Approach to economic evaluation in primary care

Review of a useful tool for primary care reform

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Abstract

Objective To present an overview of the methods of economic evaluation in health care, using examples of studies applicable to primary care.

Sources of information The main concepts discussed in this article were derived from expert opinion and substantiated with well respected textbooks and comprehensive Canadian guidelines. Examples of cost-effectiveness estimates were taken from the published literature.

Main message We describe the basic principles of economic evaluation and provide an introduction to its interpretation, using examples of studies applicable to primary care.

Conclusion A basic understanding of health economics will allow primary care practitioners to begin to incorporate economic data, including that from economic evaluations when they are available, into resource planning for their practices.

Approche de l'évaluation économique dans les soins primaires

Examen d'un outil utile pour la réforme des soins primaires

Résumé

Objectif Présenter un aperçu des méthodes d'évaluation économique des soins de santé à l'aide d'exemples d'études applicables aux soins primaires.

Sources des données Les principaux concepts discutés dans cet article proviennent de l'opinion d'experts et sont corroborés dans des manuels respectés et des lignes directrices canadiennes exhaustives. Les exemples d'estimations de la rentabilité sont tirés de la littérature publiée.

Message principal Nous décrivons les principes fondamentaux de l'évaluation économique et nous expliquons les rudiments de son interprétation, à l'aide d'études applicables aux soins primaires.

Conclusion Une compréhension de base de l'économie de la santé permettra aux médecins en soins primaires de commencer à intégrer des données économiques, y compris celles des évaluations économiques quand elles sont accessibles, dans la planification des ressources pour leurs pratiques.

Primary care physicians have traditionally played an indirect but important role in the allocation of health care resources. Every decision to order a diagnostic test, prescribe a therapy, or request a consultation from a specialist, each with the goal of improving or maintaining patient health, inevitably reduces the pool of available health care funds. However, while physicians specialize in understanding the safety and effectiveness of tests and treatments, most have less experience

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EDITOR'S KEY POINTS

- Primary care physicians have traditionally played an indirect role in the allocation of health care resources, while government policy makers and health care payors have maintained direct responsibility for deciding how health care funds are spent.
- Given the emergence of new primary care payment models that have accompanied health care reform, the balance of responsibility for resource allocation is beginning to shift toward primary care practices. It is therefore becoming important for primary care physicians to develop a systematic approach to health care priority setting, including assessing the costs and benefits of interventions. Economic evaluation provides a framework within which these costs and benefits can be assessed objectively.

POINTS DE REPÈRE DU RÉDACTEUR

- Les médecins en soins primaires ont traditionnellement exercé un rôle indirect dans l'attribution des ressources en santé, tandis que les décideurs gouvernementaux et les payeurs des soins de santé ont conservé la responsabilité directe de décider comment les fonds sont dépensés dans les soins de santé.
- Compte tenu de l'émergence des nouveaux modèles de rémunération dans les soins primaires qui ont accompagné la réforme de la santé, la balance de la responsabilité en matière d'attribution des ressources commence à pencher du côté des établissements de soins primaires. Il est donc important que les médecins en soins primaires élaborent une approche systématique de l'établissement des priorités en matière de soins de santé, y compris l'évaluation des coûts et avantages des interventions. L'évaluation économique offre un cadre selon lequel ces coûts et avantages peuvent être mesurés objectivement.

assessing the costs and economic implications. This task has traditionally fallen to government policy makers and health care payors.

Given the changes that have accompanied many of the primary care reform efforts across the globe, consideration of health care costs will likely become more prominent within the practice of primary care. For example, in an effort to improve access and encourage the delivery of comprehensive primary care, several provinces across Canada have introduced alternative payment models for family physicians, which often incorporate additional funds outside the usual physician remuneration that can be used for clinical care. As a result, some primary care physicians are playing a more direct role in the allocation of primary care services.[1] In some cases, provinces have or are planning to introduce funding to support programs that increase access to care, support interdisciplinary team-based care, and increase the use of patient care networks and information technology. Some examples are the Ontario family health teams, the Alberta primary care networks (PCNs), and the Quebec groupes de médecine familiale.[1] In the United States, the Centers for Medicare & Medicaid Services have introduced plans to support accountable care organizations, which are affiliations of providers who, as a group, agree to be accountable for quality of care and reductions in spending.[2,3] The United Kingdom has gone a step further by giving large physician groups direct responsibility for commissioning care and managing publicly funded health care budgets through primary care trusts and the newly proposed GP consortia.[4,5]

Figure 1 depicts a hierarchical model of primary care physician payment with increasing levels of responsibility for resource allocation. As the model of primary care payment changes, practices are gaining additional responsibility for deciding how resources should be allocated across groups of patients. It is therefore becoming increasingly important for primary care physicians to develop a systematic approach to health care priority setting, including assessing the costs and benefits of interventions. If Medicare is to be sustainable, some consideration of costs seems inevitable.

Depending on the specific financial reimbursement arrangement, primary care physicians might have more or less direct responsibility for resource allocation. For example, in Canada, physicians do not have a financial stake in the reimbursement of laboratory tests, the cost being borne by the health care system (although it should be acknowledged that the use of these resources will indirectly affect the amount of funds available for other health care programs or interventions). On the other hand, physician groups who have the responsibility of overseeing the allocation of health care funds, as in the examples noted above, are faced with deciding which health care programs to implement for their patient populations, often within fixed budgets. For example, a physician group might wish to provide after-hours care, chronic disease case management, and lifestyle modification programs, but the members find that they do not have enough funds to cover all 3. Alternatively, they might have a specific objective and type of program in mind, such as diabetes education, but are faced with several methods of implementation, each of which varies in resource intensity. In either case, they will have to carefully weigh the pros and cons of each, as well as the costs, in order to determine how best to allocate scarce resources.

While political and personal considerations will always enter into the decision-making process around health care resource allocation, economic theory can provide a framework within which decision makers, including primary care physicians, can prioritize spending. In this paper we present an overview of the methods of economic evaluation in health care, using examples of studies applicable to primary care. To better illustrate the relevance of economic evaluation to primary care practice, we use Alberta's PCNs as a case study.

Sources of information

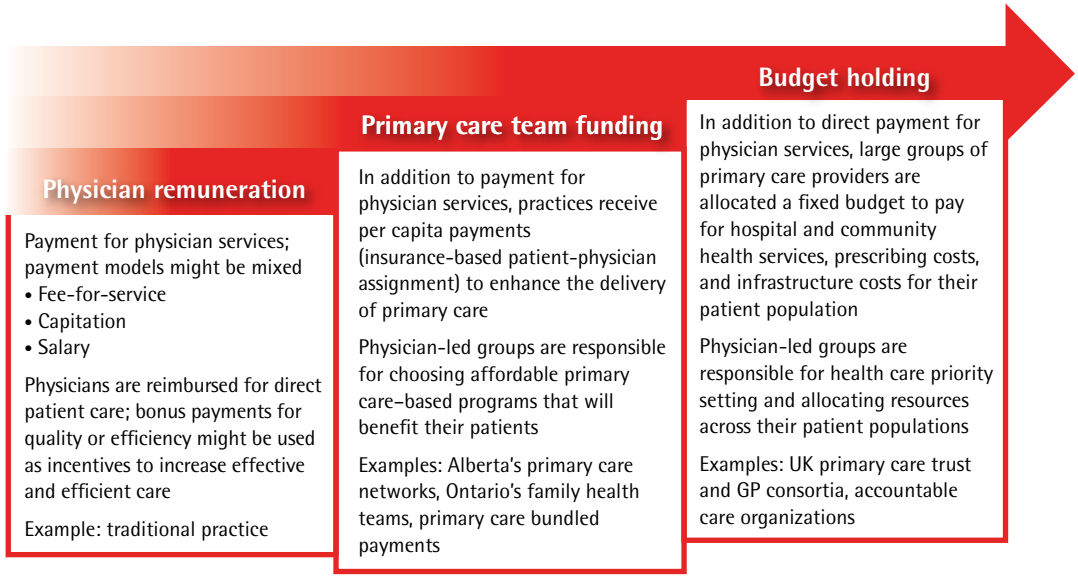
The main concepts discussed in this article were derived from expert opinion and substantiated with well respected textbooks and comprehensive Canadian guidelines. Examples of cost-effectiveness estimates were taken from the published literature.

Case study: PCNs

In Alberta, primary care reform has taken the form of PCNs, an example of a primary care model in which practices hold a budget to supplement care for their patients outside the usual fee-for-service model (**Figure 1**).[6] Approximately 80% of eligible family physicians in Alberta currently participate in PCNs.[6] Additional funding of $50 per enrolled patient per year (increased to $62 as of April 2012) is provided to PCNs to support activities that fall outside the typical physician-based fee-for-service model, but which are in accordance with specified objectives: improving access to primary care, increasing the emphasis on health promotion and disease management, and improving coordination of care.[6] Consequently, a hypothetical group of 20 family doctors, each caring for an average of 1200 rostered patients, will be allocated $1.2 million in additional funds annually.

Although these additional funds are substantial, they are not enough to support every foreseeable initiative, and budget overruns are not covered by provincial health ministries. Therefore, PCNs are faced with deciding how to efficiently allocate these additional resources to best meet the needs of their patients, considering the priorities laid out by the province. Among other factors, consideration must be given to the populations

Figure 1. Hierarchical model of primary care physician payment with increasing levels of responsibility for resource allocation



and disease areas to be targeted. Once a local set of priorities has been identified, the next step is to decide which specific initiatives will produce the best results within the budget. Broadly speaking, then, one of the important objectives for a PCN is to *maximize* the health gains for its patient population using a fixed sum of money. This can be accomplished through a systematic comparison of the relative costs and health effects of candidate programs—*economic evaluation*.

Main message

Basic concepts of economic evaluation. *Economic evaluation* can be defined as the comparative analysis of alternative courses of action in terms of both their costs and their consequences.[7] For health care programs, costs are the monetary inputs required to fund the program, and consequences are the health effects, both positive and negative, that occur as a result of the program. Two important concepts are fundamental to economic evaluation: *opportunity cost* and *efficiency*. Opportunity cost is based on the principles of scarcity and choice. Given scarcity (ie, not enough resources exist to meet all the desires of a society), societies must make choices, and, in the case of health care, these choices include which health care programs to implement and which to forego. The opportunity costs of health care programs are the benefits associated with those programs that are not chosen.

In health care, efficiency is a measure of how much health benefit is produced for a given cost. In health economics, 2 types of efficiency are often considered: *technical* and *allocative* efficiency. Technical efficiency measures the extent to which health outcomes in a specific group of patients are maximized with a given set of resources. On the other hand, allocative efficiency attempts to maximize health outcomes across different patient populations by choosing between programs that use a variety of inputs. Knowing whether you are asking a question of technical or allocative efficiency aids in selection of the correct economic evaluation.

Types of economic evaluation. Economic evaluations can be classified into 3 broad categories: *cost-effectiveness studies, cost-utility studies,* and *cost-benefit studies.* All 3 consider costs in a similar fashion, but each differs in how it measures health benefits. The 3 types of economic evaluation are outlined briefly below.

Cost-effectiveness analysis: In cost-effectiveness analysis, which can be used to address technical efficiency, health outcomes are measured in naturally occurring units such as units of blood pressure reduction, life-years gained, or deaths avoided. The specific outcome chosen will depend on the purpose of the intervention, and comparisons can only be made among interventions that can be measured in terms of the same health outcomes for similar populations of patients.

Costs and health effects are summarized in a *cost-effectiveness ratio*, a measure of the cost per unit of health effect. For example, Sekhar et al conducted a cost-effectiveness analysis of screening healthy children to detect cases of chronic kidney disease using urine dipsticks. Using observational cohort data, they determined the cost per case of chronic kidney disease detected, noting

that 800 children would have to be screened at a cost of $2779.50 (US) for 1 case to be detected.[8]

Cost-minimization analysis is a special case of cost-effectiveness analysis in which the health outcomes of 1 or more interventions are assumed to be the same, reducing the problem to one of determining which intervention is least costly. Cost-minimization analyses should be viewed with caution, however, as it is rare that any 2 technologies will have the exact same clinical effect.[7]

Cost-utility analysis: When the goal is to maximize health outcomes across a population, an example of allocative efficiency, comparisons might need to be made between programs that target different patient groups. For example, if resources were limited, it might be necessary to compare a program for monitoring international normalized ratio for patients with atrial fibrillation with a program for diabetes case management. The goal of the first program is a reduction in the overall number of strokes, while that of the second is a reduction in diabetes complications. While the health outcomes of interest vary across these 2 programs, they can each be translated into life expectancy and quality of life, and their costs can be expressed in monetary units, allowing the programs to be compared on a common scale.

Cost-utility analysis enables comparison across different health outcomes by measuring health effects with a utility-based scale, the most commonly used being the *quality-adjusted life-year* (QALY). Quality-adjusted life-years incorporate the preferences that are placed on health outcomes by weighting the length of life by its quality. Utility scores range from 0, for a state equivalent to death, to 1, for a state equivalent to perfect health. Translating health outcomes into QALYs serves 2 important functions. First, it provides a common scale on

Table 1. Common elements of economic evaluations

ELEMENT	DESCRIPTION
Target population	The group of patients to whom the results apply; can be broken down into subgroups to address variability in the target audience
Comparators	The set of interventions under study. All medically acceptable comparators that fall within the technological capacity of the target setting should be included, and if they are not included, reasons for their omission should be clearly stated. It is appropriate to include a "do nothing" comparator if some patients in routine practice are not receiving specific care for a problem
Perspective	The viewpoint from which the costs are measured, commonly that of the publicly funded health care system or society*
Time horizon	Time during which costs and benefits are measured, typically a patient's lifetime
Outcomes	Clinical outcomes of interest: QALYs, deaths, or other end points (eg, stroke, myocardial infarction). In cost-effectiveness analysis, final outcomes are preferred, such as death or hard clinical end points like myocardial infarction, as opposed to intermediate outcomes like blood pressure reduction or cholesterol reduction. In the case of QALYs, the valuation technique and the source of utility weights should be described
Data inputs	Effectiveness data: the expected relative difference in outcomes of 1 intervention vs 1 or more others; RCTs are the preferred source, and if more than 1 RCT has been done, meta-analysis can be used. Adverse events that result from a treatment should be included when they are serious or resource-intensive Supplementary clinical data: used to model the natural history of illness, often derived from observational cohort studies or administrative data Cost data: direct medical costs, including the cost of the treatment or intervention, costs associated with the intervention (eg, laboratory monitoring or adverse events related to the intervention), and future health care costs. If the societal perspective is taken, indirect costs and their valuation methods should be included. Sources include literature, fee schedules, and administrative data
Discounting	Future health effects and costs are valued in present terms, accounting for the differential timing of when costs are incurred and medical benefits are accrued. Rates of 3%-6% are typical, with Canadian guidelines recommending a rate of 5%[10]
Results	Disaggregated results detail the total costs and consequences of each comparator. The summary statistic is the ICER; ICERs represent the cost per unit of effect or QALY gained over the next best alternative
Sensitivity analysis	Used to address parameter uncertainty in a model or to identify gaps in evidence. Calculations are repeated substituting a range of plausible values for 1 or more input parameters. If the results remain consistent, then the analysis is said to be *robust*

ICER—incremental cost-effectiveness ratio or cost-utility ratio, QALY—quality-adjusted life-year, RCT—randomized controlled trial.
*When the perspective of the publicly funded health care system is used, as recommended in Canadian guidelines,[10] only direct medical costs, such as physician fees and hospital charges, and costs borne by patients are included. Studies undertaken from the societal perspective will include indirect medical costs such as lost productivity due to illness; however, for many interventions, indirect costs might not differ between comparators.
Data from Drummond et al[7] and Hunink et al.[11]

which to measure disparate health outcomes. Second, it allows the evaluator to take into account the values that individuals and society place on health outcomes.

Results of cost-utility analyses are reported as the cost per QALY gained. For example, Cameron et al studied the cost-effectiveness of self-monitoring of blood glucose in patients with type 2 diabetes managed without insulin, and found that, compared with no self-monitoring, self-monitoring was associated with a cost per QALY gained of $113 643.[9]

Cost-benefit analysis: Like cost-utility analysis, cost-benefit analysis also aims to incorporate the value that society places on different health outcomes; however, cost-benefit analysis values health outcomes in monetary units. If the monetary value placed on the health benefits of a program is higher than its cost, the program is said to be cost-effective. Cost-benefit analysis can be thought of as somewhat broader in scope, as it can be used to estimate the effect of a program on both health and nonhealth benefits (eg, convenience and other factors). However, given the challenges associated with the methodology currently used to elicit monetary values for health outcomes, studies using this strategy are less commonly found in the literature. Further details are available elsewhere.[7]

Table 2. Economic evaluation of blood glucose self-monitoring in patients with type 2 diabetes not using insulin

ELEMENT	DESCRIPTION
Overview	In the study by Cameron et al, the authors sought to clarify the costs and benefits of blood glucose self-monitoring in patients with type 2 diabetes who were not using insulin.[9] A meta-analysis of RCTs comparing self-monitoring with no self-monitoring showed that HbA_{1c} was 0.25% (95% CI 0.36% to 0.15%) lower in patients who were randomized to blood glucose self-monitoring.[12] Although the difference was statistically significant, it was uncertain whether this would translate into clinically significant health benefits. Moreover, the cost associated with blood glucose test strips was estimated to be more than $370 million in Canada in 2006, more than 50% of which was for patients not taking insulin. In order to better inform decisions regarding prescribing and reimbursement of blood glucose test strips, the authors performed a cost-utility analysis of self-monitoring of blood glucose compared with no self-monitoring for patients with type 2 diabetes who were not using insulin[9]
Target population	Patients with type 2 diabetes who did not use insulin. Baseline characteristics of the population were similar to those of patients enrolled in clinical trials, which excluded patients with impending diabetes-related complications or a history of serious disease. The authors performed subgroup analyses for patients receiving only lifestyle interventions and for patients receiving pharmacotherapy with or without lifestyle interventions
Comparators	Self-monitoring of blood glucose (in the RCTs this was done an average of 1.29 times per day) compared with a strategy of no self-monitoring
Perspective	The publicly funded health care system
Time horizon	Lifetime of patients
Outcomes	The primary outcome was QALYs. The authors began with an estimate of the effect of self-monitoring on HbA_{1c} and, based on this effect, they used modeling techniques to derive the difference in both diabetes-related end points and life expectancy that would be expected given the achieved difference in HbA_{1c}. The life-years of hypothetical patients were then weighted by the utility associated with the various health states
Data inputs	Effectiveness data: the clinical effectiveness of self-monitoring of blood glucose compared with no self-monitoring in reducing HbA_{1c} was taken from a systematic review and meta-analysis of 7 RCTs Supplementary clinical data: the effect that the difference in HbA_{1c} had on the occurrence of diabetes-related complications was determined using a mathematical model based on observational clinical data from the UKPDS trial Cost data: the cost of the intervention was determined using data from a Canadian provincial drug program, while resource use and costs for the final health outcomes were determined using administrative data
Discounting	Health effects and costs were discounted at an annual rate of 5%[10]
Results	Cameron et al detailed the projected effect of glucose self-monitoring on 7 important diabetes-related complications and provided a breakdown of the costs and benefits of both strategies before combining them into a cost-utility ratio. They found that, compared with no self-monitoring, self-monitoring was associated with a cost per QALY gained of $113 643. In the patient subgroup receiving only lifestyle interventions, the cost-utility ratio was less favourable at $292 144 per QALY
Sensitivity analysis	The cost-effectiveness of self-monitoring for blood glucose was sensitive to the price of test strips and the frequency of monitoring but remained stable when other assumptions were varied
Conclusion	Compared with other health care interventions, self-monitoring of blood glucose does not appear to be a cost-effective use of health care resources in patients with type 2 diabetes not using insulin

HbA_{1c}—glycosylated hemoglobin A_{1c}, QALY—quality-adjusted life-year, RCT—randomized controlled trial, UKPDS—United Kingdom Prospective Diabetes Study.

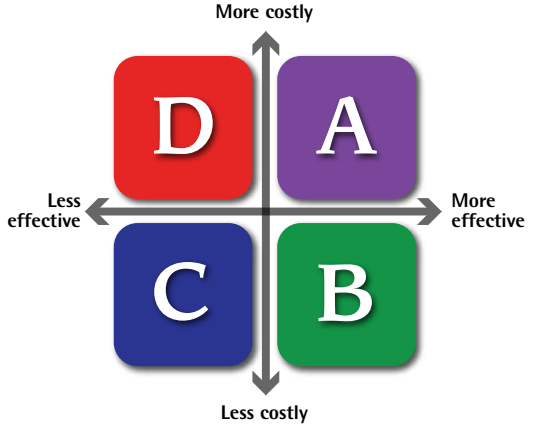
Common elements in all economic evaluations. There are several basic elements common to cost-effectiveness and cost-utility studies that the critical reader should consider when interpreting an economic analysis. These details allow the reader to determine whether the analysis applies to his or her patient population and scope of practice. Key elements of economic evaluations are detailed in **Table 1**.[7,10,11] **Table 2** illustrates their use within a recent economic evaluation of blood glucose self-monitoring for patients with type 2 diabetes not using insulin.[9,10,12]

Economic evaluations can be conducted alongside clinical trials or using decision analysis. Often, the 2 approaches are used together. When an analysis is done alongside a clinical trial, the costs and consequences incurred and measured during the trial are used as the data inputs for the economic study. When decision analysis is used, a representative model of the events of interest is constructed, and data from multiple sources, including extrapolation from clinical trials, are used to derive model inputs. Decision analysis is particularly useful for therapies for chronic conditions, in which the applicable time horizon extends beyond the duration of clinical trials, often to the lifetime of the patient.

Interpreting the results of economic evaluations. There are 4 broad categories that an intervention, relative to its comparator, can fall into: A) more costly and more effective; B) less costly and more effective; C) less costly and less effective; and D) more costly and less effective (**Figure 2**).

Clearly, interventions that fall into category B should be implemented, as they will lead to both improvements in health and real cost savings. For example, Khazeni et al estimated that vaccinating 40% of the population against pandemic influenza (H1N1) in October or November of 2009 would not only save lives but would also save nearly $400 million (US).[13] For the exact opposite reason, interventions in category D should not be implemented.

Figure 2. Categories for the relative value of interventions



When faced with interventions that fall into categories A and C, the ultimate question for decision makers is whether therapies associated with additional costs are an efficient use of health care resources. Most interventions studied fall into category A; they lead to gains in health but require additional resources. An intervention that falls into category C leads one to ask if sacrifices in health are worth the savings that would be garnered and potentially reinvested in other health-producing activities.

With respect to interventions in category A, in cost-utility analysis, the incremental cost-utility ratio, commonly referred to as the *incremental cost-effectiveness ratio* (ICER), is the amount of additional resources that would have to be invested in order to produce a gain of 1 QALY. Interventions that can purchase QALYs at a lower rate are deemed more attractive. The ICERs for commonly used interventions are shown in **Table 3**.[9,14-18]

Using ICERs for commonly used interventions as a benchmark, some guidelines suggest that all interventions with a cost-utility ratio below a particular threshold should be deemed *cost-effective* and appropriate for adoption. For instance, Laupacis et al suggest that, in Canada, a

Table 3. Cost per QALY for selected interventions

INTERVENTION	ICER: COST PER QALY (2009)*
Tight blood pressure control to a target of < 150/85 mm Hg in type 2 diabetes compared with less tight control (based on UKPDS trial)	Cost saving (US hypothetical population)[14] to $685 (UK trial population)[15]
Secondary prevention of CAD:	
• ASA alone for all eligible patients compared with usual care	$13 400[16]
• ASA for all eligible patients and clopidogrel for patients ineligible for ASA compared with ASA alone	$38 000[16]
• Clopidogrel alone compared with ASA and clopidogrel only for patients ineligible for ASA	$305 000[16]
Prophylactic internal cardiac defibrillators compared with control therapy—based on 8 different clinical trial populations	$36 700 to $75 500†[17]
Population-based screening for chronic kidney disease compared with no screening	$104 900[18]
Self-monitoring blood glucose levels in stable patients with type 2 diabetes not using insulin compared with no self-monitoring	$113 643[9]

ASA—acetylsalicylic acid, CAD—coronary artery disease, ICER—incremental cost-effectiveness ratio, QALY—quality-adjusted life-year, UKPDS—United Kingdom Prospective Diabetes Study.
*Values were converted to Canadian dollars and adjusted for inflation.
†Depending on target population.

cost-utility ratio less than $20 000 per QALY gained should provide strong evidence for adoption and appropriate use, a ratio between $20 000 and $100 000 per QALY gained provides moderate evidence for adoption and appropriate use, and a ratio greater than $100 000 per QALY gained provides only weak evidence for adoption.[19] The UK National Institute for Health and Care Excellence program currently uses a threshold of £30 000 per QALY.[20]

In the study by Cameron et al[9] described in **Table 2**,[9,1012] the cost-utility ratio for self-monitoring of blood glucose was found to be $113 643 per QALY, a value that varied little across the subgroups. Based on this value and commonly used thresholds of either $50 000 per QALY or $100 000 per QALY, the authors stated that self-monitoring for blood glucose in stable patients with type 2 diabetes not using insulin was not likely to be an efficient use of health care resources.[9]

Although the use of cost-effectiveness thresholds provides a relatively clean approach, it does not fully address the issue of opportunity cost. Critics have suggested that such an approach could lead to escalating expenditures without regard to where the additional health care resources would come from.[21] Unless funds are diverted from other programs, the continual addition of interventions with positive ICERs, even if they fall below a given threshold, will inevitably lead to higher total health care expenditures. Because health care budgets are not limitless, the implementation of some interventions will incur an opportunity cost. Therefore, decision makers must look past the individual cost-utility ratio and assess the costs and benefits of each program relative to others.

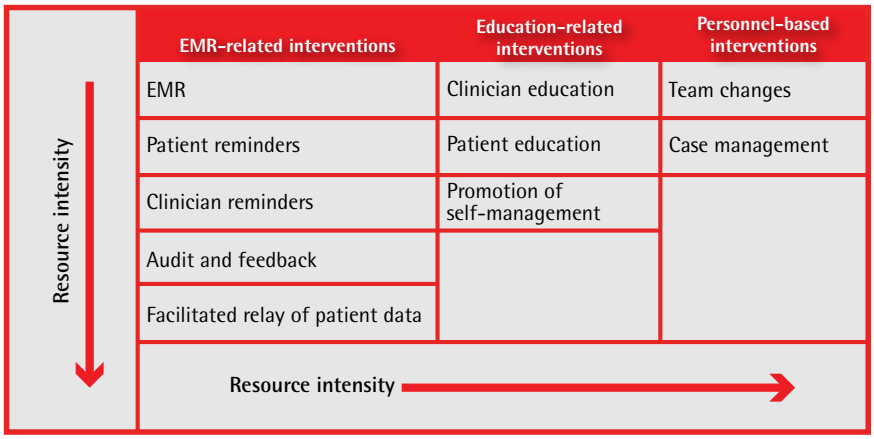
Other important inputs into resource allocation decisions. Although the cost-effectiveness of interventions is an important piece of information to consider, cost-utility analyses do not solve priority-setting problems and other factors must always be considered when making resource allocation decisions. For instance, treatments of rare or difficult-to-treat diseases or care of vulnerable populations might not meet arbitrary cost-effectiveness criteria but might still be desirable for reasons of inclusivity and equity. Other factors to consider include burden of disease, availability of alternative treatments, and uncertainty in the available evidence. We are unable to adequately address each of these in detail, and readers who are interested in learning more

Table 4. Types of CDM strategies for diabetes

STRATEGY*	DEFINITION	EXAMPLE
Electronic medical record	Electronic system for tracking patient appointments or for tracking specific patients with diabetes	NA
Patient reminders	Telephone calls or postcards to patients to remind them of upcoming appointments or other aspects of diabetes management	Reminders of annual ophthalmology appointments
Clinician reminders	Prompts to the health care provider to remind them of patient-specific diabetes management	Flag for patients who have not had recent HbA_{1c} measurements recorded
Audit and feedback	A summary of a physician's clinical performance is sent to him or her for self-evaluation	Each month the physician receives the average of the most recent HbA_{1c} values for each of his or her patients with diabetes
Facilitated relay of patient data	Clinical information from patients that is transmitted to the physician via some other route than traditional medical interactions	Patient home glucometer readings are uploaded and e-mailed to case manager on a weekly basis
Clinician education	Increasing physicians' awareness of current practice guidelines and evidence-based recommendations	Conferences, workshops, educational outreach visits from PCN staff
Patient education	Increasing patient understanding of disease pathophysiology and effective methods of secondary prevention	One-on-one counseling with nursing staff, group diabetes classes
Promotion of self-management	Providing resources for patients to succeed in self-management	Glucometers, meal-tracking charts
Team changes	Addition of 1 or more members to the health care team	Adding CDM nurses, dietitians, or pharmacists to the patient care team
Case management	A team member other than the primary care physician assumes primary responsibility for coordinating care of patients with diabetes	Registered nurses track home glucose readings, send patients for bloodwork, and ensure that patients are seeing specialists appropriately

CDM—chronic disease management, HbA_{1c}—glycosylated hemoglobin A_{1c}, NA—not applicable, PCN—primary care network.
*Strategy categories are taken from Shojania et al.[23]
Reprinted from Campbell et al.[22]

Figure 3. Resource intensities of various CDM strategies



CDM—chronic disease management, EMR—electronic medical record.
Reproduced from Campbell et al.[22]

Table 5. Example of inputs for economic evaluation of diabetes CDM programs

INPUTS	DESCRIPTION
Clinical inputs	
Expected effects on surrogate outcomes that predict improvement in clinical outcomes	
• Change in HbA_{1c}, BP, or medication adherence, each of which might be expected to lead to different rates of complications, mortality, and quality of life	Dependent on how the specific program was evaluated
Expected effect on mortality and morbidity	
• Change in complication rates owing to program effect	Might require extrapolation based on data from clinical trials or models (eg, UKPDS model)
Expected effect on quality of life	
• Quality of life, measured as patient "utility" (a measure of overall quality of life for each of the health states in question)	Obtained from published literature (for cost-utility analysis)
Cost inputs	
Costs of program implementation	
• Start-up costs	Equipment, personnel training, team meetings, etc
• Cost of materials	Patient handouts, etc
• Nursing wages	Hours, rates, benefits, etc
• Information technology	EMR, software updates, etc
• Overhead costs	Space rental, administrative staff, etc
Future medical costs	
• Cost of medications	Might be increased by improved adherence or decreased by improvement in lifestyle changes
• Cost associated with implementing the new program	Additional monitoring costs, etc
• Cost of physician visits	Might be increased by improved adherence or decreased by improved health
• Cost of future diabetes complications	Frequency or magnitude of costs might be decreased depending on effectiveness of program

BP—blood pressure, CDM—chronic disease management, EMR—electronic medical record, HbA_{1c}—glycosylated hemoglobin A_{1c}, UKPDS—United Kingdom Prospective Diabetes Study.

about how these factors can affect the use of economic evaluations in practice are referred elsewhere.[7]

Primary care network case study

Returning to our case study, care of patients with diabetes was noted to be a priority for nearly all PCNs in Alberta. Consequently, these PCNs each committed a portion of their patient care budget to improving care for patients with diabetes, typically through establishment of multidisciplinary chronic disease management (CDM) programs.[22] However, CDM programs for patients with diabetes, which can be categorized by the method used (**Table 4**),[22,23] vary by relative effectiveness[23] and by resource intensity (**Figure 3**).[22] This is an ideal situation for the use of economic evaluation.

Future implementation of CDM programs, with the view to optimizing the mix of CDM programs for each PCN, could be facilitated through a systematic review of the clinical data and the use of economic evaluation. Among patient groups for whom several different CDM programs are possible, economic evaluation could be used to determine the expected costs and benefits for each of the candidate programs. Examples of clinical and cost inputs that might be relevant for such an economic evaluation are listed in **Table 5**. This list is not exhaustive and inputs will vary depending on the types of CDMs being compared, the type of economic evaluation (ie, cost-effectiveness vs cost-utility), and the data available. The results of an economic evaluation could then be used to aid in the selection of 1 or more CDM programs that fit the budget and style of a practice, while maximizing health benefits.

The selection of a CDM program is but 1 example of how economic evaluation can be applied to the delivery of primary care. As the responsibility for allocating resources grows, the principles of economic analysis will become increasingly important.

Conclusion

Taking into account the stresses on Canadian Medicare, including the opposing forces of a constrained health care budget and the steady advances in health care technology, the importance of incorporating economic information into health care decision making is evident. Moreover, in view of the changes that are occurring in primary care across the globe, economic evaluations are likely to become more relevant for policy makers and primary care practitioners alike. We have described the basic principles of economic evaluation and provided an introduction to its interpretation. Armed with a basic understanding of health economics, primary care practitioners can begin to incorporate economic data, including that from economic evaluations when they are available, into the care plans of their individual patients and, for those managing budgets, their practices on the whole.

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Contributors

Dr McBrien performed the background research and wrote the first and revised drafts of the manuscript. **Dr Manns** provided expert knowledge, content direction, and editorial support.

Competing interests

None declared

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