HHS Public Access

Author manuscript

Am J Prev Med. Author manuscript; available in PMC 2018 October 05.

Published in final edited form as:

Am J Prev Med. 2017 December ; 53(6 Suppl 2): S155–S163. doi:10.1016/j.amepre.2017.06.012.

Community Guide Economic Reviews of Cardiovascular Disease Prevention Interventions: Tailoring Methods to Ensure Utility of Findings

Sajal K. Chattopadhyay, PhD,
The Community Guide Branch, Division of Public Health Information Dissemination, Center for Surveillance, Epidemiology, and Laboratory Services, CDC

Verughese Jacob, PhD, MPH,
The Community Guide Branch, Division of Public Health Information Dissemination, Center for Surveillance, Epidemiology, and Laboratory Services, CDC

Shawna L. Mercer, MSc, PhD,
The Community Guide Branch, Division of Public Health Information Dissemination, Center for Surveillance, Epidemiology, and Laboratory Services, CDC

David P. Hopkins, MD, MPH,
The Community Guide Branch, Division of Public Health Information Dissemination, Center for Surveillance, Epidemiology, and Laboratory Services, CDC

Randy W. Elder, PhD, MEd,
Office of Science Quality, Office of the Associate Director for Science, CDC

Christopher D. Jones, PhD, MSW, and
Division for Heart Disease and Stroke Prevention, Office of Noncommunicable Diseases, Injury, and Environmental Health, CDC.

Community Preventive Services Task Force

Abstract

Context: The Community Preventive Services Task Force recommended five interventions for cardiovascular disease (CVD) prevention between 2012 and 2015. Systematic economic reviews of these interventions faced challenges that made it difficult to generate meaningful policy and programmatic conclusions.

Objectives: This paper describes the methods used to assess, synthesize, and evaluate the economic evidence to generate valid, reliable, and useful economic conclusions and address the comparability of economic findings across interventions.

Methods: Steps were taken to assess completeness of data and identify the components and drivers of cost and benefit. Except for intervention cost of self-measured blood pressure

Address correspondence to: Sajal Chattopadhyay, Center for Surveillance, Epidemiology, and Laboratory Services, CDC, 1600 Clifton Road, MS E-69, Atlanta, GA 30329. skc9@cdc.gov.

Names and affiliations of Task Force members are available at www.thecommunityguide.org/about/task-force-members.html.

monitoring (SMBP) intervention, either alone or with patient support, all cost and benefit estimates were standardized as *per patient per year.* When possible, intermediate outcomes were converted to quality-adjusted life year (QALY). Differences within and between interventions were considered to generate economic conclusions and inform their comparability.

Results.—Intervention cost per patient per year was highest for team-based care (TBC), either alone or in combination with other interventions. TBC, SMBP with patient support, and SMBP within TBC were found to be cost-effective; however their cost-effectiveness estimates were not comparable because of differences in the intervention characteristics. Lack of enough data and/or incomplete information made it difficult to reach an overall economic finding for the other interventions.

Conclusions: Appropriate methods to handle the complexity of systematic economic reviews can help to draw transparent and valid economic conclusions for public health interventions to prevent or control CVD and inform judgment about their comparability.

Introduction

The nonfederal, independent Community Preventive Services Task Force (Task Force) was established in 1996 by the U.S. Department of Health and Human Services to identify population health interventions and recommend those that are effective, based on systematic reviews of the scientific and practice-based literature. Task Force findings and their associated systematic reviews are housed in the Guide to Community Preventive Services (www.thecommunityguide.org). The Centers for Disease Control and Prevention (CDC) provides technical and administrative support for the Task Force through its Community Guide Branch. Between 2012 and 2015, the Task Force recommended five interventions for their effectiveness in preventing and controlling cardiovascular disease (CVD). Systematic economic reviews for these interventions were conducted to provide information about their cost, benefit, cost-benefit, and cost-effectiveness. The five interventions are:

- Team-based care (TBC)—a health systems-level, organizational intervention that incorporates a multidisciplinary team including the patient, the patient's primary care provider, and other health professionals to improve patient care. [1–3]
- Reducing out-of-pocket costs (ROPC)—program and policy changes that make healthcare services or medication more affordable to patients. [4,5]
- Clinical decision support systems (CDSS)—computer-based information systems designed to assist healthcare providers in implementing clinical guidelines at the point of care. [6–8]
- Community Health Workers (CHW)—frontline public health workers who serve to bridge communities with healthcare systems (http://www.thecommunityguide.org/cvd/CHW.html).
- Self-measured blood pressure monitoring (SMBP)—support and promote the use of personal blood pressure measurement devices in the management and treatment of high blood pressure.[9]

The objectives of the Community Guide systematic economic reviews are to provide evidence-based estimates of intervention costs and benefits and judgment of economic value based on these estimates. These reviews often face challenges that make it difficult to present and interpret their findings to generate meaningful policy and programmatic insights and conclusions. For example, heterogeneity in included studies is a challenge in most systematic reviews of effectiveness, and the challenge is compounded in systematic economic reviews as economic effects and consequences are added. The individual studies included in systematic reviews typically differ substantially in quality and completeness of cost and benefit estimates, making it difficult to synthesize findings. Also, when the intervention of interest is combined with other interventions, it becomes difficult to disentangle its effectiveness and economic effects from the reported aggregate effects of the combined intervention.

To address these challenges and derive valid and reliable economic estimates that can be used as the basis of Task Force economic findings, Community Guide economic methods attempt to filter out the noise introduced by heterogeneity and to elucidate key economic drivers. Economic value estimates from both a societal perspective and from the narrower perspective of potential implementers are often provided.[10] An additional challenge faced by Community Guide reviews stems from decision makers' desire to compare economic value estimates across interventions. Careful examination of the differences in the setting, context, and perspective of interventions to be compared reveals why this may often be inappropriate.

Objectives

The objectives of this paper are therefore twofold: 1) to demonstrate how economic review methods developed for The Community Guide enabled the derivation of valid, reliable, and useful economic estimates that could be used as the basis of Task Force economic findings for five very different Task Force-recommended interventions aimed at preventing and controlling CVD; and 2) to illustrate how additional considerations about differences in intervention characteristics may inform the comparison of economic conclusions across interventions.

Methods

Consistent with Community Guide processes, candidate CVD prevention interventions for systematic review were identified by Community Guide staff in consultation with subject matter experts from CDC's Division for Heart Disease and Stroke Prevention (DHDSP) and from other federal, state, and local academic, policy and practice settings. High blood pressure, dyslipidemia, smoking, and diabetes are all major risk factors for cardiovascular disease that can be modified by one or both of medication and improvement in physical activity and nutrition.[11] Candidate interventions were prioritized based on their expected impact on these modifiable risk factors, the need to address primary and secondary prevention across a range of populations and settings, and on known obstacles to reaching treatment goals, such as adherence to medication regimens. For the top five prioritized interventions, systematic reviews were first undertaken of their effectiveness in achieving their intended outcomes.[1,2,4–7] According to Community Guide processes, since the Task

Force recommended all five interventions based on evidence of their effectiveness, systematic economic reviews were subsequently completed.[3,5,8,9]

General Community Guide economic review methods are available on The Community Guide website (http://www.thecommunityguide.org/about/economics.html) and in the published literature.[12] The Results section of this article lays out the nuances of how The Community Guide economic review team addressed the challenges involved in trying to secure useful economic information, for a range of disparate decision makers, about these five CVD interventions that differed substantially in terms of the amount and type of available economic data as well as in their intended settings, populations, and outcomes. The first Results sub-section identifies important characteristics that varied markedly across the interventions, not allowing head-to-head comparisons, and requiring adjustments in analyses to yield meaningful and useful economic findings. The remaining sub-sections identify the rules and methods followed by the team as they sought to address the variability and draw estimates from the heterogeneous populations, settings, and contexts, and by the Task Force as they deliberated about the cost, benefit, and economic merit of the five interventions.

For each of the five economic reviews, the team used the definition and description of the intervention developed by the effectiveness review team, along with additional input from subject matter experts, to identify the components that determine the cost to implement the intervention (intervention cost) and changes in healthcare cost and productivity due to the intervention. Next, the team ascertained which were the cost and benefit drivers to form the ideal set of components that was compared against the components for which information was available in the included studies to assess the ‘completeness’ of the reported economic estimates. All cost and benefit estimates were adjusted to 2015 US dollars using the consumer price index.[13]

Components of the intervention costs fell into one of three broad economic categories: capital goods, labor, and materials. Capital goods can be used multiple times before they have to be replaced, having a useful life that generally exceeds a calendar year. Labor and materials are measured in units of time and quantities per unit of time, respectively. The cost of labor and materials used over an intervention’s one year of operation is fully charged against the intervention’s benefit measured over the same one year period. However, the cost of a capital good to be assigned against the one year of intervention benefit would be the total cost of acquisition divided by its useful years of service. These differences in the appropriate treatment of capital and non-capital resources in economic evaluations were very important in assessing intervention cost for the five interventions considered in this review.

Results

Characteristics of interventions and included studies

Table 1 describes the body of studies that contain economic evidence for each of the CVD interventions in terms of five characteristics that differed substantially between the interventions: number of studies, target population, intervention implementer, risk factor focus, and what additional interventions, if any, were combined with the primary intervention of interest. The number of studies reporting economic outcomes ranged from

four for interventions engaging CHWs to prevent CVD to 31 studies for TBC to control blood pressure (BP). This range in size of the body of economic evidence affected the quantity and quality of available economic information, which in turn impacted the strength and usefulness of the overall economic evidence.

The interventions were also distinguished by whose behavior they sought to influence and how. The target population for ROPC was patients, and of interest was their adherence to treatment—particularly medication. CDSS interventions were used to guide and inform clinical decision making by healthcare providers to improve patients' CVD health outcomes. The remaining three interventions targeted healthcare providers and their care behavior, as well as patient participation in their own care: for SMBP interventions through home-based BP monitoring, for TBC interventions through interaction with their healthcare providers, and for CHW interventions through engagement with the CHWs as a bridge to the health care system and resources.

Two interventions were specifically aligned with patient self-interest: ROPC because it reduces patients' out-of-pocket costs for treatment—particularly for medication—thereby improving patients' adherence to treatment; and SMBP because it increases patients' participation in the healthcare process and makes them more proactive in self-management of their health. In contrast, for TBC, CDSS, and CHW interventions, the expectation is that they will improve patient health by altering provider behavior through better communication among providers. However, there is no purely self-interested motivation for providers to adopt these interventions unless there is additional compensation linked to performance for improved patient health compared to usual care.

The likely implementers of the interventions were deduced from definitions by the Community Guide CVD effectiveness review team since many of the studies were evaluations of funded trials and provided sparse details about implementation. SMBP and ROPC constitute healthcare resources directly consumed by patients and are therefore paid for by patients or their health insurance plans. CDSS interventions are generally paid for by clinics and other organizations that provide direct care, with expectation of savings from greater efficiency and quality of care. On the other hand, TBC and CHW interventions bring together health care personnel from different organizations into patient-centered relationships and activities that are not matched by a similarly coordinated reimbursement system for their services. Therefore, although these interventions are implemented by the healthcare system, the payment arrangement for TBC and CHW interventions is often not clear.

Acknowledgement of the likely implementer is important in informing what the appropriate perspective should be when estimating costs and benefits. The general methods for Community Guide economic reviews assume a societal perspective where the cost and benefit of the intervention are summed over individuals and organizations and compared to each other, regardless of who pays and who benefits. When societal benefits are shown to be greater than societal cost, it may be assumed somewhat simplistically that any mismatch between cost bearers and beneficiaries is remedied by public funds to fill gaps in compensation, time, and resources that participants bring to the intervention. Given the

limitations of this assumption, for some interventions, the Task Force has chosen to assess and consider the incentives for likely implementers in terms of their specific return on investment. This was the case for ROPC interventions, where the review took a health plan payer's perspective since the intervention is implemented by, and the reduced cost for the patient is ultimately borne by, the plan or insurer.

The risk factor foci also differed across the five interventions (Table 1). High blood pressure was a risk factor focus of all five interventions and the sole focus for the SMBP and TBC interventions while ROPC added dyslipidemia. The CDSS and CHW interventions were multi-focal and sought to reduce multiple cardiovascular disease risk factors. Since the included studies measured and reported health outcomes related to their specific risk factor foci, cost-effectiveness measured as cost per unit change in health outcome also differed across these studies. Hence, the cost-effectiveness computed from one study of a CHW intervention to prevent CVD may be $x per milligrams/deciliter reduction in low density lipoprotein while from another CHW study it may be $y per millimeter of mercury reduction in systolic blood pressure, and the two cannot be compared directly or grouped together to estimate the overall cost-effectiveness of CHW interventions to prevent CVD.

A number of studies included other interventions in addition to the primary intervention of interest (Table 1). When interventions are combined and the comparison is to usual care, the reported economic and other effects are due to the combination and cannot be clearly attributed to the single intervention that was the focus of the review. These challenges with disentangling the effects of combined interventions were especially relevant for the ROPC review, which included studies where ROPC was combined with TBC and disease management interventions, and for the CDSS review, which included studies that combined CDSS with TBC and quality improvement interventions. In the case of SMBP interventions, the very different levels of economic resource use associated with SMBP alone, SMBP with patient support, and SMBP within TBC prompted the economic review team to stratify the evidence into these three types of SMBP interventions. All studies of CHW interventions were TBC interventions where the CHW activities were an additional element of care, but where the CHW was not necessarily part of the care team. TBC itself is a complex intervention since it combines specialized labor in team arrangements for patient care. Therefore, interventions that included TBC were considered to be a combination intervention when the addition was a non-labor intervention such as financial incentives, BP monitors, or CDSS.

Components Analysis

No studies in the reviews reported effects of intervention on productivity of patients at their worksites. Therefore, what is discussed below are components identified from the studies included in the five reviews pertaining only to intervention cost and change in healthcare costs due to intervention.

Intervention Cost: Components and Estimates—For SMBP alone, the components of intervention cost included costs for the BP monitoring device, patient training on correct use of the device, any telemetry device to transmit the BP readings, and the cost of

generating summary reports for the healthcare provider. For SMBP with additional support, the costs of other devices (e.g., smartphones), staff, development of interactive software, and other information technology necessary to support patient self-care were added. SMBP within TBC added the cost of administrative and medical staff engaged in TBC activities. For CHW intervention, salaries for community health workers and their supervisors, training cost, cost of supplies and materials including patient education and CHW training materials, and infrastructure and equipment cost including cost of workspace and personal computing were the common cost components. The cost of acquiring and operating CDSS included development and implementation cost and cost of staff time and other resources for day-to-day use and maintenance. For ROPC intervention, the major cost component is the cost of providing reduced cost medications to existing and new users. The intervention cost for TBC was the cost of setting up and running TBC and included provider time, patient time, rent and utility. Table 2 presents the components and estimates of intervention cost. The identified cost drivers demonstrated the labor-intensity of TBC and CHW interventions and the capital-intensity of CDSS and SMBP alone or SMBP with additional support interventions. In the case of CDSS, the sum of acquisition cost distributed equally over five years of use and the recurring operating cost was divided by the number of patients to produce an annual cost per patient. For SMBP alone and SMBP with patient support, per patient one-time acquisition cost was reported instead of amortized cost since the capital component was largely the small outlay for BP devices ($50 to $75 per unit), and would be more meaningful for patients and health plans considering the purchase. On the other hand, for the combined SMBP and TBC interventions, the TBC component made this a labor-intensive intervention, and the cost to implement is therefore best expressed in per patient per year terms.

Healthcare Cost: Components and Estimates—Table 3 shows the estimates and major components of changes in healthcare cost, as reported in the included studies. The completeness of healthcare cost estimates from the included studies is reflected by the percentage of studies in the review that included each important component of healthcare costs (i.e., outpatient visits, medication costs, inpatient visits, emergency room visits, and laboratory work). The median time horizon for the economic estimates for each intervention is also provided, under the expectation that the full impact of improvements in the patients' health due to intervention takes longer to show as changes in healthcare cost. Given the practical and resource limits on the length of trials, some studies modeled long-term healthcare cost and the number of studies that did so is also identified in the table.

Studies that evaluated the effect on healthcare cost most often included the component of outpatient visits, followed by medication and inpatient stays. Emergency room and labs tests were less frequently included in the estimates. Most of the studies estimated change in healthcare cost during a 9 to 12 month horizon, probably not long enough for intervention effects to show in inpatient stays and ER use. Healthcare expenditures assessed were usually specific to the risk factor or condition that was the focus of the intervention, but some studies counted all healthcare encounters regardless of their cause. This was particularly true for SMBP with TBC and for CHW interventions, where 60% and 75% of the studies, respectively, reported healthcare costs from all causes.

The direction of effect of the intervention on healthcare cost is indicated by the sign on the estimates. Based on medians, TBC and SMBP within TBC interventions were healthcare cost increasing and the other interventions were healthcare cost saving. However, zero or 'no change' is within the interquartile interval for TBC, CDSS, CHW, and SMBP with patient support. SMBP within TBC was cost increasing everywhere within the interquartile interval. ROPC and SMBP alone interventions were healthcare cost saving everywhere in the interquartile interval.

Task Force Economic Finding Statements

An intervention's economic evidence is always reported in the rationale section of Task Force Finding and Rationale Statement. Additionally, when sufficient and consistent estimates of cost-effectiveness or cost-benefit are available or can be derived, the Task Force makes a specific finding based on economic evidence that appears alongside the finding based on the effectiveness evidence. The Task Force considers an intervention to be cost-effective when its cost per quality adjusted life year (QALY) saved is less than a widely-accepted and relatively conservative threshold of $50,000.[14] If averted healthcare costs or monetized values of health outcomes are greater than intervention costs, the Task Force notes that the intervention's benefits exceed its costs.

In the set of reviews for CVD prevention, complete assessments of both cost and benefit were rare. In particular, none of the included studies in the reviews included the monetized value of productivity improvements from averted morbidity and mortality. Hence, cost-benefit analyses were incomplete and often insufficient for the Task Force to reach a conclusion. For interventions that targeted blood pressure control, the change in systolic blood pressure reported was translated to QALY saved based on two translation formulae provided in two publications.[15,16] This was done where studies also reported the intervention cost and change in healthcare cost so that cost per QALY saved could then be computed.

Table 4 summarizes Task Force statements of economic finding for the five interventions, with 'no finding' indicating that either there was mixed evidence or not enough data on which the Task Force could deliberate. The cost-effectiveness estimates were mixed in the case of SMBP monitoring alone with two studies showing an increase in systolic blood pressure, two indicating averted healthcare cost exceeding the cost of intervention, and one study reporting cost per QALY saved greater than $50,000. Therefore, the Task Force had no finding statement for SMBP alone, whereas it found SMBP monitoring to be cost-effective when implemented with additional patient support or within TBC. For ROPC intervention, studies neither reported cost per QALY nor clinical outcomes such as changes in blood pressure that could be used to calculate cost-effectiveness ratios. Regarding evidence for cost savings, three studies on value-based insurance design (VBID) indicated mixed findings with two reporting intervention cost was higher than averted health care costs while the third found that the intervention was cost-neutral. For CDSS, results were inconsistent partly due to the incomplete assessment of the cost of implementing CDSS and its impact on healthcare cost. In addition, some studies implemented CDSS within systems-level organizational change, such as TBC, complicating interpretation of economic outcomes. For CHW

intervention, none of the included studies provided cost-effectiveness information, and there was not enough evidence to determine cost-benefit.

Comparative Assessment of Economic Conclusions across Interventions

The evidence from these systematic economic reviews showed that that TBC, SMBP with additional support, and SMBP within TBC were all cost-effective. It may be tempting to rank these three interventions in a league table to state that SMBP with additional support is most cost-effective and TBC is least cost-effective. However, SMBP within TBC is a specific application of TBC, and our methods made it clear how these interventions varied in terms of number of studies and specific cost and benefit drivers. Most importantly, the objective of the SMBP intervention was to make the patients more proactive in their self-care whereas TBC emphasized collaboration among all team members including patients to improve patient health outcomes. All these five interventions are distinct based on their main purpose, and it is not proper to categorize and rank their cost-effectiveness ratios to generate comparative statements about their economic value.

Discussion

Systematic economic reviews of public health interventions are beset with challenges that make it difficult to draw meaningful conclusions about the economic evidence. This article uses Community Guide economic reviews for five CVD interventions to illustrate how the Community Guide economic team implements simple, transparent, and effective methods to address the wide variability in cost and benefit estimates reported by individual studies in order to generate useful and valid conclusions on the economic merits of the interventions. Intervention effects, objectives, settings, expected implementers, and significant contextual factors are all important elements that are carefully considered in Community Guide reviews. Moreover, this article also identifies how Community Guide economic methods address the handling of intervention cost and benefit components and calculating cost-effectiveness estimates based on intermediate CVD outcomes.

For SMBP alone and CDSS, the cost of the blood pressure monitor and computer-based information systems respectively were significant drivers of cost. For SMBP within TBC, the personnel costs for TBC became the dominant component of costs. For ROPC interventions, the free or subsidized-price coverage for medications constituted the major cost component. For CHW intervention, the cost focused on total cost, with a CHW included as a member of TBC. In the case of benefits, averted productivity losses were not estimated in the individual studies for any of the interventions, and all benefit values were underestimated as a result. On the other hand, cost savings could be overestimated when averted healthcare costs in the individual studies considered healthcare costs from all causes including diabetes and hypertension. For the CHW intervention, 75% of studies estimated benefits based on reduced healthcare costs from all causes. Also, it was not possible to tease out the economic effect of the primary intervention when it was combined with other interventions. Finally, when studies reported a decline in systolic BP, The Community Guide economic team used formulae from published studies to derive cost per QALY estimates. The identification of components and drivers of costs and benefits, the assessment of

completeness of estimates based on what components they included, and the reporting in terms of medians and interquartile ranges enabled the Task Force to make informed economic judgment. For the five CVD prevention interventions discussed here, TBC, SMBP with additional patient support, and SMBP within TBC were found to be cost-effective. However, this paper explained why the specific cost-effectiveness estimates should not be used for comparing and ranking such heterogeneous interventions to provide their relative economic values.

An important limitation of Community Guide economic reviews is that they do not involve primary economic modeling. These methods have therefore been developed to get as much useful information as possible out of the available data and analyses in existing literature.

Conclusion

In the past, the paucity of economic evaluation studies restricted the use of systematic economic reviews of public health interventions to derive valid and reliable conclusions regarding the economic merits of these interventions. Although the quantity and quality of economic evaluations of public health interventions are improving over time, this paper underscores the need for systematic economic reviews to adopt appropriate methods and pay careful attention to intervention characteristics, study limitations, and cost and benefit drivers to make informed and useful conclusions about the economic value of these interventions. The Community Guide economic methods discussed here may be helpful to others who are attempting to undertake such reviews to synthesize and communicate the economic evidence on public health interventions.

Acknowledgments

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

References

1. Community Preventive Services task Force. Team-based Care to Improve Blood Pressure Control. Am J Prev Med 2014;47(1):100–2. [PubMed: 24933493]
2. Proia KK, Thota AB, Njie GJ, et al. Team-based Care and Improved Blood Pressure Control: A Community Guide systematic review. Am J Prev Med 2014;47(1):86–99. [PubMed: 24933494]
3. Jacob V, Chattopadhyay SK, Thota AB, et al. Economics of Team-based Care in Controlling Blood Pressure: A Community Guide Systematic Review. Am J Prev Med 2015;49(5):772–83. [PubMed: 26477804]
4. Fielding JE. Recommendation to Reduce Patients' Blood Pressure and Cholesterol Medication Costs. Prev Chronic Dis 2015;12.
5. Njie GJ. Reducing Medication Costs to Prevent Cardiovascular Disease: A Community Guide Systematic Review. Prev Chronic Dis 2015;12.
6. Community Preventive Services Task Force. Clinical Decision Support Systems Recommended to Prevent Cardiovascular Disease. Am J Prev Med 2015;49(5):796–9. [PubMed: 26477806]
7. Njie GJ, Proia KK, Thota AB, et al. Clinical Decision Support Systems and Prevention: A Community Guide Cardiovascular Disease Systematic Review. Am J Prev Med 2015;49(5):784–95. [PubMed: 26477805]
8. Jacob V, Thota AB, Chattopadhyay SK, Proia KK, Hopkins DP. Cost and Economic Benefit of Clinical Decision Support Systems (CDSS) for Cardiovascular Disease Prevention: A Community

Guide Systematic Review. J Am Med Inform Assoc 2017. doi: 10.1093/jamia/ocw16010.1093/jamia/ocw160https://www.ncbi.nlm.nih.gov/pubmed/28049635https://www.ncbi.nlm.nih.gov/pubmed/28049635

9. Jacob V, Chattopadhyay SK, Proia KK, Hopkins DP, Thota AB. Economics of Self-Measured Blood Pressure Monitoring: A Community Guide Systematic Review. Forthcoming in Am J Prev Med. 2017.
10. Glied S, Teutsch SM. How Can Economics Advance Prevention? Am J Prev Med 2016;50(5 Suppl 1):S4. [PubMed: 27102857]
11. Mozaffarian D, Benjamin EJ, Go AS, et al. Executive Summary: Heart Disease and Stroke Statistics—2016 Update A Report from the American Heart Association. Circulation 2016;133(4): 447–54. [PubMed: 26811276]
12. Carande-Kulis VG, Maciosek MV, Briss PA, Teutsch SM, Zaza S, Truman BI, Messonnier ML, Pappaioanou M, Harris JR, Fielding J. Methods for Systematic Reviews of Economic Evaluations for the Guide to Community Preventive Services. Task Force on Community Preventive Services. Am J Prev Med 2000; 1;18(1 Suppl):75–91. [PubMed: 10806980]
13. CPI Inflation Calculator. Bureau of Labor Statistics. U.S. Department of Labor. http://www.bls.gov/data/inflation_calculator.htm. Accessed on November 20, 2016.
14. Hans-Georg Eichler, Kong Sheldon X., Gerth William C., Panagiotis Mavros, Bengt Jönsson. Use of Cost-Effectiveness Analysis in Health-Care Resource Allocation Decision-Making: How Are Cost-Effectiveness Thresholds Expected to Emerge? Value in Health 2004;7(5):518–528. [PubMed: 15367247]
15. McEwan P, Peters JR, Bergenheim K, Currie CJ. Evaluation of the Costs and Outcomes from Changes in Risk Factors in Type 2 Diabetes using the Cardiff Stochastic Simulation Cost-utility Model (DiabForecaster). Curr Med Res Opin 2006;22(1):121–129. [PubMed: 16393438]
16. Mason JM, Freemantle N, Gibson JM, New JP. Specialist Nurse–led Clinics to Improve Control of Hypertension and Hyperlipidemia in Diabetes: Economic Analysis of the SPLINT Trial. Diabetes Care 2005;28(1):40–46. [PubMed: 15616231]

Table 1.

Intervention characteristics

Intervention of interest	Number of Studies in economic review	Target population	Who implements?	Risk Factor Focus	Additional interventions combined with the intervention of interest and percent of studies with that combination*
Team-based care (TBC)	31	Healthcare providers and patients	Healthcare system	High BP	CDSS 10% Disease registry 6% SMBP 13% ROPC or VBID 6% Case management 3%
Reduced out of pocket cost (ROPC)	9	Patients	Health insurance plan	Adherence to treatment for High BP and Dyslipidemia	TBC 22% Disease management 22%
Clinical decision support systems (CDSS)	21	Healthcare providers	Clinics	High BP, Dyslipidemia, Diabetes, Smoking, Physical activity, Nutrition	TBC 24% Provider incentives 9% Provider audit and feedback 5% Patient phone reminders or report to patient 28% Quality improvement 38%
Self-measured blood pressure monitoring (SMBP)	22 grouped into three categories* •SMBP alone 8 •SMBP with spport 8 •SMBP within team-based care 8	Patients and healthcare providers	Patient or Health insurance plan	High BP	Patient support 36% TBC 36%
Community health workers (CHW)	4	Healthcare providers and patients	Healthcare system	High BP, Dyslipidemia, Smoking, Physical activity, Nutrition	TBC 100%

*Studies are not mutually exclusive

BP, blood pressure; SMBP, self-measured blood pressure; VBID – value-based insurance design

Table 2:

Intervention cost: components and estimates

Intervention	Capital	Materials	Labor	Labor or Capital Intensive	Intervention Cost: Median (IQI) in 2015$
Team-based Care	Rent		Provider time in team-based activities[a]	Labor intensive	$309 ($166 to $728) per patient per year
Reduced out of pocket cost		Cost of ROPC for covered products or services[*a]		NA	$172 ($70 to $530) per patient per year
Clinical decision support systems	Software; System development and implementation[a]		Operating and maintenance cost; Staff training	Capital intensive	$56 ($23 to $73) per patient per year[**]
SMBP Monitoring SMBP alone SMBP with support SMBP with team-based care	Home BP device[a] Home BP device; Systems for patient support[a] Home BP device		Patient training; PCP reviews of BP reports Patient training; PCP reviews of BP reports Patient training; PCP reviews of BP reports: Provider time in team-based care[a]	Capital intensive Capital intensive Labor intensive	$60 ($55 to $74) per patient $174 ($63 to $362) per patient $733 ($279 to $947) per patient per year
Community health workers			CHW time; CHW training; CHW Supervisor time[a]	Labor intensive	$157 ($22 to $395) per patient per year[***]

BP, blood pressure; CHW, community health worker; PCP, primary care provider; ROPC, reduced out of pocket cost; NA, not applicable; IQI, interquartile interval

[a] Cost drivers

[*] All studies were for ROPC for medications

[**] Estimated overall sizes of CDSS implementations with 5-year life of capital

[***] Two of the four estimates were poor, with one reporting only a nominal stipend for the CHW.

Table 3.

Changes in healthcare cost: major components and estimates

Intervention	Time horizon in months Median (IQI)	# Studies with any healthcare cost	# Studies modeling long-term healthcare costs	Percent of studies reporting healthcare cost for all causes	Major components and percent of studies reporting each component					Change in healthcare cost per patient per year Median (IQI) (in 2015$)
					Outpatient	Medication	Inpatient	ER	Labs	
Team-based care	12 (6, 24)	21	2	29	76	86	52	29	0	$71 (−$255, $346)
Reduced out of pocket cost	24 (12, 24)	7	0	38	100	100	100	71	0	−$127 (−$633, −$18)
Clinical decision support systems	12 (12, 120)	15	4	40	67	53	60	27	27	−$70 (−$463, $5)
SMBP Monitoring SMBP alone SMBP with support SMBP within team-based care	12 (12, 60) 9 (6, 39) 18 (15, 42)	8 6 5	2 2 0	13 0 60	100 100 100	71 83 40	43 67 100	0 33 60	29 17 40	−$148 (−$316, −$89) −$3 (−$58, $62) $369 ($57, $549)
Community health workers	12 (12-24)	4	0	75	50	75	75	50	25	−$262 (−$2,886, $562)

IQI, interquartile interval; SMBP, self-measured blood pressure; ER, emergency room visit

Am J Prev Med. Author manuscript; available in PMC 2018 October 05.

Table 4.

Community Preventive Services Task Force economic findings for the five interventions

Intervention	Economic Evidence	Task Force Economic Finding
Team-based Care	Limited cost-benefit estimates; 15 cost-effectiveness estimates; Median (IQI) Cost per QALY saved based on two conversions: $10,561 ($6,295 to $24,375 and $15,209 ($9,064 to $35,100)	Intervention is cost-effective
Reduced out of pocket cost	3 cost-saving estimates on value-based insurance designs; No cost per QALY saved estimates	No economic finding – limited/mixed evidence
Clinical decision support systems	Limited cost-benefit/cost-effectiveness information	No economic finding – inconsistent/ incomplete assessment of cost and benefit
SMBP Monitoring SMBP alone	No cost-benefit estimates Cost per QALY saved from one study $100,000 and $144,000 2 studies cost-saving 2 studies ineffective	No economic finding – mixed evidence
SMBP with patient support	No cost-benefit estimates Median (IQI) Cost per QALY saved based on two conversions: $2,800 ($526 to $5,100) and $4,000 ($757 to $7,400)	Intervention is cost-effective
SMBP within team-based care	No cost-benefit estimates Median (IQI) Cost per QALY saved based on two conversions: $7,500 ($4,600 to $79,200) and $10,800 ($6,600 to $114,000)	Intervention is cost-effective
Community health workers	Limited evidence on cost-benefit estimates No cost per QALY saved estimates	No economic finding – limited evidence