Priorities Among Recommended Clinical Preventive Services

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Background: Many recommended clinical preventive services are delivered at low rates. Decision-makers who wish to improve delivery rates, but face competing demands for finite resources, need information on the relative value of these services. This article describes the results of a systematic assessment of the value of clinical preventive services recommended for average-risk patients by the U.S. Preventive Services Task Force.

Methods: The assessment of services' value for the U.S. population was based on two dimensions: burden of disease prevented by each service and cost effectiveness. Methods were developed for measuring these criteria consistently across different types of services. A companion article describes the methods in greater detail. Each service received 1 to 5 points on each of the two dimensions, for total scores ranging from 2 to 10. Priority opportunities for improving delivery rates were determined by comparing the ranking of services with what is known of current delivery rates nationally.

Results: The highest ranked services (scores of 7+) with the lowest delivery rates (≤50% nationally) are providing tobacco cessation counseling to adults, screening older adults for undetected vision impairments, offering adolescents an anti-tobacco message or advice to quit, counseling adolescents on alcohol and drug abstinence, screening adults for colorectal cancer, screening young women for chlamydial infection, screening adults for problem drinking, and vaccinating older adults against pneumococcal disease.

Conclusions: Decision-makers can use the results to set their own priorities for increasing delivery of clinical preventive services. The methods provide a basis for future priority-setting efforts.

Medical Subject Headings (MeSH): cost-benefit analysis; delivery of health care; economics; healthcare quality, access, and evaluation; health policy; health priorities; preventive health services; preventive medicine; quality-adjusted life years (Am J Prev Med 2001;21(1):1–9) © 2001 American Journal of Preventive Medicine

Introduction

Delivery of clinical preventive services, including screening tests, counseling, and immunizations, has increased in the United States during the past decade. However, many groups and individuals still fail to receive effective preventive services.[1–6] The U.S. Preventive Services Task Force (USPSTF) found approximately 50 preventive services to be effective, and other authorities recommend additional services.[7–10] Clinicians, healthcare administrators, employers, and public policymakers have shown a willingness to invest in prevention, but lack sufficient information regarding what services will provide the greatest benefit.

The nation did not attain all objectives for improving delivery of clinical preventive services outlined in *Healthy People 2000*.[1] For example, rates of delivery of preventive services to older adults (aged ≥65 years), such as colorectal cancer screening and pneumococcal vaccination, are low nationwide and vary by locality.[2,3] In 1997, one in five women reported not having had a Pap smear in the preceding 3 years, and one in four women aged ≥50 years reported not receiving a mammogram in the preceding 2 years.[4] Among select managed care–plan enrollees, 35% of smokers did not receive advice to quit when visiting a healthcare pro-

vider in 1999, and 41% of adolescents had not received appropriate vaccinations by age 13.[5]

Because of competing demands[11] and opportunities,[12] even the most well-intentioned clinicians and conscientious patients have difficulty engaging all recommended preventive services in a single visit.[13,14] In a study examining the recommendations of the USPSTF, the authors concluded that, on average, adult patients have approximately a dozen risk factors requiring approximately 24 preventive services.[15] In addition, some services that have not been proven to be effective are commonly delivered.[16–18]

Numerous attempts have been made to prioritize health resources. The state of Oregon ranked services covered under its Medicaid program, using cost-effectiveness analysis and various qualitative measures, to extend coverage for high-priority services to a greater number of the state's low-income residents.[19–21] Other efforts have prioritized causes of morbidity and mortality to focus attention on conditions that affect the most people or that would be most amenable to preventive interventions.[22–24]

The effort described here is the first to apply structured analyses in a consistent fashion across a full set of recommended clinical preventive services to determine their importance to the U.S. population. For decision-makers, knowledge that a clinical preventive service is effective is not sufficient to set priorities for delivery of preventive care. Resources (including clinician and patient time) are limited, and services differ in their potential health impact and costs.

This article presents a priority ranking of 30 clinical preventive services recommended by the USPSTF based on their relative value to the U.S. population. A companion article describes the methods used to assess services' value.[25] All service-specific data and calculations used to derive the rankings of services are available for scientific scrutiny and for use by researchers and policymakers.[26]

The findings should provide valuable information to healthcare administrators for setting priorities for programs and systems aimed at increasing delivery of preventive services. For purchasers of healthcare services, including employers and public sector payers, the priority list should guide efforts to expand insurance coverage for preventive care and hold health plans accountable for delivery of priority preventive services. Clinicians should find guidance on how to make their encounters with patients more productive, and patients may find insights on preventive services that offer substantial benefits. The methods used to develop priorities are also an important contribution and may be adapted to identify priorities for specific populations. For example, priority setting may focus on people with chronic conditions (such as diabetes), Medicaid beneficiaries, or people in specific geographic areas.

Methods
Purpose and Scope

Key aspects of the methods necessary to interpret the results are briefly summarized here and illustrated in Figure 1. A more comprehensive discussion of the methods is provided in the companion article.[25]

In 1997, Partnership for Prevention, a national nonprofit organization, with support from the Centers for Disease Control and Prevention and the Health Care Financing Administration, convened the Committee on Clinical Preventive Service Priorities (the Committee). The Committee was charged with (1) developing an approach to making valid comparisons of clinical preventive services based on their relative value, and (2) ranking services recommended by the USPSTF. The 25-member panel—consisting of health plan medical directors, public- and private-sector purchasers of health care, state and local public health officials, clinicians, and consumer advocates—met three times during June 1997–June 1998. A working group of technical experts collected data and conducted the analyses.

The Committee's analysis of priorities included services recommended by the USPSTF for average-risk patients as part of periodic health examinations, as outlined in the *Guide to Clinical Preventive Services*, second edition[7] (the *Guide*). Preventive services recommended by the USPSTF for subpopulations at higher risk for disease, such as HIV screening and counseling about sun protection, were excluded from this analysis. The USPSTF did not consider tertiary preventive services, such as screening for retinal, renal, and peripheral vascular disease among people with diabetes; thus, these services are not evaluated here. Finally, two services recommended for patients at average risk—periodic height and weight measurement and counseling about pregnancy prevention—are excluded from the analysis. (No quantifiable preventive benefits were identified for height and weight measurement relative to visual inspection for obesity; counseling all patients [regardless of body-mass index] on physical activity and diet are evaluated separately. Benefits to maternal health from avoided complications of unplanned pregnancies were found to be very small; complete measurement of the benefits of preventing unplanned pregnancy would require value judgments that are outside the scope of this project.)

In the analysis, some services were grouped. For example, all childhood vaccines (e.g., measles, mumps, and rubella [MMR]; diphtheria–tetanus toxoids and pertussis [DTP]) were grouped to reflect the fact that multiple vaccines are delivered in a single office visit. Similarly, four other clustered services were defined: counseling about safety-related behaviors (one service for young children and one for older children, adolescents, and adults); counseling about infant feeding practices; and newborn screening services provided in hospitals rather than clinicians' offices. A total of 30 services and groups of services are assessed in the analysis.

The Committee chose to assess services' relative value
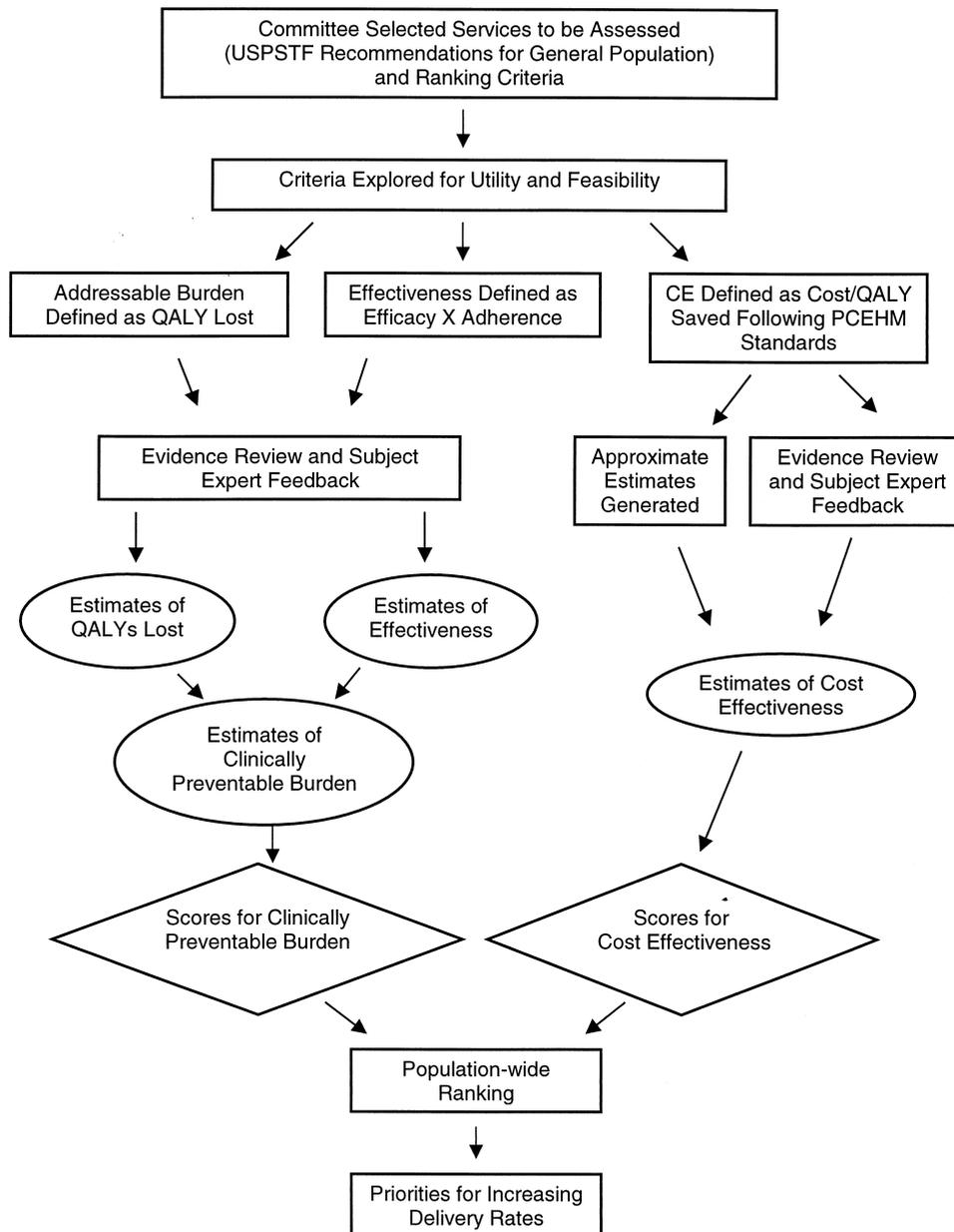
Figure 1. Methods overview. QALY, quality-adjusted life years; PCHEM, Panel on Cost Effectiveness in Health and Medicine.

based on two criteria: clinically preventable burden (CPB) and cost effectiveness (CE).

Clinically Preventable Burden

CPB refers to the proportion of disease and injury prevented by the clinical preventive service in usual practice if the service were delivered to 100% of the target population at recommended intervals. CPB is the product of both the burden of disease targeted by the service and the effectiveness of the service, measured as the percentage of burden reduced. Potential harms associated with the services were not analyzed for CPB. With the exception of counseling on the risk and benefits of hormone replacement therapy, the harms presented by services recommended by the USPSTF are minimal.

Methods were developed that provide consistent estimates of CPB across different types of services—immunizations, screening, chemoprophylaxis, and counseling. The CE estimates, further described below, also conform to these methods.

For every clinical preventive service, all morbidity and mortality that would be addressed by each service was considered. Thus, a common measure—quality-adjusted life years (QALYs) saved—was used. QALYs saved combine years of life gained with improvements in health-related quality of life into a single metric.[27,28] Thus, in this analysis, the number and timing of deaths averted as well as the seriousness and duration of illnesses and injuries averted were considered.

Comparable CPB estimates also required a consistent time frame over which effectiveness of the services is measured.

Table 1. QALYs saved and cost/QALY saved in each quintile[a]

Score	QALYs saved	Score	Cost($)/QALY saved
5	325,000 to 2,600,000	5	Most likely cost saving
4	65,000 to 185,000	4	May be cost saving to 12,000
3	33,000 to 55,000	3	12,000 to 18,000
2	19,000 to 27,000	2	19,000 to 35,000
1	100 to 12,000	1	43,000 to 2,000,000

[a] The upper and lower ends of each quintile are the base-case estimates for the highest and lowest services in each category.
QALY, quality-adjusted life year.

Some services require a single intervention (e.g., pneumococcal vaccination), while others require multiple interventions (e.g., breast cancer screening). To ensure consistency, CPB is measured as the burden prevented in a 1-year, U.S. birth cohort when the service is delivered over the years recommended by the USPSTF. For example, CPB for counseling women about folic-acid intake includes burden of disease prevented when counseling is delivered repeatedly to a birth cohort of women during the course of their childbearing years.

All CPB estimates were based on effectiveness in typical practice, which required consideration of patient adherence for every service. Patient adherence ranges in type from accepting a service once it is offered by a clinician, to completing follow-up treatments, to making changes in daily habits. Adherence data were limited for all services, but especially limited for counseling services addressing behavior changes such as physical activity, diet, and safety. Adherence for counseling services refers to the portion of people at risk who change behavior as a result of brief, opportunistic counseling delivered repeatedly over time. Available data were reviewed to estimate plausible ranges of adherence for the counseling services.

The effect of current delivery rates on burden of disease was also consistently accounted for across services. CPB was adjusted to reflect both burden of disease that is currently being prevented by the service and the burden that would be prevented if the service were delivered to those in the target population not receiving it yet. The approach used here illustrates services' total value. It allows decision-makers to interpret the results of this analysis in light of local delivery rates without analyzing the distortions introduced by national delivery rates, which may be different from their own for every service.

All types of evidence were considered. Systematic exclusion criteria were not employed, given the large number of data points underlying each service's CPB estimate for each of the services and the numerous types of data points required (including, for example, incidence rates, effectiveness, and portion of the population currently at risk).

Cost Effectiveness

CE was measured as the net cost of the clinical preventive service divided by QALYs saved. QALYs saved are conceptually the equivalent of CPB, but in the CE ratio, QALYs saved are discounted. Therefore, CPB and CE are not entirely independent. Net costs in the CE ratio were defined as the value of resources used in providing the preventive service and any follow-up services less the resource savings from averted disease or injury. The basic cost-effectiveness formula is:

$$\text{Cost effectiveness} = (\text{costs of prevention} - \text{costs averted})/\text{QALY saved}$$

For 13 of 30 services, published CE studies were available. However, these studies often use different methods and express results in different base-year dollars. Recently developed methods for systematically reviewing the CE literature to make valid comparisons across services were used.[29] To arrive at comparable estimates, results of published CE studies were adjusted to (1) 1995 U.S. dollars; (2) the "reference case" methods recommended by the Panel on Cost Effectiveness in Health and Medicine (PCEHM)[28]; and (3) the target population and frequency of delivery defined in the USPSTF recommendations.

For the other 17 services, no published CE studies were found; thus, an alternative to formal CE analysis was developed to derive estimates comparable to those found in published studies. The goal was to approximate what the CE of each service would be if a detailed CE analysis were performed using the "reference-case" methods of the PCEHM. Whether the CE estimates are based on adjustments to published studies or on original estimates developed for this analysis, they are consistent with the methods used to estimate CPB and the reference-case methods of the PCEHM.

Calculating the Rankings

CPB was sorted in descending order of the base-case estimates. CE was sorted in ascending order of the base-case CE ratios. Services with the same base-case estimate for either CPB or CE were sorted in descending order of certainty. Each service was assigned a CPB and CE score from 1 to 5 according to quintile, with 5 being the best possible score. Thus, services with the highest CPB were assigned a CPB score of 5, and services with the lowest CE ratios were assigned a CE score of 5. These scores were then added to give services a total score on a possible scale of 2 to 10 (integer values only).

Results

Table 1 summarizes the QALYs saved in each quintile for CPB and the cost per QALYs saved in each quintile for CE. Scores are listed in Table 2 for all services recommended by the USPSTF for the general population as part of periodic health examinations in the *Guide to Clinical Preventive Services*.[7]

Fourteen services, the majority of which are screening services, received scores of 7 or higher. Three are vaccine services: The childhood vaccine series received the highest score (10), and the influenza and pneumo-

Table 2. Priorities among recommended clinical preventive services

Services	CPB	CE	Total
Vaccinate children: DTP/DTaP, MMR, Oral Polio/IPV, Hib, Hep B, Varicella	5	5	10
Assess adults for tobacco use and provide tobacco cessation counseling[a]	**5**	**4**	**9**
Screen for vision impairment among adults aged ≥65	**4**	**5**	**9**
Assess adolescents for drinking and drug use and counsel on alcohol and drug abstinence	**3**	**5**	**8***
Assess adolescents for tobacco use and provide an antitobacco message or advice to quit	**4**	**4**	**8***
Screen for cervical cancer among sexually active women or ≥18 years	5	3	8
Screen for colorectal cancer (FOBT and/or sigmoidoscopy) among all persons aged ≥50 years	**5**	**3**	**8**
Screen for hemoglobinopathies, PKU, and congenital hypothyroidism among newborns	3	5	8
Screen for hypertension among all persons	5	3	8
Vaccinate adults aged ≥65 years against influenza	4	4	8
Screen for chlamydia among women aged 15 to 24 years	**3**	**4**	**7***
Screen for high blood cholesterol among men aged 35 to 65 years and women aged 45 to 65 years	5	2	7
Screen for problem drinking among adults and provide brief counseling	**4**	**3**	**7***
Vaccinate adults aged ≥65 years against pneumococcal disease	**2**	**5**	**7**
Assess infant feeding practices and provide counseling on: breastfeeding, use of iron-enriched foods, risk of baby-bottle tooth decay	1	5	6
Assess risk of STDs (including HIV) and provide counseling on measures to reduce risk	3	3	6*
Screen for breast cancer (mammography alone or with CBE) among women aged 50 to 69 years	4	2	6
Screen for vision impairment at age 3 to 4 years	2	4	6*
Assess oral health practices and provide counseling on: brushing and flossing daily, visiting a dental care provider regularly	3	2	5*
Assess the safety practices of parents of children aged 0 to 4 years and provide counseling on: child safety seats, window/stair guards, pool fence, poison control, hot water temp, bicycle helmet	1	4	5*
Counsel on risks/benefits of hormone replacement among peri- and post-menopausal women	4	1	5*
Assess calcium/vitamin D intake of adolescent and adult women and counsel on use of supplements	2	2	4*
Assess folic acid intake among women of childbearing age and counsel on use of supplements	1	3	4*
Assess physical activity patterns of all persons aged ≥2 and counsel on increasing activity levels	3	1	4*
Provide newborns with ocular prophylaxis to protect against gonococcal eye disease	1	3	4*
Screen for hearing impairment among persons aged ≥65 years	2	2	4*
Assess dietary patterns of persons aged ≥2 and provide counseling on: intake of fat/cholesterol; caloric balance; intake of fruits, vegetables, grains	2	1	3
Assess the safety practices of all persons aged ≥4 and provide counseling on: seatbelt use, smoke detector use, firearm storage/removal from home, bicycle/motorcycle helmet use, dangers of alcohol use, protection against slip and fall hazards for older persons	2	1	3*
Screen for rubella among women of childbearing age using serology and/or history and vaccinate	1	1	2
Vaccinate all persons against tetanus–diphtheria (Td boosters)	1	1	2

* Services for which total scores have greater uncertainty. See companion article[25] for explanation.
[a] Services in boldface are those with scores of 7 + for which available data indicate that delivery to the U.S. population eligible for the services is ≤ 50%.[33–39]
CE, cost effectiveness; CPB, clinically preventable burden.

coccal vaccines for older adults received scores of 8 and 7, respectively.

Three of the 14 services receiving scores of 7 or higher are counseling services: tobacco cessation counseling for adults (score = 9), providing counseling to adolescents on alcohol and drug abstinence, and providing adolescents with an anti-tobacco message or advice to quit (scores = 8). The best information available on adults' adherence with repeated clinician advice (including advice to use nicotine replacement therapies) was used, but it is imperfect. For adolescents, evidence on adherence to clinician advice during the course of adolescence is lacking, but must reach only one third of 1% for these services to be cost saving. For counseling adolescents about tobacco, 1% adherence refers to 1% of the 35% (roughly) of adolescents who would otherwise become adult smokers for some period of time (or 0.35% of all adolescents). Therefore, one third of 1% is 0.12% of all adolescents.

Several services with scores of 7 or higher address preventable conditions with little mortality, but substantial morbidity. Screening for vision impairment among older people (score = 9) rated high due to a high prevalence of undercorrected vision. Vision screening was cost effective whether or not prevention of vision-related hip fractures was included in the analysis. Screening for chlamydial infection among young women (score = 7) was very cost effective even in populations with low to moderate prevalence of the disease.

The services identified in bold type (Table 1) may be more important for decision-makers who want to know where to spend their next dollar, given current investments in clinical preventive services. An indication of where additional resources may be directed was found by comparing the rankings with what is known of current delivery rates at the national level. Services in bold type are those with a total score of 7 or higher that
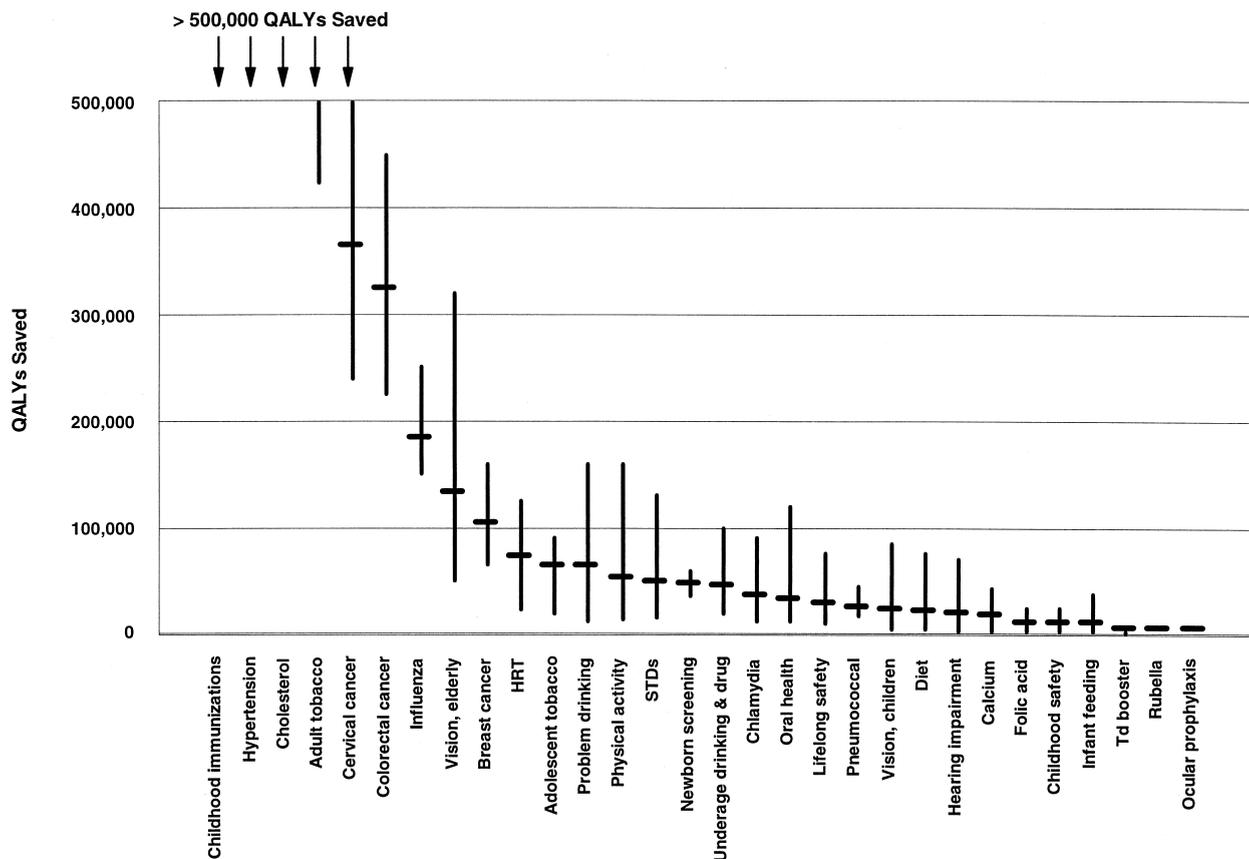
Figure 2. Clinically preventable burden ranges. HRT, hormone replacement therapy.

are delivered to ≤50% of their target populations nationally (based on limited available data for all people, both insured and uninsured). For the U.S. population, these services are important missed opportunities for preventing disease and promoting health.

Sensitivity analysis identified variables that contributed the greatest uncertainty to estimates. For most of the counseling services, the level of adherence with long-term repeated advice is very uncertain, and CPB and CE may be very sensitive to the estimate of adherence. CPB and CE estimates for most services are relatively insensitive to estimates of the duration of morbidity and utility weights used to estimate QALYs. However, the CPB and/or CE estimates for vision and hearing screening, screening for chlamydia, counseling on the use of calcium and vitamin D supplements, counseling on oral health practices, and counseling on risks and benefits of hormone replacement therapy are more sensitive to duration of morbidity and utility weights and, in most cases, these variables are relatively uncertain. In addition, the CE estimates of screening for problem drinking and providing newborns with ocular prophylaxis are very sensitive to several variables, making any point estimate a nearly arbitrary designation of a base-case estimate.

The extent of uncertainty indicated by sensitivity

analyses for all CPB and CE estimates is shown in Figures 2 and 3. In Figure 3, lines extending below zero indicate only cost savings, not the extent of cost savings. Services for which changes in total scores of at least 2 (and in some cases 3) are possible have been identified with an asterisk (*) in Table 2.

Discussion

This analysis provides important missing information necessary for well-informed decision-making. Top-ranking services from Table 2 with particularly low delivery rates are high-priority opportunities to begin improving delivery rates. Local decision-makers (in community, health plan, medical clinic, or employee populations) will need to set priorities according to their own current rates of delivery of preventive services and taking into account any new recommendations of the USPSTF as they become available. Differences in incidence and prevalence of risk factors may also be important considerations. In addition, decision-makers may want to consider the effectiveness of available systems for improving delivery rates. The ease of increasing delivery rates will vary from service to service, and this issue is not reflected in the rankings.

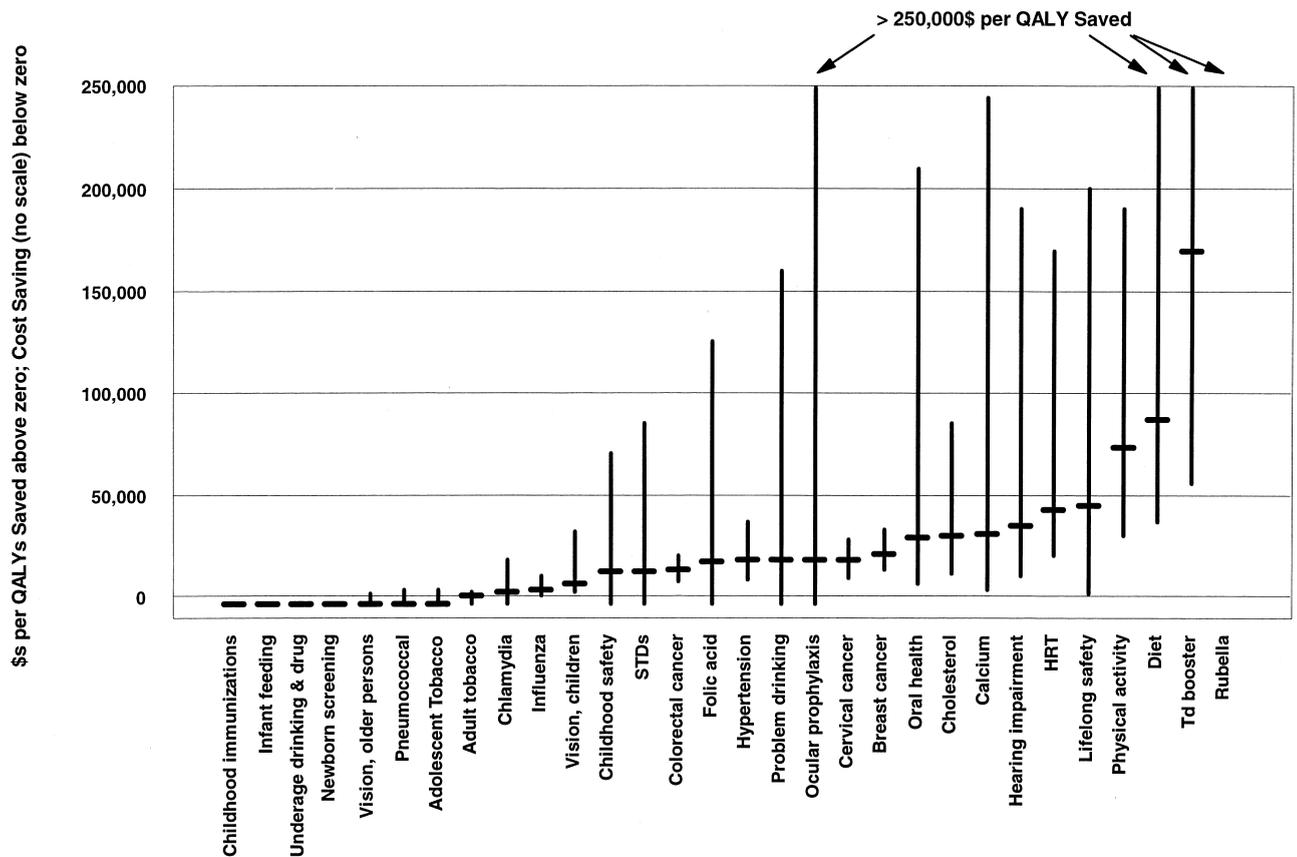Several other issues are important when interpreting

Figure 3. Cost-effectiveness ranges. HRT, hormone replacement therapy.

the results. Some decision-makers, such as state and local public health officials, may need to address priorities for high-risk groups. Some recommended preventive services are provided at lower rates to people who are of low-income status, less educated, or members of racial and ethnic minorities.[30] These populations are at higher risk for some preventable illnesses, including cancers, heart disease, stroke, most infectious diseases, and both intentional and unintentional injuries.[30] Improving delivery of preventive services to these populations may produce larger health gains, but a list of high-priority services for these populations may differ from services listed in Table 2. Table 2 must also be carefully interpreted if used to inform priorities for age groups. Most services with scores of 7 or higher are aimed at adults; three of these are aimed solely at adults aged >65. Incidence of disease is greater among older people, providing more opportunities for prevention; as people live longer, there are more years for older people to benefit from preventive services.[31] In contrast, in a list of priorities for average-risk patients seen by pediatricians, counseling about childhood injury prevention would be a top priority.

These results reflect an assessment of the value of clinical preventive services, not the relative importance of risk factors for disease and injury. For example,

increasing physical activity is a high priority for many individuals and the population as whole, but brief counseling in the clinical setting may not be the most effective means to address rates of physical activity.

Consistent with PCEHM reference-case methods,[28] this analysis uses the societal perspective to estimate cost effectiveness. The societal perspective includes all costs and all financial savings, regardless to whom they occur. The relative value of some services might be different if an alternative perspective had been used. For example, from the commonly used "health-systems perspective," varicella vaccinations are less cost effective (relative to the societal perspective) because unpaid caregiver time is not included in costs averted. In contrast, counseling to encourage physical activity is more cost effective when the health-systems perspective is used because time spent on physical activity is not included in the costs of prevention.

The Committee chose to add scores for CPB and CE, yet theoretically, cost effectiveness by itself should provide a basis for priority setting by indicating where a given investment will produce the greatest health gains.[32] In practice, however, complete reliance on cost-effectiveness analyses may fail. Even when estimates are constructed to be reasonably comparable, imprecision in the estimates leads to potential error in

ranking the relative cost effectiveness of services. In addition, CE does not generally account for resources incurred by health systems to increase delivery rates, such as provider- or patient-reminder systems, training of staff, or restructuring of organizational relationships. The necessary investment of resources to produce increases in delivery rates may be better spent on services that yield larger health benefits, as indicated by the CPB scores.

Many effective preventive services reach only a small portion of the recommended population. This analysis begins with the premise that clinicians, clinic and medical group managers, health plan medical directors, insurance providers, employers, government administrators, and legislators would like to increase the delivery rates of recommended clinical preventive services, but have inadequate information on how best to move forward. Recognizing that delivery rates are increased step by step rather than in giant leaps, the goal of this analysis is to assist decision-makers in choosing where to improve delivery rates first. Decision-makers who already make such choices in a careful and thoughtful manner have, until now, done so with incomplete and incomparable data on each service's relative value, and these results should aid their efforts and lead to larger improvements in population health. Decision-makers who are currently in a state of inaction with respect to increasing delivery rates may be motivated by these results to take the first steps necessary to improve delivery of highly valuable clinical preventive services.

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