

Prioritizing Clinical Preventive Services: A Review and Framework with Implications for Community Preventive Services

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Abstract

Setting priorities on the basis of factors such as health impact and economic value is the key first step to ensure that the most important services receive the most attention. Few prioritization efforts have been published that produce either rankings or information that can guide decision making. We propose a framework to help decision makers and clinicians balance short-term demands against long-term objectives. This framework provides guidance for decisions about scope, prioritization criteria, evidence review methods, evaluation of criteria fit, and presentation of results. The framework is the result of our experience setting priorities among clinical preventive services. It has not been tested in prioritizing community interventions and other health care services but should provide a useful starting point for designing priority-setting efforts in those areas.

INTRODUCTION

Clinical preventive services differ substantially in the strength of evidence supporting their use, the extent to which they improve health, current delivery rates, and their cost and economic value to various stakeholders (18). Ideally, their utilization should reflect these differences along with individual patients' preferences and values. However, current delivery rates often do not seem to reflect that ideal. For example, in 2005 more than 70% of smokers and an even higher proportion of problem drinkers reported no clinician offer of assistance for these problems in the past year, and more than half of adults were not up-to-date with colorectal cancer screening, even though these are among the most cost-effective services. Racial disparities for many high-value preventive services have also persisted for years (2, 27).

Of course, clinical preventive service rates already reflect some kinds of priority; They just do not correspond well to evidence. Daily decisions about which services to deliver in the limited time available in care settings are often driven by patient demands, recent news stories, and various short-term needs. These decisions are further influenced by factors such as clinician interest, the adequacy of reimbursement, medical education, time pressures, and the nature and capacity of practice systems. A deliberate priority-setting process can help balance immediate realities against medium- to long-term objectives.

Rational prioritization among preventive services is challenging. Choices must be made about which criteria will be used to set priorities, how these criteria will be applied consistently across services, how thoroughly the evidence base will be reviewed, how many additional analyses will be conducted to assess the services' value, how multiple criteria will be combined into a single priority list, and in which form the results will be presented to decision makers. Ideally the choices made will result in a product that is valid, simple, and credible.

For this review, we distinguish between priority setting and insurance coverage decisions.

Priority setting provides information about each intervention's relative value so that decision makers can identify and promote high-value interventions. Structured processes and analyses to aid coverage decisions that do not report the relative value of services do not serve this purpose. Others have reviewed efforts to aid insurance coverage decisions in national health systems (14, 15, 21, 32). This paper provides a focused review of efforts to produce estimates of the relative value of interventions, particularly those that have addressed a variety of diseases, risk factors, and behaviors. Because there are few published examples of completed priority-setting efforts, this paper provides a tested framework for priority setting in health care in hopes of assisting others in designing their own priority-setting effort. To illustrate the application of each piece of the framework, examples are drawn from the existing literature on priority setting.

This guide focuses on clinical preventive services, with some examples of how the concepts may apply to community interventions for those services. The framework is also likely to be useful for setting priorities among disease management and clinical treatment services. We treat priority setting as a tool for medium- to long-term planning. Therefore, we do not discuss incorporating modifiable factors into priority setting, such as adding resource capacity, eliminating delivery barriers, and training personnel. These constraints must be considered during implementation. Finally, we also do not explore the difficult process of soliciting public input into priority setting, but rather focus on approaches that are quantitative.

REVIEW OF PRIORITY-SETTING ACTIVITIES

Since the late 1980s, the World Bank has reviewed the cost-effectiveness of health interventions to assist priority setting in developing countries (16). The initial results demonstrated differences in the cost-effectiveness of interventions to address the different conditions in low- and middle-income countries (42),

and current reports describe the relative value of multiple options to address a single condition or risk factor (16). They found that differences in methods, data availability, and reporting limited their ability to make direct comparisons across conditions and risk factors for priority setting.

The World Health Organization initiated a project called WHO CHOICE (CHOosing Interventions that are Cost-Effective) in 1998 (43). WHO CHOICE had six main goals:

1. To develop standardized cost-effectiveness methods that can be applied to interventions in various settings,
2. To develop and disseminate tools to assess interventions at the population level,
3. To determine costs and effectiveness of health interventions,
4. To summarize results in regional databases available on the Internet,
5. To assist decision makers in interpreting and using the results, and
6. To create country contextualization tools.

WHO has evaluated numerous clinical and community interventions in 18 different disease categories (**Table 1**). WHO has reported the results in terms of the effects and costs of the various interventions in each of the 14 epidemiological subregions and has made them available on the Internet for decision makers to adapt to their own needs (43).

The Assessing Cost Effectiveness (ACE) studies in Australia have prioritized interventions for cancer, heart disease, obesity in children and adolescents, mental health, and preventive services (**Table 2**) (11, 12, 23, 25, 40). Interventions within each area were sorted by incremental cost-effectiveness ratios or health impact. Information on second-stage filters such as equity, acceptability, strength of evidence, and health impact were reported to aid decision-making but were not incorporated into the rankings. ACE studies used the same framework for each topic but differed somewhat in their application across topics, limiting the ability to make direct comparisons for priority setting.

Table 1 Intervention categories examined by WHO-CHOICE (43)

Intervention categories
• Alcohol use
• Bipolar affective disorder
• Blindness (cataract, trachoma)
• Cardiovascular disease
• Childhood diseases
• Depression
• Diabetes
• Epilepsy
• HIV/AIDS
• Indoor air pollution
• Iron deficiency anemia
• Malaria
• Maternal and neonatal health
• Schizophrenia
• Tobacco use
• Tuberculosis
• Unsafe injections
• Unsafe water, sanitation, and hygiene

The most far-reaching prioritization effort in the United States was conducted in Oregon and has engaged in nearly 15 years of priority setting among the whole range of clinical health care services. This effort was first initiated in 1989 with the goal of covering more people under the state's Medicaid program by limiting coverage to a basic bundle of services. Although the primary purpose of the exercise was to make coverage decisions, it is included in this review because the results were reported as an ordered list that can aid priority setting.

In 1989, the Oregon legislature charged a new health services commission (HSC) with

ACE: Assessing Cost Effectiveness
HSC: health services commission

Table 2 Assessing Cost Effectiveness (ACE) interventions

ACE intervention categories	Number of interventions
Cancer	7 interventions
Heart disease	20+ interventions
Mental health	20+ interventions
Obesity	13 interventions
Prevention	150 interventions

Table 3 Oregon categories and criteria

General categories of care—initial methodology	Health care categories—revised methodology [category weight]	Criteria for sorting services within each health care category (score ranges)
1. Acute fatal condition. Treatment prevents death with full recovery.	1. Maternity and newborn care [100]	<ul style="list-style-type: none"> ● Impact of healthy life years (range 0 to 10) ● Impact on suffering (range 0 to 5) ● Population effects (range 0 to 5) ● Vulnerability of affected population (range 0 to 5) ● Tertiary prevention (range 0 to 5) ● Effectiveness (range 0 to 5) ● Need for medical services (range 0 to 1) ● Net cost (range 0 to 5)
2. Maternity care	2. Primary prevention and secondary prevention [95]	
3. Acute fatal condition. Treatment prevents death without full recovery.	3. Chronic disease management [75]	
4. Preventive care for children	4. Reproductive services [70]	
5. Chronic fatal condition. Treatment improves life span and quality of life.	5. Comfort care [65]	
6. Reproductive services (excluding maternity and infertility services)	6. Fatal condition, where treatment is aimed at disease modification or cure [40]	
7. Comfort care	7. Nonfatal condition, where treatment is aimed at disease modification or cure [20]	
8. Preventive dental care	8. Self-limited conditions [5]	
9. Proven effective preventive care for adults	9. Inconsequential care [1]	
10. Acute nonfatal conditions. Treatment causes return to previous health state.		
11. Chronic nonfatal condition. One-time treatment improves quality of life.		
12. Acute nonfatal condition. Treatment does not result in a return to previous health state.		
13. Chronic nonfatal condition. Repetitive treatment improves quality of life.		
14. Self-limiting condition where treatment expedites recovery		
15. Infertility services		
16. Less effective preventive care for adults		
17. Fatal or nonfatal condition. Treatment causes minimal or no improvement in quality of life.		

prioritizing a list of health services to be covered. The HSC initially derived a formula to compute cost-utility values for condition-treatment pairs. However, after public outcry about the resulting priorities, the HSC abandoned that strategy (29). Next, it created 17 general categories of care (Table 3, first column), and the services within each category were ranked first by public input followed by an analysis of data about relative effectiveness and cost (29). Finally, services were adjusted by hand to reflect the best judgment of HSC members. This methodology also came under criticism, however, because it appeared to reflect inadequately the needs of disabled people

(29). Concerned with possible bias, the HSC concluded that the priorities could be based only on two factors: (a) whether the treatment prevented death, and (b) the cost of treatment. Once a new list was created using these criteria, ~75% of the items were then adjusted by hand on the basis of the judgments of HSC members (29). This prioritization list was implemented for Medicaid patients in early 1994.

Oregon's prioritization list has been reviewed biennially. In 2005, the HSC decided to completely reprioritize the list, placing a greater emphasis on preventive services and chronic disease management (29). The HSC placed all services in one of nine health care

categories, each of which was weighted, and then it developed a list of criteria to sort the services within each health care category (Table 3, second and third columns). Services received a score for each criterion, and a service's total score was calculated using the following formula:

$$[\text{Impact on healthy life years} + \text{impact on suffering} + \text{population effects} + \text{vulnerability of population affected} + \text{tertiary prevention (health care categories 6 and 7 only)}] \times \text{effectiveness of service} \times \text{need for service}$$

When this process resulted in a tie between services, the criterion's net cost was used as a tie breaker. The weight for each health care category was then multiplied by the total score for the final score used to prioritize the services. The HSC then adjusted ~5% of the services subjectively.

Another prioritization effort conducted in the United States was led by the Committee on Clinical Preventive Service Priorities (the Committee) in 1997, which was convened by Partnership for Prevention, a national nonprofit organization focused on disease prevention and health promotion. Unlike Oregon, which included all types of services/treatments, the Committee limited its scope to those clinical preventive services that had been recommended by the U.S. Preventive Services Task Force (USPSTF). The goal of this effort was to apply a standardized approach to calculating the relative value of 30 different clinical preventive services (5). The Committee used two criteria to assess a service's relative value: clinically preventable burden (CPB) and cost-effectiveness (CE). CPB was the product of the burden of disease targeted by the service and the effectiveness of the service, measured as the percentage of burden reduced [in quality-adjusted life years (QALYs)]. CE was defined as the net cost of the clinical preventive service divided by the QALYs saved.

To ensure a valid and acceptable ranking of services, the Committee's methodology focused on maintaining consistency in

applying these criteria across services. Differences among types of preventive services—immunizations, screening, and counseling—complicated the task of ensuring this consistency. Clinical preventive services also differ in the size and characteristics of their target populations, current frequency of delivery, and complexity of achieving the intended benefits. The Committee addressed these challenges by developing detailed definitions of CPB and CE. These definitions and their application are discussed briefly in this article. More detailed information has been published elsewhere (19, 20).

To calculate this ranking without overstating the precision of the individual CPB and CE estimates, these estimates were sorted into quintiles; each service received a priority score from 5 to 1 on each measure. Services with the highest CPB estimates received a CPB score of 5, and services with the lowest (best) CE ratios received a CE score of 5. Scores for CPB and CE were then added to give each service a total score range between 10 and 2. This first ranking was published in 2001.

In 2003, Partnership for Prevention convened the National Commission on Prevention Priorities (NCPP) to guide an update that incorporated new USPSTF recommendations and new literature. The scope of preventive services analyzed by the NCPP included 21 services recommended by the USPSTF through December 2004 and immunizations recommended for the general population by the Advisory Committee on Immunization Practices (ACIP) through December 2004. The NCPP continued to use CPB and CE as their criteria and also used the same scoring system as in the previous methods developed by the Committee. The latest NCPP rankings were released in 2006 (18) and can be found in Table 4.

FRAMEWORK FOR PRIORITY SETTING

Using examples from the literature noted above, we outline the basic framework steps for designing a priority-setting exercise.

CPB: clinically preventable burden
CE: cost-effectiveness
NCPP: National Commission on Prevention Priorities

Table 4 Ranking of clinical preventive services for the U.S. population

Clinical preventive service	CPB	CE	Total
Discuss daily aspirin use: men 40+, women 50+	5	5	10
Childhood immunizations	5	5	10
Smoking cessation advice and help to quit: adults	5	5	10
Alcohol screening and brief counseling: adults	4	5	9
Colorectal cancer screening: adults 50+	4	4	8
Hypertension screening and treatment: adults 18+	5	3	8
Influenza immunization: adults 50+	4	4	8
Vision screening: adults 65+	3	5	8
Cervical cancer screening: women	4	3	7
Cholesterol screening and treatment: men 35+, women 45+	5	2	7
Pneumococcal immunization: adults 65+	3	4	7
Breast cancer screening: women 40+	4	2	6
<i>Chlamydia</i> screening: sexually active women under 25	2	4	6
Discuss calcium supplementation: women	3	3	6
Vision screening: preschool children	2	4	6
Folic acid chemoprophylaxis: women of childbearing age	2	3	5
Obesity screening: adults	3	2	5
Depression screening: adults	3	1	4
Hearing screening: adults 65+	2	2	4
Injury-prevention counseling: parents of child 0–4	1	3	4
Osteoporosis screening: women 65+	2	2	4
Cholesterol screening: men <35, women <45 at high risk	1	1	2
Diabetes screening: adults at risk	1	1	2
Diet counseling: adults at risk	1	1	2
Tetanus-diphtheria booster: adults	1	1	1

Priority setting, as opposed to making coverage decisions or rationing, compares each service's relative value on the basis of evidence and data and then provides quantitative ranking among them. With the value of services determined in a systematic and consistent manner, decision makers can make valid comparisons among them and determine which services to emphasize by, for example, changing performance measurement, adjusting payment to assure adequate reimbursement, and implementing clinic systems that facilitate delivery in designing a priority-setting exercise that informs such choices. The steps described in this framework are presenting linearly, but decisions about each step often impact the feasibility of other steps.

Scope of Services

The first step in a priority-setting exercise is to define the range of services that should be included in the ranking. Scope will be driven primarily by the purpose of priority setting, the timeline, and the budget. However, the scope will also be driven by the criteria chosen to compare services. Less complex criteria may mean that more services can be examined for a given cost. However, it is easy to underestimate the time and resources needed for systematic criteria measurement. Another important consideration in selecting services is the ability to define the service clearly, including the frequency with which it must be utilized to produce health benefits and the nature of the service's target population.

Criteria for Priority Setting

Choosing the criteria is fundamental to systematic priority setting. A well-reasoned set of predetermined criteria is perhaps the most important contribution that systematic priority setting can make toward creating a more long-term focus.

Burden of disease: health. Decision makers may choose to emphasize preventive services that address the greatest burden of disease: either the leading causes of death or the leading preventable causes of death (22, 24). The number of deaths is a natural and important measure of disease burden. Deaths that occur at younger ages can be given more weight in priority setting by measuring years of life lost rather than measuring simply the total number of deaths. Conditions that also have a greater impact on quality of life can be adjusted by using a measure such as QALYs, which adjusts for health-related quality of life (7, 9).

Burden of disease: costs. In contrast, decision makers may want to emphasize those preventive services that result in the highest medical treatment costs (8, 37). Cost of care for conditions, or for conditions attributable to health behaviors, is another logical measure of disease burden. Whereas public health goals are driven by the health impact of preventive interventions, market and legislative desires to control health care spending are addressed by measuring costs of care.

Productivity effects in the form of lost work time (absenteeism), reduced on-the-job performance (presenteeism), and employee replacement costs may be important criteria for (a) employers who purchase health insurance, (b) employees, and (c) self-employed workers. Finally, nonfinancial economic burden from productivity losses outside of paid work are also important. The ability to care for family members, address other household needs, and enjoy leisure time all have economic value to individuals. The CostIt software available through WHO and used by WHO CHOICE

was designed to analyze the economic costs of interventions, and it includes costs specific to obtaining care (e.g., travel time) (1).

Strength of evidence of effectiveness. Although much of a clinician's work does not have a strong evidence base, there is considerable evidence for many preventive interventions. Strength of evidence can be used as a minimum threshold for including an intervention in a ranking or to give higher priority to those services with stronger evidence. ACE studies have reported strength of evidence as a second-stage criteria for decision makers to use in setting their priorities (11, 12, 25). Excellent examples for evidence grades of preventive services are those of the U.S. Preventive Services Task Force (38), the Task Force on Community Preventive Services (36), the Cochrane Library (35), and the Health Technology Assessment Program (28).

Effect size. Although evidence of whether or not a service is effective is important, the degree of effectiveness can help to differentiate the relative priorities among effective interventions. However, relative effectiveness must be combined with the frequency of each condition in such differentiation. For example, an intervention with 95% effectiveness seems clearly better than one with 5% effectiveness, especially if the results are relatively consistent across multiple studies. However, achieving 95% effectiveness at reducing adult tetanus cases with the tetanus-diphtheria booster is not better than achieving 5% effectiveness at reducing long-term tobacco use through screening and brief intervention because of the great difference in population risk (18). In addition, the percent effectiveness from a study of a one-time intervention cannot fairly be compared with that from a 10-year study of repeated cancer screenings.

Utilization and patient adherence. Utilization rates and patient adherence should also be considered as criteria for prioritizing among preventive services. Focusing on effective services that are underutilized will produce greater

benefits than focusing on those already being widely used. Some preventive services also face larger obstacles than others to increasing utilization. For example, the availability of mammography machines and health professionals able to perform colonoscopies are potential obstacles to improving screening rates for those services (33, 34).

Patient adherence with recommended services may be adversely affected by wait times or vaccine shortages. Patient nonadherence may also be harder to modify if compliance requires modifying risky behaviors such as smoking, alcohol misuse, and sedentary living; tolerating the discomfort of services such as colorectal cancer screening (39); addressing cultural barriers to managing a risk factor such as physical inactivity (3); or coping with side effects of a prescribed medication. If adherence is largely beyond the control of clinicians, then nonadherence should be considered along with all other components that limit effectiveness, such as low sensitivity of screening or limited options for effective early treatment. Low patient adherence reduces the effectiveness of an intervention and should be incorporated into effectiveness measures (19).

Opinions will differ about whether and how to incorporate into priority setting obstacles to improving utilization rates. To some, significant obstacles mean that resources and attention devoted to a preventive service are less likely to produce health benefits than are other alternatives; thus, that service should receive a lower priority. To others, significant obstacles mean more resources are needed to realize the potential of the service, and the service should be given a higher priority.

Health disparities. Preventive services with the greatest disparity in utilization among various population groups may warrant greater emphasis. Some preventive services are currently provided at lower rates to people who are low income or less educated, or members of racial and ethnic minorities (2, 27). These populations may also be at a higher risk for certain preventable diseases and injuries. Decision makers

may want to focus on those preventive services that would help achieve greater equity in health status across population groups.

Unintended consequences. Side effects and harms can be quantified in QALYs and subtracted from estimates of the health benefit. Their costs and health consequences should be factored into CE estimates, resulting in less favorable CE ratios for services with significant unintended consequences. Alternatively, they can be rated as mild, moderate, or severe, for example, and used as a separate criterion. For recommended clinical preventive services, we have found that unintended consequences are generally minor relative to health benefits when quantified in QALYs. However, they may be more important for services such as prostate cancer screening, which is not universally recommended owing to concerns over unintended consequences.

Performance measurement issues. Some preventive services are much easier than others to measure and to provide periodic reports on utilization rates. Therefore, some will want to include this consideration in creating or making use of any prioritization ranking.

External demands. Decision makers must also react to the demands of various stakeholders. Payer and purchaser priorities, patient demands, and community concerns will affect where improvement efforts for preventive services will be focused. These external demands can be factored into the priority-setting exercise itself, but because factors like these, which are difficult to quantify, may lead to concern about the objectivity of the priority-setting methods, it may ultimately reduce the acceptability of the exercise. Thus, it may be better to treat these external demands as additional information when deciding on how to apply the results of the prioritization.

Composite Criteria

It is especially difficult to combine multiple criteria in one ranking. The individual

criteria noted above can be measured and reported separately and then weighted according to perceived importance to decision makers to determine final priorities. Alternatively, some criteria might be combined into composite criteria, which combine the concepts of the several criteria into a single criterion. We propose three composite criteria: number needed to treat, preventable burden, and cost-effectiveness.

Number needed to treat (NNT). NNT combines burden of disease and effectiveness of the intervention. It is the inverse of the absolute risk reduction, but it expresses intervention impact as the number of patients that must receive an intervention to prevent an adverse event, such as one death or cardiovascular event (41). The higher the risk of a preventable event in the target population, and the more effective the intervention is, the lower the NNT will be. Lower NNT indicates a more valuable service. NNT was proposed to help interpret the results of clinical trials, and it could serve the same purpose in comparing intervention impact in priority setting. One ACE study reported NNT as a secondary result (25).

When the event prevented is a death, NNT does not distinguish between prevented deaths that extend life for several years from those that have only a marginal impact on life expectancy. Similarly, when applied to preventing chronic conditions, NNT does not distinguish between prevented conditions that result in many years of poor health and those that result in few. Thus, NNT may be best suited for comparing interventions that have similar costs and prevent acute events or prevent deaths that would otherwise occur at about the same age.

Clinical preventable burden. Clinical preventable burden (CPB) measures the health burden that is prevented by a clinical intervention in a defined population. It is the absolute risk reduction of intervention effects generalized to a larger population. In priority setting, the NCPP measured CPB in terms of QALYS saved and calculated CPB in a population equivalent to a U.S. birth cohort of 4,000,000 (18).

CPB goes beyond NNT by combining the effects on both length and quality of life.

CPB is inherently consistent across preventive services when measured carefully. In our work for the NCPP, we produced consistent estimates of CPB by first assessing the available effectiveness data and then deriving estimates of burden of disease that match effectiveness on the basis of the population addressed by the service and the extent of burden prevented. We have used four simple but challenging rules to ensure consistent measurement of CPB:

1. Account for all mortality and morbidity prevented by the service.
2. Estimate CPB on the basis of repeated delivery of the service over the age range for which the service is recommended.
3. Account for incomplete patient adherence with the service and any follow-up.
4. Estimate CPB to reflect the total burden of disease prevented by the service, among both those currently up-to-date with the service and those who are not (19).

No method, however, can overcome inherent limitations of the underlying data. In particular, the precision of calculated variables such as CPB must be interpreted cautiously when the underlying data are available only from studies performed in unique communities or care settings or studies conducted in the highly controlled conditions of a randomized control trial.

ACE studies have used similar metrics of absolute risk reduction generalized to broader target populations including disability adjusted life years saved (DALYs) and events and deaths prevented. These have been reported as the primary criterion (12) and as a secondary result (25).

Cost-effectiveness. In general terms, cost-effectiveness (CE) measures the economic value of a health intervention. In practice, the term cost-effective and its derivatives are often used very loosely and mean different things to different people. A full discussion of the many ways the term cost-effectiveness is used and measured is beyond our scope. We provide a brief

NNT: number needed to treat

description here and below discuss measuring CE from different perspectives further.

In its most complete form, CE measures net cost per QALY saved, for which net costs equal the cost of the intervention minus any downstream financial savings from prevention. Others have used years of life saved (without quality adjustment) and other health outcomes such as deaths or disease cases prevented rather than QALYs. However, since the release of the recommendations of the Panel on Cost-Effectiveness in Health in Medicine in 1996 (9), most published reports used QALYs.

The CE ratio has intuitive appeal as a priority-setting criterion: It indicates which intervention produces the greatest gain in health at the lowest cost. Since its earliest inception, the CE ratio has been suggested as a rational priority-setting tool all by itself. The ACE studies noted above, as well as priority-setting efforts among cancer control interventions (4, 10), HIV (31), nutrition interventions (6), and alcohol misuse (26), have used CE as the sole primary criterion. By spending on the most cost-effective intervention first and then sequentially spending on the next most cost-effective intervention and so on until a budget is exhausted, the highest health benefit can be obtained from a fixed budget. The value of this approach can be seen more easily by inverting the CE ratio and expressing results in terms of QALYs gained per dollar spent.

The CE ratio may be the most original and comprehensive composite criterion. The numerator incorporates both the costs of the intervention and the downstream savings, and the denominator is, in effect, CPB. The savings in the numerator reflect both the financial cost of the disease targeted and the effectiveness of the intervention at preventing those expenditures. Likewise the QALYs saved in the denominator reflect the health burden of the disease(s) targeted and the effectiveness of the intervention at preventing it.

In comparison with NNT, the CE ratio measures the dollars needed to treat to obtain a QALY. Thus, the CE ratio measures resources needed in dollars rather than in the number

of patients needed, and it expands the measure of health benefit from an event or death prevented to incorporate the length and quality of life saved. What the CE ratio loses in clinical intuitiveness and transparency compared with NNT, it gains in comprehensiveness.

Cost analyses. As defined above, cost-effectiveness identifies the cost of a service to produce a defined health benefit. However, the term cost-effectiveness is frequently used in the context of a pure accounting analysis of whether or not a service saves money. The results of these analyses may be expressed as net costs, where negative net costs indicate a cost-saving intervention, or as a return on investment (ROI) calculation, where savings are divided by costs and an ROI greater than one indicates a cost-saving intervention. Cost-analyses are composite criteria because they capture the cost of a service, the financial burden of a disease, and the effectiveness of the intervention in reducing the financial burden.

Cost-benefit. Comparisons of intervention costs to cost savings can also be assessed by a cost-benefit analysis. A cost-benefit analysis compares intervention costs to all benefits by placing a dollar value on the health benefit obtained or on the probability of obtaining the anticipated benefit. Cost-benefit analysis is rarely performed, in part because its methods are not especially practical and accurate. We refer interested readers to other sources (7, 13, 30).

Effectiveness. We introduced effect size as a single criterion above because it is typically thought of as a single measure that comes from scientific studies. However, percent effectiveness is a composite criterion, especially when measured using intent-to-treat analysis. For a screening service, for example, percent effectiveness reflects the sensitivity of the screen in identifying a risk factor or an early form of disease; the adherence of patients with necessary follow-up diagnostics, early treatment, or behavior changes; and the efficacy of early

treatment or behavior change at mitigating disease risk.

Collecting Evidence and Measuring Criteria

The literature needed to prioritize preventive services is enormous, inconsistent, and greatly varied in quality. Therefore, tools are necessary to sort through it to obtain the right data for measuring the extent to which a specific service meets the criteria.

We designed the NCPP's evidence-collection methods to determine how effective and cost-effective many services were relative to others, not to determine an individual service's effects. Thus, we devised unique data search strategies that both ensured transparency for the search strategy and captured the vast majority of evidence while minimizing the resources spent gathering and evaluating estimates. These methods, which differ from the standard approaches used in many systematic literature reviews, have been described elsewhere (20).

Using the Criteria to Define Priorities

To compare interventions using multiple criteria, rules must be established for combining them. There are three approaches for combining criteria: (a) considering them in an ordered sequence, (b) considering them simultaneously, and (c) applying weights to them.

Ordered sequence. Here criteria are ordered such that priorities are first identified by a single criterion, after which additional criteria are used sequentially to further refine the priority of each service. For example, a health plan or employer may determine the ~3 conditions that result in the highest health or financial burden in a population. Then, they may apply other criteria, such as effectiveness or cost-effectiveness, to prioritize the options for addressing each condition identified as high priority by the first criterion. In effect, ACE studies use ordered criteria by defining a single

criterion (either CE or health impact) on which to sort results and report unsorted quantitative and qualitative information on other criteria such as strength of evidence, equity, or health impact if CE is the primary criterion (11, 12, 23, 25, 40).

Simultaneous consideration. In this approach, all chosen criteria are entered into the priority scoring simultaneously. As described above, NCPP scored two criteria, CPB and CE. The NCPP considered using ordered criteria by first sorting by one criterion, and sorting the ties on the first criterion using the other criterion. Ultimately CPB and CE were used simultaneously by adding their scores together to create the final ranking (18).

Utilizing only two criteria provides a relatively straightforward and transparent system for a combined ranking of services, even though CPB and CE incorporate numerous variables, including all aspects of burden of disease and all dimensions of service effectiveness, as well as costs and cost offsets. Decision makers are thus free to consider both criteria (which the NCPP weighted equally) or to consider each in isolation.

Weighting systems. There is little theoretical basis for weighting criteria. Assigning weights is a two-step subjective task of first ranking the criteria by importance and then quantifying their relative importance. The Delphi technique or other nominal group techniques (17) may be used with experts or stakeholders to elicit and quantify their preferences, although we found no published examples that apply weighting criteria for priority setting in health care. Lacking a theoretical foundation for weighting its two composite criteria of CPB and CE, the NCPP chose to use equal weights (18).

It is interesting that all the issues involved in combining individual criteria in the composite criterion noted above are settled by the construction of the composite measure. In composite measures, single criteria are added or multiplied together according to the logic of

the composite criterion and entered simultaneously as required to calculate the composite. Thus, the weight of each single criterion is determined by the logic of the calculation. A list of services sorted by a composite criterion could be considered a priority ranking that is based on the embedded criteria. Indeed, since the inception of CE, it has been proposed that priority setting could be based on CE alone using league tables (7, 9).

The revised methods of the Oregon Medicaid priority system feature ordered criteria of a slightly different nature (29). Each service was placed in one of nine categories (**Table 3**, second column). Services were then prioritized within these categories (**Table 3**, third column). The HSC applied subjective weights to each category to reflect their relative priority. In effect, the category a service was placed in was a criterion that was considered simultaneously with all other criteria. However, unlike other criteria, the category weight was multiplicative rather than additive. Service costs were used only to break ties and, as such, could be considered a true ordered criterion.

Summarizing Results for Decision Makers

Results of priority setting need to be summarized such that decision makers can understand the information and act on it. In World Bank and WHO-CHOICE reports, CE ratios are typically reported in sorted order. These reports are aimed at national health authorities and, as such, presume a fundamental comfort level of decision makers with CE ratios. Similarly, in ACE studies, incremental CE ratios are reported as they would be in any CE journal article, but additional information on second-stage filters for consideration by decision makers was concisely summarized. The HSC's public reporting is a simple ordered list of services for Oregon Medicaid without their computed scores or underlying estimates. Covered preventive services are also broken down into services by age group without priority sorting.

Addressing decision makers across the U.S. health care systems and levels of government, the NCPP uses a scoring system to present results to show large differences in service value while trying to avoid overstating the precision of results. Both criteria (CPB and CE) are sorted and assigned a score from 1 to 5 according to quintiles. CPB and CE scores are added to produce an equally weighted total score that ranges from 2 to 10, with 10 being the best possible. Once decision makers understand the methods behind the scores, they can quickly refer to scoring to begin setting their own priorities, which might factor in some of the second-stage information reported in ACE studies.

Point of View

In the end, the most important consideration for specific decision makers may be the point of view taken by the criteria. Any particular perspective chosen by generic analysts will not be ideal for all decision makers (perhaps for any), whether they represent health care systems, payers, purchasers, clinicians, or patients.

The NCPP chose to use the societal perspective to estimate cost-effectiveness following the guidelines of the Panel on Cost Effectiveness in Health and Medicine (9). The societal perspective includes all costs and savings, including patients' costs and the long-term costs to society as a whole. An important component of patients' costs is the value of their time used for the preventive service and any follow-up, principally for travel to and participation in clinic visits. Placing a monetary value on patients' time assumes that people consider the time commitment when making decisions about their health care and that any time devoted to these behaviors has valuable alternative use, such as paid and unpaid work as well as leisure and sleep. Preventive services vary significantly in the time costs required for the patient to benefit. For example, obesity screening would be more cost-effective from a health care system perspective compared with the societal perspective because the patients' time spent on physical activity during the intervention

period and for maintenance of physical activity over time would not be included in its costs.

In practice, it is not possible to accurately reflect the perspective of specific decision makers within the U.S. health care system across a wide range of health care interventions in a priority-setting effort. For example, no preventive services pay substantial returns in one to two years, yet the perspective of employers and health plans is often such a short time horizon owing to employee and health-plan-member turnover. Even when decision makers are at risk for the long-term consequences of preventable conditions, market competition and political pressures for short-term budgetary restraint reduce that time horizon for many. From the point-of-view of health care providers, the costs of prevention are typically incurred in primary care, whereas some of the largest financial gains are realized by health plans and purchasers by avoiding hospitalizations. Employees' out-of-pocket costs, savings, time commitment, and long-term health benefits are part of the total compensation package used to attract and retain a quality workforce, so they are important to employers as well as employees. The employers' perspective is also complicated by policies that share productivity losses with employees in the form of unpaid and partial paid time off from work, and by their ability to mitigate some losses by replacing employees. For health plans, the productivity gains that an employer and employees might realize are also an important part of the product they offer.

Including or excluding patient adherence when calculating the effectiveness of preventive services will also vary with different perspectives. The NCPP's rankings, which do reflect differences in patient adherence across services, address the perspectives of providers,

insurers, and employers more directly than that of patients. A priority list that focuses on patients might instead seek to identify the best preventive measures an individual can take. In creating such a list, patient nonadherence would not be factored in, and the resulting priority ranking would look very different.

CONCLUSION

Although efforts to make evidence-based national coverage decisions have been reported and reviewed, few published articles address the issues and methods for setting priorities among health care services. There has been little formal discussion about which criteria to use beyond cost-effectiveness, how to combine the criteria to establish priorities, and how to present the information to decision makers in such a way that decision makers can understand them in the context of their own objectives and constraints and act on the information.

The framework offered here is the result of our experience setting priorities among clinical preventive services. The framework has not been tested in prioritizing community interventions and other health care services but should provide a useful starting point for designing priority-setting efforts in those areas. It will be important to learn how to present results about priorities for specific population groups—such as racial, ethnic, age, and gender groups—in a way that will be both understandable and resistant to misuse. A final challenge is to learn how to make carefully considered and evidence-based priority-setting efforts influential in policy and practice. If we are to develop a more effective and efficient health system, we will need to give priority to the most valuable services.

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