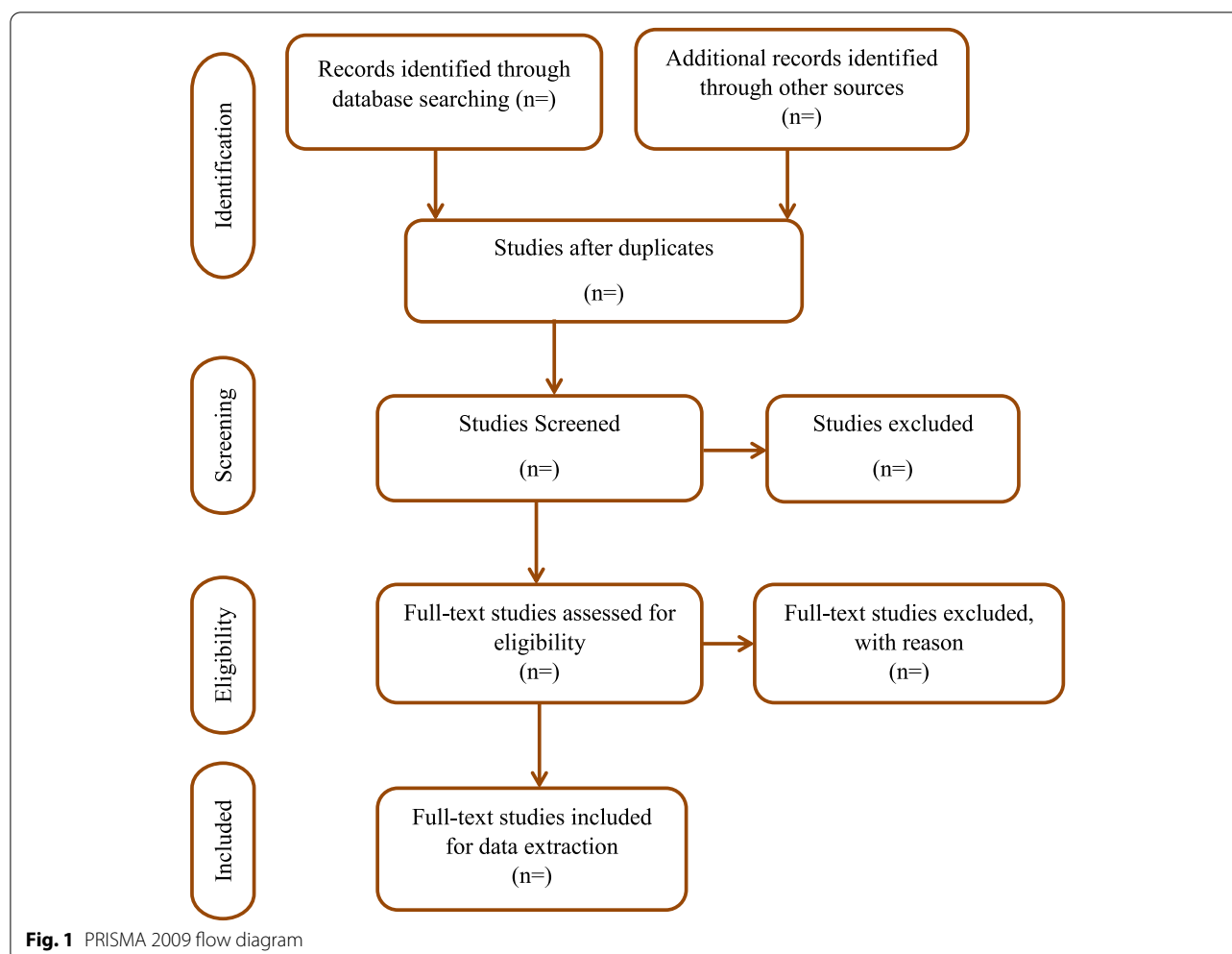
A data charting form will be designed for the extraction of all relevant data from the included studies. The form will contain the following headings: author(s) and year of publication, study title, objective/aim of the study, study design, country (study location), study setting (school, health facility, community, or others), study population, intervention(s), study results and 'key findings relating to the implementation of the intervention for unhealthy diet'. To ensure the accuracy of the data extraction form, it will be pretested by two independent reviewers (AK and MAM) using a couple of the included studies and amended appropriately. AK will perform the data extraction, but two members of the review team will independently double-check the results extracted for completeness. The authors of the included evidence sources/studies will also be contacted to verify the results extracted.

Collating, summarising, and reporting the results

Content thematic analysis approach [25] will be used to identify relevant themes and sub-themes to answer the review questions. The emerging themes will be structured around the four domains: effective interventions with cost-effectiveness analysis (CEA) less than or equivalent to hundred US dollars per DALYs averted in LMICs, effective interventions with CEA greater than hundred US dollars per DALYs averted in LMICs, other

Table 3 Pilot search in PubMed electronic database

Date	Database	Keywords	Search results
30 March 2021	PubMed	((implementation) AND (best buys[MeSH Terms])) OR (best buys)) OR (cost-effective, affordable and evidence-based interventions[MeSH Terms])) OR (cost-effective, affordable and evidence-based interventions)) AND (cost-effective interventions[MeSH Terms])) OR (cost-effective interventions)) AND (affordable interventions[MeSH Terms])) OR (affordable interventions)) AND (evidence-based interventions[MeSH Terms])) OR (evidence-based interventions)) AND (prevention and control[MeSH Terms])) OR (prevention and control)) AND (prevention[MeSH Terms])) OR (prevention)) AND (control[MeSH Terms])) OR (control)) AND (noncommunicable diseases[MeSH Terms])) OR (non-communicable diseases[MeSH Terms])) OR (noncommunicable diseases)) OR (non-communicable diseases)) OR (chronic diseases[MeSH Terms])) AND (salt[MeSH Terms])) OR (salt)) AND (nutrition labelling[MeSH Terms])) OR (nutrition labelling)) OR (food labelling[MeSH Terms])) OR (food labelling)) AND (food legislation[MeSH Terms])) OR (food legislation)) AND (fruits and vegetables[MeSH Terms])) OR (fruits and vegetables)) AND (fruits[MeSH Terms])) OR (fruits)) AND (vegetables[MeSH Terms])) OR (vegetables)) AND (unhealthy diet[MeSH Terms])) OR (unhealthy diet)) AND (diet[MeSH Terms])) OR (diet)) AND (Sub-Saharan Africa)) OR (WHO African region)) OR (SSA) Filters: from 2017/6/1 - 2021/3/30	10,241



recommended interventions for the prevention and control of NCDs and barriers/challenges of implementing the ‘best buys’ and other interventions. The barriers/challenges will be identified using thematic content analysis. A qualitative approach will be used to report summaries of emerging key findings. Where appropriate, tables and figures will be used to represent this review’s findings, but tables and figures will also be used where possible. The Preferred Reporting Items for Systematic Reviews and Meta-analysis: Extension for Scoping Review (PRISMA-ScR) checklist will be followed to report this study.

Discussion

This scoping review aims to identify and describe research evidence on the adoption and implementation of WHO ‘best buys’ and other interventions for the prevention and control of NCDs that relate to unhealthy diets in SSA. The review will have relevance to a variety of audiences including researchers, policymakers, NCD units and managers of various countries in SSA, donors

and other interested bodies in understanding the extent of implementation of these ‘best buys’, as well as the barriers to implementation in SSA. Policymakers will also use this research for reflection and as a form of feedback on the progress of implementation of ‘best buys’ and other interventions for reducing the risk of NCDs due to unhealthy diet in SSA.

Evidence from WHO CEA demonstrates that investing in the implementation of the WHO ‘best buys’ and other interventions for NCDs prevention and control will not only improve health outcomes and save lives but can also improve a country’s economic productivity [13]. It is anticipated that the results of the proposed study will inform future research and reveal evidence-based information to address potential issues that may arise from implementation of the ‘best buys’ and other interventions for unhealthy diet in SSA. The proposed study will thus contribute to addressing implementation gaps, strengthen health systems and improve resource allocation as well as improve research in implementing the

'best buys' and other interventions to reduce NCDs in SSA.

Although there are four common risk factors of NCDs [2], due to resource and time constraints, this review will exclude evidence, policies and interventions relating to risk factors of tobacco use, physical inactivity and harmful use of alcohol.

Therefore, the results produced by this review will help identify implementation and policy gaps to inform future implementation research/interventions studies using a variety of evidence-based strategies towards the prevention and control of NCDs due to unhealthy diets in SSA.

Abbreviations

CEA: Cost-effectiveness analysis; CMNN: Communicable, maternal, neonatal and nutritional; DALYs: Disability-adjusted life years; LMICs: Low- and middle-income countries; NCDs: Non-communicable diseases; PRISMA: Preferred Reporting Items for Systematic Reviews and Meta-analysis; SSA: Sub-Saharan Africa; WHO: World Health Organization.

Supplementary Information

The online version contains supplementary material available at <https://doi.org/10.1186/s13643-022-01992-7>.

Additional file 1. PRISMA-P 2015 Checklist.

Acknowledgements

Sincere appreciation to almighty God for his benevolence from the beginning to the end of this protocol and to the Faculty of Health and Allied Sciences, Catholic University College of Ghana, Fiapre, Sunyani, Ghana, for their invaluable support and contribution towards this study especially during the conceptualization and writing of this manuscript.

Authors' contributions

AK and DK conceptualized the study. AK wrote the protocol, and MA-M made critical contributions to the writing. DK and VB designed the study methodology and critically reviewed the protocol. AK prepared the manuscript and reviewed by the other authors. The manuscript was read and approved by all authors.

Funding

No funding has been secured for this study. All expenses relating to this study will be funded by the authors.

Availability of data and materials

All materials/data used for this review will be duly cited and presented in the form of references.

Declarations

Ethics approval and consent to participate

Not applicable

Consent for publication

Not applicable

Competing interests

The author declare that they have no competing interests.

Author details

¹Faculty of Health & Allied Sciences, Catholic University College of Ghana, Sunyani, Fiapre, Ghana. ²National Health Insurance Authority, Claims Processing Centre (CPC), Tamale, Northern Region, Ghana. ³Department of Public Health

Medicine, School of Nursing and Public Health, University of KwaZulu-Natal, Durban 4001, South Africa. ⁴Department of Health Services Management and Administration, School of Business, SD Dombo University of Business and Integrated Development Studies (SDD-UBIDS), Wa, Ghana.

Received: 16 June 2021 Accepted: 27 May 2022

Published online: 13 June 2022

References

- United Nations General Assembly. Resolution A/RES/65/238: scope, modalities, format and organization of the High-level Meeting of the General Assembly on the Prevention and Control of Non-communicable Diseases, vol. 11759; 2011. p. 2011.
- World Health Organization 2013. Global action plan for the prevention and control of non-communicable diseases, 2013-2020 [Internet]. 2013 [cited 2018 Aug 31]. Available from: www.who.int
- World Health Organization. Global status report on noncommunicable diseases; 2014. p. 2014.
- WHO (2018). Noncommunicable diseases country profiles 2018. Geneva: World Health Organization; 2018.
- World Health Organization (2018, June 1). Key facts; noncommunicable diseases. [Internet]. WHO. 2018 [cited 2021 Feb 4]. Available from: <https://www.who.int/news-room/fact-sheets/detail/noncommunicable-diseases>
- Bigna JJ, Noubiap JJ. The rising burden of non-communicable diseases in sub-Saharan Africa. *Lancet Global Health*. 2019;7:1295–6. The Author(s). Published by Elsevier Ltd. This is an Open Access article under the CC BY-NC-ND 4.0 license; Available from: [https://doi.org/10.1016/S2214-109X\(19\)30370-5](https://doi.org/10.1016/S2214-109X(19)30370-5).
- WHO Africa Regional Office 2014. Noncommunicable diseases and mental health. [Internet]. 2014 [cited 2021 Feb 6]. Available from: <http://www.afro.who.int/health-topics/noncommunicable-diseases>
- Nyirenda MJ. Non-communicable diseases in sub-Saharan Africa: understanding the drivers of the epidemic to inform intervention strategies. *Int Health*. 2016;8(3):157–8.
- Juma PA, Mohamed SF, Matanje Mwagomba BL, Ndinda C, Mapa-Tassou C, Oluwasanu M, et al. Non-communicable disease prevention policy process in five African countries authors. *BMC Public Health*. 2018;18(Suppl 1).
- Gouda HN, Charlson F, Sorsdahl K, Ahmadzade S, Ferrari AJ, Erskine H, et al. Burden of non-communicable diseases in sub-Saharan Africa, 1990–2017: results from the Global Burden of Disease Study 2017. *Lancet Glob Heal*. 2019;7(10):e1375–87. Available from: [https://doi.org/10.1016/S2214-109X\(19\)30374-2](https://doi.org/10.1016/S2214-109X(19)30374-2).
- World Health Organization (2015). Report on the status of major health risk factors for noncommunicable diseases: WHO African Region, 2015; 2015. p. 1–74.
- WHO 2017. Noncommunicable Diseases Progress Monitor, 2017, vol. 2017. Geneva: World Health Organization; 2017.
- WHO 2018. Saving lives, spending less: a strategic response to noncommunicable diseases: Geneva, Switzerland. World Health Organization; 2018 (WHO/NMH/NVI/18.8) [Internet]. WHO. 2018. Available from: <http://apps.who.int/bookorders>.
- Beaglehole R, Bonita R, Horton R, Adams C, Alleyne G, Asaria P, et al. Health Policy Priority actions for the non-communicable disease crisis. 2011;6736(April).
- United Nations General Assembly 2014. Non-communicable disease resolution [Internet]. a/Res/68/3. 2014. Available from: <http://www.who.int/nmh/events/2014/a-res-68-300.pdf>
- UN General Assembly (2018). Political declaration of the third high-level meeting of the General Assembly on the prevention and control of non-communicable diseases. Vol. 38067, UN General Assembly. 2018.
- WHO (2017). Tackling NCDs: "best buys" and other recommended interventions for the prevention and control of noncommunicable diseases. World Health Organization [Internet]. Tackling NCDs 2017. Geneva: WHO; 2017. Available from: https://www.who.int/ncds/management/WHO_Appendix_BestBuys.pdf
- Arksey H, O'Malley L. Scoping studies: towards a methodological framework. *Int J Soc Res Methodol Theory Pract*. 2005;8(1):19–32.

19. Sixty-sixth World Health Assembly. Follow-up to the political declaration of the high-level meeting of the general assembly on the prevention and control of non-communicable diseases. WHO. 2013.
20. United Nations 2015. Transforming our world: The 2030 Agenda for sustainable development. 2015.
21. Levac D, Heather Colquhoun KKO. Scoping studies: advancing the methodology. *Implement Sci*. 2010;1–18 Available from: <http://www.implementationscience.com/content/5/1/69%0A>.
22. Peters M, C G, P M, Z M, AC T, Khalil H. 2017 Guidance for the Conduct of JBI Scoping Reviews Chapter 11: Scoping Reviews Scoping Reviews. Underst scoping Rev Defin Purp Process. 2017;(September).
23. World Health Organization. *Countries in the WHO African Region*. [Internet]. 2021 [cited 2021 Feb 18]. Available from: <https://www.who.int/about/regions/afro/en/>
24. Moher D, Liberati A, Tetzlaff J, Altman DG, Altman D, Antes G, et al. Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. *PLoS Med*. 2009;6(7).
25. Braun V, Clarke V, Hayfield N, Terry G. Thematic Analysis. 2019:1–18.

Publisher's Note

Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Ready to submit your research? Choose BMC and benefit from:

- fast, convenient online submission
- thorough peer review by experienced researchers in your field
- rapid publication on acceptance
- support for research data, including large and complex data types
- gold Open Access which fosters wider collaboration and increased citations
- maximum visibility for your research: over 100M website views per year

At BMC, research is always in progress.

Learn more biomedcentral.com/submissions

