


ORIGINAL PAPER

Assessing costs of a hypertension management program: An application of the HEARTS costing tool in a program planning workshop in Thailand

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Abstract

The HEARTS technical package, a part of the Global Hearts Initiative to improve cardiovascular health globally, is a strategic approach for cardiovascular disease prevention and control at the primary care level. To support the evaluation of costs associated with HEARTS program components, a costing tool was developed to evaluate the incremental cost of program implementation. This report documents an application of the HEARTS costing tool during a costing workshop prior to the initiation of a HEARTS pilot program in Thailand's Phothong District, 2019-2020. During the workshop, a mock exercise was conducted to estimate the expected costs of the pilot study. The workshop application of the tool underscored its applicability to the HEARTS program planning process by identifying cost drivers associated with individual program elements. It further illustrated that by supporting disaggregation of costs into fixed and variable categories, the tool can inform the scalability of pilot projects to larger populations. Lessons learned during the initial development and application of the costing tool can inform future HEARTS evaluation efforts.

1 | BACKGROUND

Cardiovascular diseases (CVD) are responsible for 18 million deaths annually—a third of all deaths worldwide.¹ Over three-quarters of CVD morbidity occurs in low-income and middle-income countries (LMICs), where it is more likely to strike prematurely (under the age of 70).² CVD is largely preventable through population-wide approaches to reduce harmful behaviors such as smoking, physical inactivity, high dietary intake of salt and trans-fatty acids, and

patient-centered approaches to address CVD risk factors such as hypertension, diabetes, and hyperlipidemia.¹⁻³ Recognizing the rising significance of CVD globally, all 194 WHO member states have established 2020 targets of reducing the risk of premature CVD death by 25%, reducing the prevalence of high blood pressure by 25%, and increasing drug treatment for the prevention of CVD by 50%.²

The Global Hearts Initiative (GHI) provides a comprehensive set of strategies for improving cardiovascular health globally. A principal GHI component is HEARTS, a technical package of strategies

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for CVD prevention and management at the primary care level.^{4,5} HEARTS focuses on CVD reduction through lifestyle counseling, standardized protocols for medication treatment, improved access to medication, and strengthened health care efficiencies through monitoring, team-based care, and CVD risk assessment. Given the key role of hypertension in all-cause and CVD mortality,⁶ combined with high levels of uncontrolled hypertension in LMICs,^{7,8} HEARTS places a strong emphasis on improving health outcomes at the population level through streamlining service delivery in primary care.

Incorporating HEARTS program components in country health systems depends on the availability of information on expected health outcomes and expected costs associated with implementation. To support the evaluation of HEARTS program costs, a cost-assessment instrument was developed as part of program planning. The HEARTS costing tool is an Excel-based platform for collecting and summarizing the incremental costs associated with HEARTS implementation. The tool can facilitate program development by informing budgeting needs for program rollout and scale-up.

This report describes the HEARTS costing tool and its relevance to budget planning and evaluation by documenting an application of the tool at the initiation of a HEARTS pilot program in Thailand. Lessons learned and gaps identified during the initial development and application of the costing tool can inform improvements in future HEARTS evaluation efforts.

2 | THE HEARTS COSTING TOOL

2.1 | Context

The HEARTS technical package provides a framework for CVD prevention and management with six practical, step-by-step modules.⁵ HEARTS modules are based on the following themes: H—Healthy

Lifestyle, E—Evidence-Based Treatment Protocols, A—Access to Essential Medicines and Technology, R—Risk-Based Management, T—Team Care and Task Sharing, and S—Systems for Monitoring. A robust monitoring and evaluation framework to track process indicators and health outcomes is an integral part of the package. HEARTS is implemented at primary health facilities that typically handle risk screening, assessment, management, and referral of high-risk patients to district hospitals and may involve community outreach to promote health education and preliminary screening. Modules can be adopted selectively or adapted to the local context based on the availability of personnel, medicines, and technology at primary health care centers.⁵ When considering selective implementation or program expansion, country decision-makers might examine and compare the costs of implementing individual HEARTS components, taking into account resource availability and sustainability. To this end, a comprehensive yet simple-to-use costing tool provides necessary program-specific information.

2.2 | Costing tool overview

The HEARTS costing tool uses an activity-based costing approach, where a cost is derived for every activity conducted as part of the program. It assumes a one-year time horizon and is organized according to the six HEARTS elements. It captures the incremental cost of implementation of each HEARTS element thereby highlighting the additional resources needed to rollout the program over the specified time period. The development of the tool entailed an iterative process of identification of the cost components through expert and stakeholder consultations and reviews, compliance with the underpinnings of cost theories and existing global cost frameworks (eg, WHO-PEN, WHO-CHOICE/OneHealth Tool).^{9,10} An overview of the tool is presented in Table 1.

In addition to supporting program planning and evaluation within individual countries, a contribution of employing the HEARTS

TABLE 1 Overview of the HEARTS costing tool

Who?	The HEARTS costing tool is an Excel-based instrument to collect, track, and evaluate the incremental cost of participating in the HEARTS program.
What?	The costing tool will provide information that can be used to inform national stakeholders about budget needs for HEARTS service delivery. The implementing health facility will be provided with a User's Guide to provide instructions, facilitate data collection, and guide the development of a set of standardized reports.
How?	The tool is organized to track costs by HEARTS elements: Healthy Lifestyle (H), Evidence-Based Treatment Protocols (E), Access to Essential Medicines and Technology (A), Risk-Based Management (R), Team Care and Task Sharing (T), and Systems for Monitoring (S). An additional section, Administrative Costs, tracks expenses associated with administering the program not readily classifiable into one of the six elements. Where country-specific cost data are not available, the tool provides built-in default values that can be substituted for actual incurred costs. Default values are available for a limited number of countries. After costs are inputted, the tool automatically organizes cost estimates using summary tables and graphs, classifying costs into fixed and variable categories, and by HEARTS element. Tool users need to have a basic knowledge of Microsoft Excel.
Why?	Information on program costs supports program budgeting, procurement, and evaluation. It supports planning for program scale-up. Application of the HEARTS costing tool across multiple countries enables the collection of standardized cost data, which can allow cross-country comparisons of the cost and effectiveness of HEARTS.
Where?	Local staff familiar with HEARTS implementation in participating countries will facilitate the data collection, with technical assistance from global partners as needed.

costing tool across multiple countries is the standardization of cost data collection. Standardized data facilitate cross-country comparisons, potentially helping to identify gaps or relative efficiencies in program performance. Standardized cost data can also contribute to better economic evaluation of cardiovascular disease interventions, informing advocacy, and policy decisions for population health. An important condition for successful costing tool implementation is incorporating plans for using the tool in the pre-implementation phase of each HEARTS program. Such plans would secure appropriate human resources for cost data collection as the program unfolds, and costs are being incurred. The next section describes step by step the organization of the HEARTS costing tool.

2.3 | Costing tool structure

2.3.1 | Title page and guide

The “Title page” worksheet tab contains the table of contents for the tool and allows users to navigate to other tabs of the worksheet. This tab presents the user guide with an overview of the costing tool and answers frequently asked questions, including: (a) What is the HEARTS technical package? (b) How can the HEARTS technical package costing tool be used? (c) What are the expectations of the user of this tool? (d) How is the tool organized? (e) What are the assumptions of this tool? (f) How do I use this tool? (g) What are fixed costs? What are the variable costs? (h) What if I have costs that are not included in the cost categories listed? and (i) What if I am only conducting a hypertension intervention?

2.3.2 | Initialize page

In the “initialize” worksheet tab, the user selects a country from a list of pre-determined countries. Upon country selection, the costing tool calculator becomes prepopulated with default values of costs and other inputs obtained from the WHO-PEN tool.⁹ The user can also supply input values specific to their own district if they are available. Input cells in this costing tool are color-coded in either blue or green, where the user can enter data into blue cells; remaining cells would be populated automatically using default values. Green cells are not to be altered as these are generated automatically and contain formulas.

2.3.3 | H: Healthy lifestyles

The “H” component of HEARTS entails lifestyle counseling to individuals by health care providers. This worksheet records resource use and costs for these activities. The main cost components include training of health care providers, the additional provider time spent on lifestyle counseling during primary care visits, informational materials such as brochures and leaflets, and

smoking quitline operations. Assumptions incorporated into the worksheet model include the following: (a) training sessions for healthy lifestyle counseling are paid for at the central district level; (b) risk screening and counseling will be carried out during routine primary care visits; (c) all patients will be provided with an informational leaflets; (d) screening costs are derived from the average time the provider spends with the patient multiplied by the number of patients; and (e) tobacco counseling will be carried out by trained quitline employees and informational leaflets. Because all activities are assumed to use existing facilities, no costs for additional infrastructure are included.

2.3.4 | E: Evidence-based treatment protocols

The HEARTS technical package includes simple, standardized treatment protocols, including integrated algorithms for the management of high blood pressure and diabetes. This worksheet records costs associated with time spent with patients on screening, physical examinations and obtaining blood and urine tests. Blood test times include time spent to draw blood and time to process laboratory tests. Urine tests only include processing times. Based on their CVD risk level, patients will have 1-4 follow-up visits within the year.

2.3.5 | A: Access to essential medicines and technologies

The HEARTS package promotes the use of simplified treatment protocols with a defined list of core medicines and technology for managing key CVD risk factors and facilitating procurement and distribution mechanisms. This worksheet tab is prepopulated with a list of medicines, diagnostic technologies, tools and protocol logistics (eg, prediction charts, clinical record, and referral criteria), and associated staffing cost (eg, laboratory technician and pharmacist).

2.3.6 | R: Risk-based management

CVD risk assessment reflects the patient likelihood of experiencing a cardiovascular event (heart attack or stroke). The level of risk is determined with simple risk-scoring tools based on the combined effect of risk factors that include age, sex, smoking status, blood pressure, and total cholesterol or body mass index. Updated CVD risk prediction charts will be available for each country, based on country-specific estimates of CVD risk factors and CVD mortality. Costs falling under this category include provider time spent on estimating patient CVD risk using risk charts during an annual primary care visit, in addition to time spent collecting patient history. Other costs included provider time spent in training on risk management estimation.

2.3.7 | T: Team care and task sharing

A well-trained workforce with the capacity to initiate and sustain CVD prevention and management programs is a critical component of care delivery. Task sharing is the redistribution of tasks among different types of health care providers, for example, doctors to nurses, to increase efficiencies of service delivery. The HEARTS package supports team care and task sharing by training non-physician health care workers in providing CVD risk management care as appropriate and indicated by WHO approaches. Cost assessment in this worksheet is based on estimates of how much additional time spent with patients by each provider type could be reduced or increased as a result of task sharing. If the time to conduct tasks by physicians decreased as other providers take up task sharing, it is possible to observe cost savings.

2.3.8 | S: Systems for monitoring

In the HEARTS technical package, systems for registration and patient and cohort monitoring will be aligned with ongoing initiatives to standardize health management information systems in primary health care. Systems for monitoring include tracking patient outcomes electronically or using traditional paper and pencil methods by administrative staff. Allowances are made for specialized staff such as a statistician to compile individual data. Cost items are categorized as human resources (administrative and technical), technology (hardware and software), supplies, and training.

2.3.9 | Administrative Costs

This worksheet tab is used to keep track of miscellaneous implementation costs.

2.3.10 | Reporting

Summary tables and figures depicting HEARTS costs in local currency and in US dollars are generated in separate worksheet tabs. Costs are summarized by HEARTS elements and into fixed and variable categories. Because costs are broken down into the HEARTS elements, users of the costing tool can assess the cost of specific aspects of the program. For example, what is the cost of including counseling on smoking cessation for the population? These costs would be borne out in tab H, while tab A would allow users to quantify the savings resulting from less expensive medications.

2.3.11 | Hypertension prevention (HTN-P) and hypertension treatment (HTN-T)

In some instances, countries may limit the scope of the CVD program to hypertension management only, using hypertension as an

entry point to broader CVD interventions. Two additional worksheet tabs are available to track the costs of activities specific to hypertension prevention and treatment, such as the cost of medicines, durable equipment, and personnel.

3 | HEARTS COSTING TOOL: A CASE STUDY APPLICATION IN THAILAND

3.1 | Project description

The Thailand Ministry of Public Health (MoPH) collaborates with the World Health Organization (WHO) and the US Centers for Disease Control and Prevention (CDC) in incorporating elements of the HEARTS technical package in CVD prevention and control programs. In 2017, the Thailand Bureau of NCDs (BoNCD) conducted a community baseline assessment of six elements of the HEARTS technical package in the Phothong District among five groups: hypertensive patients, caregivers, community leaders, health care staff, and village health volunteers. With community participation, BoNCD designed a Thailand HEARTS plan for CVD management in the Phothong community, which selected three HEARTS elements for community implementation: (a) Healthy Lifestyle, focusing on salt intake reduction, physical activity, and hypertension self-monitoring, (b) Team-based Care and Task Sharing, emphasizing collaboration between community leaders and health care providers in CVD health promotion, and (c) Systems for Monitoring, with a focus on tracking patient treatment compliance.

A pilot study to assess CVD intervention effects has been planned for 2019-2020 in the Nong Mae Kai Community, Phothong District, Angthong Province. The intervention seeks to increase knowledge and practice of salt reduction among hypertensive patients, increase drug compliance and blood pressure control rates, reduce the Thai CVD Risk Score, and reduce the rate of missed follow-up appointments. This study focuses on hypertension patients without comorbidities who have been diagnosed in the past 3 years. About 41 and 75 study participants qualified from Non Mae Kai community and Muang Tia community, respectively. To support program evaluation and inform scale-up at the district level, the project aims to estimate incremental costs of program implementation.

3.2 | Costing tool workshop

A demonstration workshop to introduce the HEARTS costing tool was conducted in February 2019 in Bangkok, Thailand. During the workshop, a mock exercise was conducted to assess the expected costs of the planned pilot project. The workshop participants examined and identified the potential cost elements and inserted values into the tool based on their local knowledge.

Workshop activities began by introducing the purpose of the costing tool. A demonstration of the cost components across

HEARTS elements was conducted. This strengthened understanding of how cost items relate to individual elements of the HEARTS technical package and presented options to adapt elements to the local context. In the **H** (Healthy Lifestyle) worksheet, participants identified costs attributable to provider training, meetings, primary care screening, and promotional materials. In the **E** (Evidence-based Treatment Protocols) worksheet, participants registered costs from screening of patient history in primary care, providing physical examinations, return-visit physical examinations for low-risk and high-risk patients. The participants reported the cost of acquiring blood pressure measurement devices in the **A** (Access to Medicine) worksheet. No costs were inputted in the **R** (Risk-based Management) worksheet as this element was not part of the pilot. Inputting data in the **T** (Team-based Care and Task Sharing) worksheet required participants to stipulate the change in time spent by various providers (ie, physicians, nurses, and community health workers) due to task sharing. Cost items in the **S** (Systems for Monitoring) worksheet included disbursements for administrative and statistical staff support, software expenses, paper materials, and training. Workshop participants added the following items in the Administrative Cost worksheet: compensation for the program director, program manager, research support staff, printing, office supplies/postage, and telephone charges. Table 2 provides examples of questions that were discussed during the data input exercise. It helped in eliciting responses from the participants on various aspects of the Thailand hypertension management project, helped to map them to the relevant costing tool tab and to assess issues and challenges in the operationalization of the costing tool.

Table 3 describes the amounts identified by workshop participants for HEARTS elements included in the pilot study. As estimated by participants in the costing workshop exercise, the total cost of implementing the proposed pilot study for 2019-2020 in the Nong Mae Kai Community, Phothong District was \$32 300. A large portion of the cost was from fixed costs including costs from establishing systems for monitoring, staff training, and procuring blood pressure measuring devices. This indicates that scale-up of the program to more patients is likely to be efficient due to economies of scale. As these estimates were derived impromptu from the participants during the workshop, the distinctions between the fixed and variable categories may be subject to further scrutiny and recategorization in the context of within-facility scale-up prospects, project life, and analytic horizon.

The total cost estimate generated during the workshop was close to the ex-ante stipulated program budget of \$33 000 that was sent by the implementing agency to the funding agency before the workshop. Specifically, the pilot program plan by the Thailand Bureau of NCDs indicated that 58% of the ex-ante budget was attributed to personnel cost, 20% to equipment, supplies, and travel, and 22% to other costs. However, these ex-ante budget allocations were not further disaggregated by program activity and were not classified as fixed or variable, limiting the comparability of the ex-ante budget to the costing tool estimation.

TABLE 2 Examples of pilot testing questions—Global HEARTS technical package costing tool

These questions are meant to facilitate feedback from the first users of the Global HEARTS technical package costing tool. As you are completing the tool, we kindly request that you address these questions.

1. **Description of your site.** How many people does your site serve? (Rough estimate is okay) Approximately how many people will be affected by the Global HEARTS Technical Package in your site?
2. **User's guide.**
 - a. Was the user's guide instructive? Were any parts missing that needed explanation? Did it print properly if you printed it?
3. **Time spent on the tool.**
 - a. Approximately how long did it take you to find the information that needed to be entered into the tool?
 - b. Approximately how long did it take to enter the information into the tool?
4. **Training courses under worksheet H, counseling on tobacco cessation, diet, physical activity, alcohol use, and self-care.**
 - a. What type of training will be taking place at your site?
 - b. Who would you need to administer the training? (Local experts, national experts, or other)
 - (i) Will your site pay for travel and per-diem?
 - c. Who will be receiving the training?
 - (i) Primary care physicians only? Will other staff be participating? (Please list)
 - d. How long will the training last? (Will these sessions be multi-day workshops, or 1-2 sessions, or other)
 - e. How frequently will the training occur? (1× per year, or multiple times)
 - f. Will there be any overhead costs associated with the training? (Training booklets, building rentals, etc)
 - (i) Will your site bear all of the above costs?
5. **Costs under worksheet A, access to medicine.**
 - a. Is this worksheet sufficiently comprehensive in capturing all the additional prescription drugs which are needed for the Global HEARTS Technical Package, or is there too much detail?
 - b. How much of the drugs are health facilities expected to maintain in stock? How much of the drugs are health facilities expected to maintain in stock? Do you have any stock-out problems? If so, how frequently and which medicines are most likely to stock out?
6. **Wage costs.** The wage costs for the costing tool are located in the default costs worksheet. These were pulled from the WHO-PEN non-communicable disease costing tool.
 - a. Are these wages representative for a person of average skill within the job category listed?
 - b. If not, how much would you estimate these wages are higher or lower than a person with average skill within the job category? 10% higher? 10% lower?
7. **Other issues.** Did you run into other technical issues with the tool? Please explain.

4 | CONCLUSION

The HEARTS costing tool workshop conducted in Thailand introduced a platform for tracking costs associated with the implementation of a HEARTS pilot study in Thailand's Phothong District during 2019-2020. During the workshop, a costing exercise was conducted to estimate the expected costs of the pilot study. The workshop application of the tool underscored its applicability to the HEARTS program planning process by identifying cost drivers

TABLE 3 Cost components of Thailand HEARTS pilot study identified by workshop participants

HEARTS element	Calculations	Cost in local currency (Baht)	Cost in USD
H: Healthy lifestyles		410 912	\$11 916
Training	3 × 120 000	360 000	
Meetings	10 × 5000	50 000	
Screening in primary care	10 min × 40 × 0.00008% FTE × 169 887	545	
Leaflets	1 × 40 × 9	367	
E: Evidence-based treatment protocols		2178	\$63
Screening in primary care (patient history)	5 min × 40 × 0.00008%FTE × 169 887	272	
Physical examination	10 min × 40 × 0.00008%FTE × 169 887	545	
Return visit physical examination (low risk)	10 min × 30 × 0.00008%FTE × 169 887	817	
Return visit Physical Examination (high risk)	10 min × 10 × 0.00008%FTE × 169 887	545	
A: Access to essential medicines and technologies^a		115 161	\$2900
Blood pressure measurement device adult	2000 × 50	100 000	
R: Risk-based management		--	-
T: Team care and task sharing^b		266 718	\$7735
Training for supervisors	3 trainings × 60 000	180 000	
Physician	(-5% change in time) × 169 887	(8494)	
Nurse	(5% change in time) × 104 924 × 3	15 739	
Community health worker	(10% change in time) × 79 474 × 10	79 474	
S: Systems for monitoring		68 427	\$1984
Administrative staff	3 × 0.1 FTE × 79 474	23 842	
Statistician	2 × 0.1 FTE × 104 924	20 985	
Software	1 × 12 000	12 000	
Paper	60 Reams × 110	6600	
Training cost	1 × 5000	5000	
Administrative Costs		265 580	\$7702
Program director (0.07 FTE)	1 × 0.07 FTE × 255 017	17 851	
Program manager (1 FTE)	1 × 1 × 169 887	169 887	
Other support staff (researcher; 3 × 0.1 FTE)	3 × 0.1 × 79 474	23 842	
Printing	60 000 pages	30 000	
Office supplies/postage		20 000	
Telephone	1 × 4000	4000	
Total cost		1 113 815	\$32 300
Fixed vs variable costs			
Fixed costs		1 024 007	\$29 696
Variable costs		89 808	\$2604

Notes: Figures were estimated during costing workshop mock exercise and inputted into the costing tool worksheets. Estimates based on 40 patients. These are not actual program costs.

The bold values indicate the sub-totals for the H, E, A, R, T, S, and administrative costs.

Abbreviation: FTE, full-time equivalent.

^aDuring the exercise, the participants did not identify the medicine cost as an incremental cost for this particular program.

^bFor the "T" component participants assumed that the training would reduce doctors' hours by 10% and nurses and CHW workers increased their hours by 5% and 10%, respectively.

associated with individual program elements. It further illustrated that by supporting disaggregation of costs into fixed and variable categories, the tool can inform the scalability of pilot projects to larger populations.

HEARTS is active in 17 countries at various stages of implementation; some countries are introducing the full set of HEARTS interventions, while others are considering partial components. Nearly all countries are in the beginning stages of program planning or rollout.

Information on program costs is essential not only to assess program efficiency, make cost projections, and inform budgeting and procurement but also to help national managers to effectively plan and coordinate future program resources.¹¹ It can help to identify areas where economies of scale can support program expansion through spreading out fixed costs over larger patient populations. When cost data collection over time is aligned with the collection of monitoring and evaluation indicators that track process and health outcomes, cost-effectiveness evaluations can be conducted to describe program performance.

To accommodate the country needs for forecasting HEARTS costs that have not yet been incurred, a prospective version of the HEARTS costing tool can be used. The prospective version of the tool projects costs under different implementation scenarios in order to support program uptake that is optimal for each individual county context. During the planning stages of HEARTS implementation, choice of treatment protocols and counseling interventions might be dependent on expected costs. By estimating future expenditures, the costing tool can help to guide program implementation from a practical angle by establishing budget needs, informing program evaluation, and supporting optimal health policy action.

CONFLICT OF INTEREST

The authors declare no conflict of interest.


AUTHOR CONTRIBUTIONS

MJH, DK, BTA, KJ, RN, and LK conceptualized the paper, conducted data analysis, interpreted the results, and drafted the manuscript. LK, SS, KY, NP, DK, BH, KTJ, and MJH contributed in the data collection and curation. MJH, BTA, BH, LK, SS, KY, NP, RN, BKD, KTJ, and DK reviewed and finalized the manuscript. All authors read and approved the final manuscript.

DISCLAIMER

The findings and conclusions in this report are those of the author(s) and do not necessarily represent the views of the Centers for Disease Control and Prevention.

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