

# The World Health Organization STEPwise Approach to Noncommunicable Disease Risk-Factor Surveillance: Methods, Challenges, and Opportunities

Leanne Riley, MSc, Regina Guthold, PhD, Melanie Cowan, MPH, Stefan Savin, MD, MPH, Lubna Bhatti, MD, Timothy Armstrong, PhD, and Ruth Bonita, PhD

**Objectives.** We sought to outline the framework and methods used by the World Health Organization (WHO) STEPwise approach to noncommunicable disease (NCD) surveillance (STEPS), describe the development and current status, and discuss strengths, limitations, and future directions of STEPS surveillance.

**Methods.** STEPS is a WHO-developed, standardized but flexible framework for countries to monitor the main NCD risk factors through questionnaire assessment and physical and biochemical measurements. It is coordinated by national authorities of the implementing country. The STEPS surveys are generally household-based and interviewer-administered, with scientifically selected samples of around 5000 participants.

**Results.** To date, 122 countries across all 6 WHO regions have completed data collection for STEPS or STEPS-aligned surveys.

**Conclusions.** STEPS data are being used to inform NCD policies and track risk-factor trends. Future priorities include strengthening these linkages from data to action on NCDs at the country level, and continuing to develop STEPS' capacities to enable a regular and continuous cycle of risk-factor surveillance worldwide. (*Am J Public Health.* 2016;106:74–78. doi:10.2105/AJPH.2015.302962)

The global burden of chronic, non-communicable diseases (NCDs)—largely heart disease, stroke, cancer, chronic respiratory disease, and diabetes—is increasing rapidly and will have significant social, economic, and health consequences unless urgently addressed. In 2012, the major NCDs accounted for 63% of all deaths, representing 38 million deaths a year. Eighty percent of these deaths are already occurring in low- and middle-income countries.<sup>1</sup> Because NCDs are largely preventable, these deaths can be significantly reduced.

To address this global health problem, in 2013, the World Health Assembly—the decision-making body of the World Health Organization (WHO)—adopted a Global Monitoring Framework for NCDs with 25 key indicators to track progress in prevention and control of NCDs. The World Health Assembly also agreed on a set of global

voluntary targets linked to the Global Monitoring Framework to prevent and control NCDs by 2025, including a target to reduce premature mortality from the 4 main NCDs by 25%, and targets for the main behavioral and metabolic NCD risk factors and 2 health systems targets.<sup>2</sup> Furthermore, in 2015, the 2030 Agenda for Sustainable Development recognizes the importance of addressing NCD issues with the inclusion of a similarly ambitious target to reduce the

number of premature deaths from NCDs by one third by 2030.<sup>3</sup>

The key to controlling the global epidemic of NCDs and meeting these ambitious but achievable NCD targets is primary prevention based on comprehensive population-wide programs. Effective prevention of NCDs is possible through identification of the major common risk factors and their prevention and control.<sup>4–6</sup>

A few common and preventable risk factors underlie most NCDs. These NCD risk factors are the leading cause of the death and disability burden in all countries, regardless of their economic development status. The leading behavioral risk factors for NCDs are tobacco use, harmful alcohol consumption, unhealthy diet including high salt and sodium intake, physical inactivity, and overweight and obesity, and the leading physiological risk factors are raised blood pressure, raised blood glucose, and abnormal blood lipids.<sup>7,8</sup>

Recognizing a global need for risk-factor data on these key NCD risk factors, WHO initiated the STEPwise approach to surveillance (STEPS) in 2002. The key goals of STEPS are to guide the establishment of risk-factor surveillance systems in countries by providing a framework and approach; to strengthen the availability of data to help

## ABOUT THE AUTHORS

Leanne Riley, Regina Guthold, Melanie Cowan, Stefan Savin, Lubna Bhatti, and Timothy Armstrong are with Department for Prevention of Noncommunicable Diseases, World Health Organization, Geneva, Switzerland. Ruth Bonita is with University of Auckland, Auckland, New Zealand.

Correspondence should be sent to Leanne Riley, World Health Organization, 20 Avenue Appia, CH1211, Geneva, Switzerland (e-mail: riley1@who.int). Reprints can be ordered at <http://www.ajph.org> by clicking the “Reprints” link.

This article was accepted October 26, 2015.

**Note.** The authors alone are responsible for the views expressed in this publication and they do not necessarily represent the decisions, policy, or views of the World Health Organization.

doi: 10.2105/AJPH.2015.302962

countries inform, monitor, and evaluate their policies and programs; to facilitate the development of population profiles of NCD risk-factor exposures; to enable comparability across populations and across time frames; and to build human and institutional capacity for NCD surveillance.<sup>9,10</sup>

Since its inception, the STEPS approach has advocated that small amounts of good-quality data are more valuable than large amounts of poor-quality data.<sup>10</sup> The STEPS approach supports monitoring a few modifiable NCD risk factors that reflect a large part of the future NCD burden and that can indicate the impact of interventions considered to be effective in reducing the leading NCDs. Because STEPS also promotes the collection of data on a number of different risk factors, it has the benefit over single risk factor surveys in that it allows an understanding of how risk factors cluster within a population and offers an opportunity for countries to estimate the small proportion of the population with high overall risk of a cardiovascular event for referral for possible treatment.<sup>9,10</sup>

Our objective was to outline the framework and methods used by STEPS, to describe the development and current status of STEPS, to discuss the strengths and limitations of STEPS surveillance, and to highlight future directions.

## METHODS

The STEPS framework is based on the concept that surveillance systems require standardized data collection, but also sufficient flexibility to be appropriate in a variety of country situations and settings.<sup>10</sup> The key element of this framework is the distinction between different levels of risk-factor assessment that allow greater or lesser levels of detail, depending on the resources available, without compromising the comparability of the data.

In step 1, information on demographics and behavioral risk factors (tobacco use, alcohol consumption, dietary behaviors such as fruit and vegetable intake and salt and sodium intake, and physical inactivity, as well as history of NCDs and related conditions such as raised blood pressure, diabetes, raised cholesterol, cardiovascular diseases; cervical cancer screening coverage in women; and

provision of general lifestyle advice to tackle NCDs) is collected through self-report.

Physical measurements of height and weight to measure the body mass index (defined as weight in kilograms divided by the square of height in meters), waist circumference, and blood pressure are undertaken in step 2, and step 3 consists of biochemical measurements of fasting blood glucose, total cholesterol levels, and urinary sodium.

Within each step, countries are encouraged to focus on the “core” or most essential information on each risk factor. “Expanded” items, also in standardized format, are available for those countries requiring more nuanced information on any of the risk factors, resources permitting. Expanded items include additional information for the core questions on each of the behavioral risk factors of step 1, measurement of hip circumference and heart rate in step 2, and biochemical assessment of triglycerides and high-density lipoprotein cholesterol levels in step 3. Finally, standardized “optional” modules have been developed in collaboration with the respective technical departments in WHO and topic area experts in violence and injury, mental health and suicide, oral health, sexual and reproductive health, and tobacco policy.<sup>9,10</sup>

The STEPS instrument has undergone a number of revisions to accommodate new and emerging evidence on the various risk factors over time and to ensure that STEPS surveys track the most important aspects of NCD risk factors and determinants. The latest revision of the STEPS instrument accommodates 6 risk-factor targets and 1 health systems target in the Global Monitoring Framework.<sup>11</sup>

## STEPwise Approach to Surveillance Sampling

The basis of STEPS risk-factor surveillance is repeated cross-sectional, population-based household surveys.<sup>12</sup> Multistage cluster sampling is used in most countries to draw a nationally representative sample of adults aged 18 to 69 years. However, sampling strategies vary across countries depending on the local context, and exceptionally, there are a few very small or well-resourced countries that have performed simple random sampling or censuses.

Sample sizes for STEPS surveys are calculated on the basis of a number of factors,

including the level of confidence, the acceptable margin of error, the estimated design effect, the estimated baseline levels of the behaviors to be measured, the desired number of age-gender estimates, and the anticipated nonresponse rate.<sup>12</sup> A typical STEPS survey includes between 5000 and 6000 participants to be able to generate age- and gender-specific estimates according to strata relevant by the implementing country.

## STEPwise Approach to Surveillance Fieldwork

STEPS surveys are implemented at the country level as national household surveys via trained interviewers who undertake face-to-face interviews at households with selected survey respondents of behavioral risk factors and physical measurements such as blood pressure and height and weight measurements (steps 1 and 2). Step-3 biochemical assessments for blood glucose, blood lipids, and urinary sodium usually take place at a local clinic or health center.

eSTEPS (World Health Organization, Geneva, Switzerland), a suite of software that allows for the preparation and implementation of data collection with a handheld PC, has been used widely since 2009. This method of data collection has proved to be a significant improvement on the previous paper-based method in that it allows automatic skip patterns to be programmed into the questionnaire, performs immediate error checking, provides a simplified and documented means of selecting participants from within each selected household, and requires no data-entry work following data collection.

The introduction of eSTEPS allows a more streamlined and standardized approach to quality control and substantially reduces the time from data collection to production of the final report. eSTEPS can be adapted to suit any survey and allows implementation in a large number of different languages. As of late 2015, eSTEPS data collection is also possible with Android devices such as tablets and smartphones.

## Coordination, Technical Support, and Resourcing

STEPS surveys are usually initiated and coordinated at the country level by ministry of health officials, working in collaboration

with local technical partners. Financial resources to conduct the surveys are the responsibility of national authorities. The WHO provides resourcing support in the form of equipment loans such as blood pressure-measuring devices, small amounts of seed funding, and links to potential international donors.

Technical support for the implementation of STEPS is provided across WHO headquarters, regional and country offices, and in collaboration with other technical partners. To provide overall guidance on the planning and implementation of STEPS, STEPS training workshops are delivered at different stages of the surveillance process: planning and training, data collection, data analysis, and reporting, as well as data utilization.

For each of these stages, survey tools and training materials are available. They include, for example, the STEPS Manual and CD (updated along with the STEPS Instrument

in 2015); templates for an implementation plan and ethical approval; sampling tools, such as a sample size calculator and a sampling spreadsheet; various forms for data collection; analysis programs for several statistical packages; and reporting templates.<sup>9,12</sup>

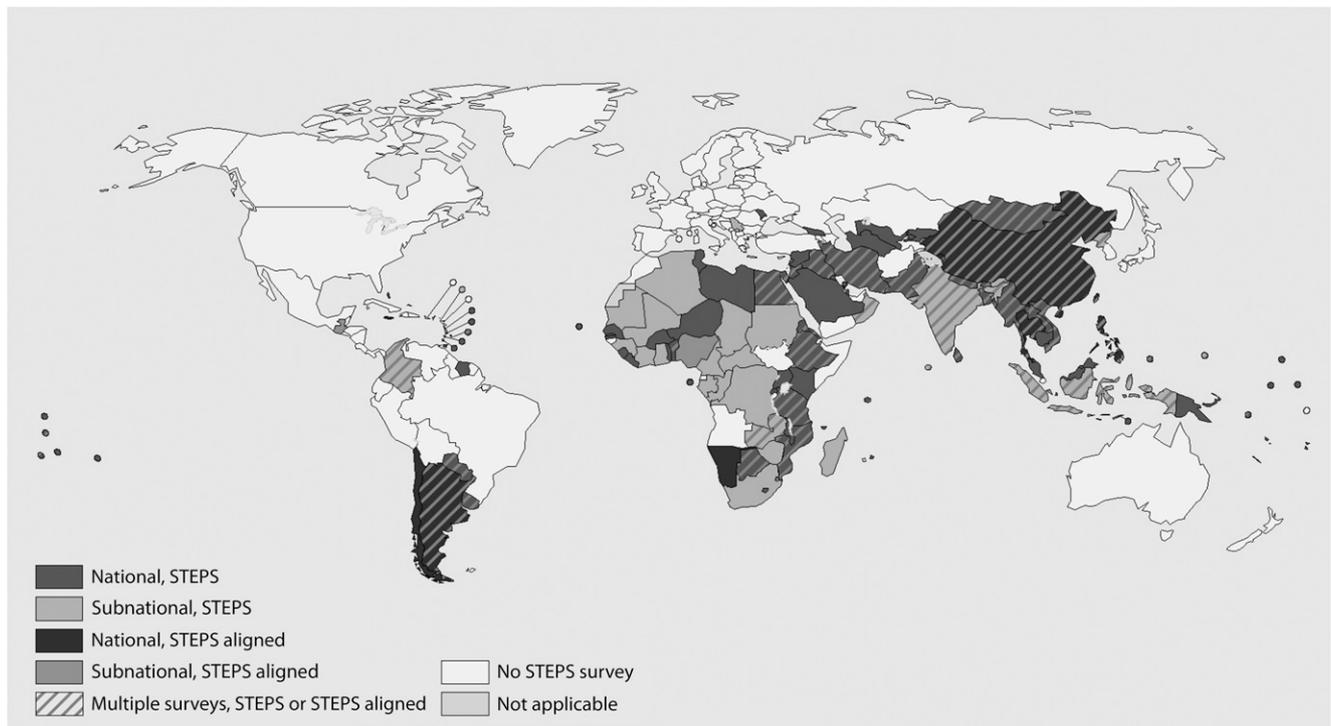
## RESULTS

Pilot testing of STEPS began in 2002 and, following several regional workshops, several countries implemented the first round of surveys collecting data in 2002 and 2003.<sup>10</sup>

By 2005, 56 countries had attended 17 regional or national workshops, and 52 countries (14 WHO African Region, 1 WHO Region of the Americas, 11 WHO Eastern Mediterranean Region, 9 WHO South-East Asia Region, 17 WHO Western Pacific Region), including 6 that aligned STEPS to their national risk-factor studies,

had, by the end of that year, completed data collection (Figure A, available as a supplement to the online version of this article at <http://www.ajph.org>). Of these surveys, 28 were national.

To date, 129 countries from all regions have attended a total of 166 regional or national workshops, and 122 countries (42 WHO African Region, 21 WHO Region of the Americas, 16 WHO Eastern Mediterranean Region, 6 WHO European Region, 11 WHO South-East Asia Region, 26 WHO Western Pacific Region) have completed data collection (Figure 1), including 11 STEPS-aligned surveys. In total, 93 countries have carried out national surveys. A total of 48 countries have already undertaken more than 1 STEPS or STEPS-aligned survey.<sup>9</sup> Of those 48 countries, 21 have either moved from subnational to national, or done several subnational STEPS surveys, and 24 have done 2 STEPS



*Note.* The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city, or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted and dashed lines represent approximate border lines for which there may not yet be full agreement.

*Source.* Data are from the World Health Organization. Map production by Health Statistics and Information Systems.

**FIGURE 1—Status of the World Health Organization’s STEPwise Approach to Noncommunicable Disease Surveillance Implementation in 2015**

or STEPS-aligned surveys, and 3 have conducted several STEPS surveys in a systematic, ongoing way.

Of the 122 countries that have completed data collection to date, 10 have done steps 1 and 2 (questionnaire and physical measurements) only, and 112 have completed all 3 steps, including biochemical measurements.

## DISCUSSION

More than a decade has passed since a few low- and middle-income countries started implementing STEPS surveys, and great progress has been made in generating new country-specific risk-factor data.<sup>9</sup> Nearly 100 countries have published the results of their STEPS surveys in form of summary data, country reports, or journal articles.<sup>9</sup> From a bleak picture of very little data available in 2000 from most low- and middle-income countries, to 15 years on, we can see from the mapping of STEPS activities that many countries now have robust data on NCD risk factors that they are using to report their progress against national targets for NCDs and to guide their policy and programming in NCD, such as for the development of NCD action plans in Benin, Cabo Verde, Mauritania, and Togo, to name a few. Countries increasingly report that having their own reliable data on risk factors leads to an increasing awareness and commitment to address NCDs, and is of utmost importance for setting meaningful NCD program evaluation mechanisms at the national level.

Risk-factor surveillance has also served as an entry point to developing programs for NCDs in a number of countries. Countries have started with an initial survey and followed this with the development of a national NCD policy and program involving key stakeholders to set clear and achievable targets for action based on their STEPS data. STEPS “Data to Action” workshops have helped to accelerate this process by focusing on how the STEPS data can help a country consider what its priorities for NCD programming might be on the basis of reliable, recent data.

At a global level, data generated through STEPS has been used in a number of projects, including global reporting on risk-factor

status, the Global Burden of Diseases Project, and publications on global and regional levels of selected risk factors.<sup>1,8,13</sup>

More than a decade of implementation of STEPS has also proved that the evolving STEPS methodology is flexible and adaptable enough to be used even in the most resource-constrained settings.

## Challenges and Limitations

Despite this progress, a number of limitations, challenges, and constraints hamper broader progress in advancing NCD risk-factor surveillance. Although there has been increased global attention, global targets and indicators have been set,<sup>2,11</sup> and countries’ implementation of these have been monitored, NCD risk-factor surveillance is still not considered a priority in many countries. There is inadequate progress in integrating NCD risk-factor surveillance into national health information systems.

At the country level, progress in institutionalizing ongoing NCD risk-factor surveillance is hampered by a number of factors. These include the often high turnover of personnel involved in surveillance; the lack of resources available at the country level to support surveillance activities; out-of-date sampling frames; lack of geographical accessibility of some areas in some countries; weak infrastructure (e.g., travel and transport systems) that makes household surveys difficult; weak country capacity in data management, analysis, and report writing; and technological problems with step-3 measurements, to name but a few. In a number of countries, these limitations have resulted in poor data quality.

Frequently the awareness generated by conducting a STEPS survey in a country leads to an increase in demand for preventive and curative health services—this demand is often unmet by the current health system in low- and middle-income countries. Other challenges include the dependence on WHO for technical support and assistance, when WHO has few resources and personnel to help meet this demand.

Multiple surveys at national and global levels are also being increasingly implemented, addressing some of the risk factors already captured in STEPS. Single-issue surveys supported by WHO, including those

on alcohol, nutrition, tobacco, and injuries, tend to elicit similar information, leading to survey fatigue in many countries. Because STEPS can be considered the primary data source of all NCD risk factors, other surveys should consider the availability of STEPS results before introducing the same items or indicators.

## Future Directions

The need for robust, comparable NCD risk-factor data at the national, regional, and global level has been further strengthened by the global adoption of the set of 9 voluntary targets for NCDs and the Global Monitoring Framework for NCDs indicators which include many of the risk factors monitored by a STEPS survey.<sup>11</sup> By implementing a STEPS survey, a country will have the necessary data to monitor and report on 7 of the 9 global targets for NCDs (tobacco, harmful use of alcohol, physical inactivity, salt and sodium intake, diabetes and obesity, hypertension, prevention of heart attack and strokes) and a number of other indicators included in the Global Monitoring Framework (e.g., total cholesterol, cervical cancer screening). In addition, the Global Action Plan for the Prevention and Control of Noncommunicable Diseases adopted by the World Health Assembly in May 2013 calls on WHO Member States to

undertake periodic data collection on the behavioural and metabolic risk factors (harmful use of alcohol, physical inactivity, tobacco use, unhealthy diet, overweight and obesity, raised blood pressure, raised blood glucose, and hyperlipidemia). . . .<sup>2(p52)</sup>

STEPS therefore remains a key approach and resource to help countries meet this obligation.

There remains a strong need to continue with the capacity-building aspects of STEPS technical support to help build sustainable national capacity for NCD risk-factor surveillance and institutional support for NCD surveillance. Increased advocacy efforts are needed at the country level to improve linkages with NCD-related data into national health information systems to ensure these have an integral place.

The STEPS methodology recommends the implementation of STEPS surveys every

3 to 5 years, and even this cycle is proving challenging in low-resource countries. Support is needed to encourage countries to move from having conducted a baseline survey to having a regular and continuous cycle of risk-factor surveillance reflected in their national NCD plans of action. Similarly, other countries need encouragement to move from subnational, piecemeal implementation of STEPS surveys to capture national prevalence data where this would be preferable.

The questionnaire items and measures used in STEPS and the indicators reported from STEPS surveys need to be periodically reviewed to adapt to the latest scientific standards and policy needs in countries. Recent discussions have focused on whether items such as objective measurement of physical activity patterns using wearable technology could be routinely captured in population-based risk-factor surveys such as STEPS. Similarly, measures such as hemoglobin A1c as an indicator for diabetes could be included if and when more reliable, cost-effective, and portable measuring equipment is developed.

Efforts are needed to make the data collected from STEPS more widely available, so that it is fully used for strengthening NCD programming and policymaking. Aggregate data are routinely entered into the WHO Global InfoBase,<sup>14</sup> but this relies on countries providing their published reports to WHO for this purpose. Further mechanisms are needed to make STEPS data more available and ideally accessible through a central repository or portal. Participation in such a mechanism should be agreed on at the start of a survey.

Finally, future efforts to strengthen the linkages from data to action on NCDs at the country level remain a firm priority. One method that has shown promise in this area is the implementation of pilot workshops in selected African countries to strengthen the link between having the STEPS data and moving to action. There is enormous value in linking good national NCD risk-factor data to processes that inform policy and program making at the country level and help with target setting and monitoring of progress. This is after all one of the key goals of STEPS surveillance—to strengthen the availability of data to help countries inform, monitor, and

evaluate their policies and programs—and future STEPS work should remain firmly focused on this goal. **AJPH**

#### CONTRIBUTORS

L. Riley designed the study, with input from the other authors. L. Riley and R. Guthold led the writing of the first draft of the article. R. Guthold and L. Riley designed the figure graphics. All others contributed to subsequent drafts.

#### HUMAN PARTICIPANT PROTECTION

Human participant protection is not applicable because this article is not reporting any individual-level data.

#### REFERENCES

1. *Global Status Report on Noncommunicable Diseases 2014*. Geneva, Switzerland: World Health Organization; 2014.
2. *2013–2020 Action Plan for the Global Strategy for the Prevention and Control of Noncommunicable Diseases*. Geneva, Switzerland: World Health Organization; 2013.
3. United Nations Sustainable Development Knowledge Platform. Transforming our world: the 2030 Agenda for Sustainable Development. New York, NY: United Nations Department of Economic and Social Affairs; 2015. Available at: <https://sustainabledevelopment.un.org/post2015/transformingourworld>. Accessed September 10, 2015.
4. *The World Health Report 2002—Reducing Risks, Promoting Healthy Life*. Geneva, Switzerland: World Health Organization; 2002.
5. *Preventing Chronic Diseases: A Vital Investment*. Geneva, Switzerland: World Health Organization; 2005.
6. Kontis V, Mathers C, Rehm J, et al. Contribution of six risk factors to achieving the 25×25 non-communicable disease mortality reduction target: a modelling study. *Lancet*. 2014;384(9941):427–437.
7. *Global Health Risks. Mortality and Burden of Disease Attributable to Selected Major Risks*. Geneva, Switzerland: World Health Organization; 2009.
8. Lim SS, Vos T, Flaxman AD, et al. A comparative risk assessment of burden of disease and injury attributable to 67 risk factors and risk factor clusters in 21 regions, 1990–2010: a systematic analysis for the Global Burden of Disease Study 2010 [Errata in *Lancet*. 2013;381(9867):628; *Lancet*. 2013;381(9874):1276]. *Lancet*. 2012;380(9859):2224–2260.
9. World Health Organization. WHO STEPwise approach to surveillance (STEPS). Available at: <http://www.who.int/chp/steps/en>. Accessed August 10, 2015.
10. Armstrong T, Bonita R. Capacity building for an integrated noncommunicable disease risk factor surveillance system in developing countries. *Ethn Dis*. 2003;13(suppl 2):S13–S18.
11. World Health Organization. NCD Global Monitoring Framework. Available at: [http://www.who.int/nmh/global\\_monitoring\\_framework/en](http://www.who.int/nmh/global_monitoring_framework/en). Accessed August 20, 2015.
12. *WHO STEPS Surveillance Manual: The WHO STEPwise Approach to Chronic Disease Risk Factor Surveillance*. Geneva, Switzerland: World Health Organization; 2008.
13. Ng M, Fleming T, Robinson M, et al. Global, regional, and national prevalence of overweight and obesity in children and adults during 1980–2013: a systematic

analysis for the Global Burden of Disease Study 2013. *Lancet*. 2014;384(9945):766–781.

14. World Health Organization. WHO Global InfoBase. Available at: <https://apps.who.int/infobase>. Accessed September 9, 2015.