Priorities Among Effective Clinical Preventive Services

Results of a Systematic Review and Analysis

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Background: Decision makers at multiple levels need information about which clinical preventive services matter the most so that they can prioritize their actions. This study was designed to produce comparable estimates of relative health impact and cost effectiveness for services considered effective by the U.S. Preventive Services Task Force and Advisory Committee on Immunization Practices.

Methods: The National Commission on Prevention Priorities (NCPP) guided this update to a 2001 ranking of clinical preventive services. The NCPP used new preventive service recommendations up to December 2004, improved methods, and more complete and recent data and evidence. Each service received 1 to 5 points on each of two measures—clinically preventable burden and cost effectiveness—for a total score ranging from 2 to 10. Priorities for improving delivery rates were established by comparing the ranking with what is known of current delivery rates nationally.

Results: The three highest-ranking services each with a total score of 10 are discussing aspirin use with high-risk adults, immunizing children, and tobacco-use screening and brief intervention. High-ranking services (scores of 6 and above) with data indicating low current utilization rates (around 50% or lower) include: tobacco-use screening and brief intervention, screening adults aged 50 and older for colorectal cancer, immunizing adults aged 65 and older against pneumococcal disease, and screening young women for Chlamydia.

Conclusion: This study identifies the most valuable clinical preventive services that can be offered in medical practice and should help decision-makers select which services to emphasize.
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Introduction

Receipt of evidence-based clinical preventive services among the population of the United States has improved over the past 10 years, yet it remains discouragingly low for some services and among some population groups. For example, the majority of people at risk for colorectal cancer are not being screened.[1,2] In 2005, 78% of Hispanic adults and 63% of black adults aged over 65 years reported never having received the pneumococcal immunization compared to 38% of white adults aged over 65.[3]

An important reason for the less-than-ideal delivery of preventive care is limited clinician time coupled with the difficulty of integrating many preventive service recommendations among many competing demands.[4–6] Clinicians must decide which preventive services to offer, and decision makers must decide which services should be the focus of practice improvement efforts and other policies and programs. Clinicians, health insurance plans, care delivery leaders, employers, and consumers all need information about which preventive services produce the greatest returns on investment, to be able to target them for improved utilization rates.

This article updates a 2001 ranking of clinical preventive services based on comparable measures of their relative value to the U.S. population.[7,8] An update was necessary because of new recommendations from the U.S. Preventive Services Task Force (USPSTF) and more recent data on the burden of disease, service effectiveness, use of services, and costs of delivery. A description of the methods as well as the findings for three important services may be found in companion articles.[9–12] Additional resources are available online: a detailed methods report,[13] all of the service-specific data and calculations used to derive the estimates, and

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tables with many of the component values on which the rankings were based (prevent.org/ncpp).

The overall goal of the analysis was to develop a ranking of services with fair to good evidence of effectiveness, excluding services with insufficient evidence or evidence of ineffectiveness. The ranking was designed to assist decision makers at multiple levels: Clinicians and their patients can use the ranking to identify which among these recommended services to emphasize, and care delivery leaders should find the ranking valuable as they make choices about the design of prevention programs. The ranking should also enlighten discussions about health insurance coverage for preventive services and encourage the evaluation of benefit packages. Employers, public health agencies, and others may use the ranking as a starting point in encouraging more appropriate consumer demand for high-quality, high-value healthcare services. The findings and methods can also be adapted to assess prevention quality, ascertain priorities for specific population subgroups, or identify research and data needs.

Methods

Although more-comprehensive discussions of the methods used are available,[9,13] the key aspects needed to interpret the results are summarized here briefly. In 2002, Partnership for Prevention, a national nonprofit organization, asked David Satcher to chair a National Commission on Prevention Priorities (NCPP) to guide an update to the 2001 ranking of clinical preventive services. The NCPP—a 24-member panel of decision makers from health insurance plans, an employer group, academia, clinical practice, and governmental health agencies—met in-person three times between July 2003 and July 2005. Additional meetings to address methods issues were held by conference call. HealthPartners Research Foundation personnel conducted all of the analytical work.

The scope of clinical preventive services chosen by the NCPP for the ranking consisted of primary and secondary preventive services, including immunizations, screening tests, counseling, and preventive medications offered to asymptomatic people in clinical settings. Included were 21 clinical preventive services recommended by the USPSTF through December 2004 for this population and for people at high risk of coronary heart disease, and childhood immunizations as a group and three adult immunizations recommended by the Advisory Committee on Immunization Practices (ACIP) through December 2004 for the general population.

The analysis was restricted to services as defined by the USPSTF and ACIP. For example, the USPSTF defined cholesterol and hypertension screening as both screening and treatment with medications to lower lipid and blood pressure levels, respectively. The USPSTF recommended diet counseling as a separate intervention aimed at people with hyperlipidemia as well as those with other risk factors for cardiovascular disease or diet-related chronic disease. All childhood immunizations were grouped in the analysis because multiple immunizations are combined and delivered in single office visits. All injury prevention issues for young children (such as child safety seats, window/stair guards, or hot water temperature) were also combined as a single counseling service, although they are typically delivered over a continuum.

The NCPP chose to base the ranking on the same measures used in the previous effort: clinically preventable burden (CPB), which measures the health impact on the relevant population, and the cost effectiveness of each service.

Clinically Preventable Burden

Clinically preventable burden was defined as the total quality-adjusted years of life (QALYs) that could be gained if the clinical preventive service were delivered at recommended intervals to a U.S. birth cohort of 4 million individuals over the years of life for which a service was recommended. The following five approaches were used to apply this definition consistently across services:

Clinically preventable burden was measured in terms of QALYs saved to include both morbidity and mortality impacts. QALYs saved combine years of life gained with improvements in health-related quality of life into a single metric.

Clinically preventable burden measured the total potential health benefits from the service among both those who have received the service and those who have not yet received it. For a service with high utilization rates and high effectiveness, such as childhood immunizations, the remaining burden of disease in the U.S. population may be relatively small. Using total health benefits rather than just the benefit gained from increasing the use of the service leads to a more accurate reflection of the overall importance of each service.

Total CPB was estimated under the premise that 100% of the target population is offered each service, but it was not assumed that 100% comply. Expected patient adherence for every service was accounted for in CPB, thus providing a realistic estimate of the service's value when offered as part of usual care. The components of patient adherence included accepting a service once it is offered by a clinician as well as completing follow-up treatments and making needed changes in behavior.

The size of the population for which a service is recommended varies considerably over time, depending on the size of birth cohorts that have reached the recommended age range for the service. To reduce this variability among services, CPB was estimated for all services for a hypothetical average birth cohort of 4 million since recent birth cohorts have been approximately that size.[14]

Some services require only a single intervention (e.g., pneumococcal vaccination) while others require many repetitions (e.g., breast cancer screening) to achieve their full benefit. To account for a service's full benefit, each CPB estimate included the cumulative benefit of multiple deliveries of the service over the recommended age range at recommended intervals. For example, the CPB of screening for colorectal cancer was measured as the benefit of repeated screenings over time,[10] and the CPB of tobacco-use screening and brief intervention was measured as the benefit of repeated attempts to engage smokers in cessation activities.[12]

Cost Effectiveness

The definition of cost effectiveness was the average net cost per QALY gained in typical practice by offering the clinical preventive service at recommended intervals to a U.S. birth cohort over the recommended age range. To compute average cost effectiveness, the costs and benefits of each service were measured incremental to no provision of the service.

Like CPB, cost effectiveness was based on provision of the service to the entire target population rather than the marginal cost effectiveness of extending delivery to those not currently receiving the service. Cost effectiveness also incorporated both morbidity and mortality. Costs and QALYs were discounted in the cost-effectiveness ratio, unlike the CPB calculation, which did not include discounting. Imperfect patient adherence was also accounted for in the cost-effectiveness estimates, and cost effectiveness was estimated over the lifetime of a U.S. birth cohort rather than across the current U.S. cross-section.

The comparability of the cost-effectiveness estimates was improved across services by adhering to the "reference case" methods advocated by the Panel on Cost Effectiveness in Health and Medicine (PCEHM).[15] These methods required use of a 3% discount rate and measurement of health outcomes as QALYs. Costs in the numerator included all quantitatively important medical care costs for screening, counseling, pharmaceutical treatment, follow-up diagnostic tests, and hospitalizations for treatments following screening when applicable. The value of patients' time associated with receiving the service and needed follow-up were also included in the cost of each preventive service. Potential savings included all medical costs for avoided treatments or reduced costs for less intensive, earlier stage treatments. These costs included inpatient, outpatient, laboratory, radiology, pharmacy, and care giving. All cost-effectiveness ratios were also standardized to year 2000 dollars.

A cost-effectiveness estimate for each service was developed in one of two ways. For six services, existing cost-effectiveness estimates from the literature were used. However, adjustments typically had to be made to such published cost-effectiveness ratios so that they better reflected the principles outlined above and could be directly comparable to cost-effectiveness estimates for other services in the ranking. When there was no published cost-effectiveness estimate that could yield an up-to-date estimate consistent with the principles outlined above, a new cost-effectiveness estimate was produced using the service's CPB estimate as the basis for the cost-effectiveness model. The latter approach is demonstrated in the accompanying articles on influenza immunization and tobacco-cessation counseling.

Evidence Gathering

Two types of standardized search strategies were developed for the overall prioritization study: one for effectiveness and cost-effectiveness data and a second for burden of disease and cost data. Each strategy included four levels, where Level 1 included the most-current literature and data sources, and each subsequent level extended to less-current sources and sources less likely to yield useful data. The Level 1 search used PubMed for English-language articles dating to 1992 and was limited to MeSH major terms and to title word terms and phrases. The Cochrane Collaboration reviews were also searched back to 1992. Special abstraction forms were created, and multiple reviewers were used with an adjudication process for discrepancies.

Calculating the Rankings

A scoring system was used to group services in order to make distinctions among services without overstating the precision of the CPB and cost-effectiveness estimates. A ranking grounded on base-case estimates for CPB and cost effectiveness would falsely imply exactitude. While services' base-case estimates were close for some services, across all services there was a wide range of base-case estimates for CPB and cost effectiveness.

First, services were sorted in descending order by the CPB base-case estimates and in ascending order by the base-case cost-effectiveness ratios. Services were then divided into five groups at the quintiles, and each service was assigned a score from 5 to 1 for both CPB and cost effectiveness according to group. Services with the highest CPB were thus assigned a CPB score of 5, and services with the lowest cost-effectiveness ratios were assigned a cost-effectiveness score of 5. Scores for CPB and cost effectiveness were then added to give each service a total possible score between 2 and 10. This approach resulted in different ranges in each quintile than were used in 2001 as the distribution of estimates is different.

Calculating Marginal Effects

In addition to scoring services on total CPB, the marginal CPB of increasing the number of people at the national level who receive selected preventive services was estimated. This was done by comparing the difference between QALYs saved among those in the target population who have received the services to the QALYs that could be saved if 90% of the target population received the services. No assumptions were made regarding how 90% receipt rates may be achieved, such as through increasing offers of the service, adherence with offers, or both.

Due to self-selection, it is likely that individuals who are currently not receiving services have different risk characteristics than the average target population. However, available data were insufficient to quantify the impact of these differences in risk characteristics on CPB. Therefore, the estimates assume that those currently not receiving services are at average risk.

Marginal cost effectiveness would be virtually identical to the average cost effectiveness used in the ranking when assuming that individuals currently not receiving the service are at average risk, and without incorporating the cost of systems to increase clinician or patient adherence with guidelines. This is because the costs of delivering additional preventive services would be proportionate with the cost offsets and the health benefits. Therefore, marginal cost-effectiveness ratios were not tabulated.

Results

Table 1 summarizes the QALYs saved in each quintile-defined group for CPB, and the cost per QALYs saved in each group for cost effectiveness. Scores are listed in

Table 1. Scoring ranges

Score	CPB range: QALYs saved, undiscounted	CE range: $/QALY saved, discounted
5	≥360,000	Cost saving
4	≥185,000 <360,000	>0 <14,000
3	≥40,000 <185,000	≥14,000 <35,000
2	≥15,000 <40,000	≥35,000 <165,000
1	<15,000	≥165,000 <450,000

CE, cost effectiveness; CPB, clinically preventable burden; QALY, quality-adjusted life year.

Table 2 for all services meeting the study's inclusion criteria.

Eleven services received scores of ≥7. Three of these received scores of 10 and are cost saving: discussing aspirin use with high-risk adults, immunizing children, and tobacco-use screening and brief intervention. Other services receiving scores of ≥7 were two adult vaccines (influenza and pneumococcal), two cancer screenings (cervical and colorectal), and four additional screenings (vision screening among adults aged ≥65 years, hypertension screening, cholesterol screening, and problem-drinking screening).

Four services received a score of 6. Among these are two services that have small target populations compared to other services on the list and thus a relatively low CPB, but are very cost effective: screening young women for Chlamydia and screening young children for visual impairments.

Seven services ranked high on the list, yet available data indicate that delivery rates are particularly low. For four services, approximately 50% or fewer in the target population nationally are likely being offered them: tobacco-use screening and brief intervention, screening adults aged ≥50 years for colorectal cancer, immunizing adults aged ≥65 against pneumococcal disease, and screening young women for Chlamydia. Limited utilization data for three other high-ranking services also point toward low utilization rates: discussing aspirin use with high-risk adults, screening adults for problem drinking, and screening adults aged ≥65 for vision impairment.

Although childhood immunizations are successfully delivered to most children in the United States, influenza immunization was an exception in 2004 when only 36% of children aged 6 to 23 months were vaccinated.[3] This was the first year that the vaccine was recommended in that population, and most in this population must receive two doses. The vaccine shortage in 2004 may have also influenced utilization.

Table 3 provides additional information on unmet opportunities by listing the QALYs that would be saved in descending order were the number of people nationally who received selected services increased to 90%. These results must be interpreted with some caution because they depend on the accurate measurement of current utilization rates. Services for which data on utilization rates were limited were assigned rates of 50% and separated from other services in the table. Despite this and the limitations noted in the methods, large differences clearly indicate that there are more substantial health gains to be made from improving the utilization of some services above current national rates than others. These results do not represent a complete ranking of priorities for improving utilization rates. In particular, Table 3 includes only health impact. Decision makers may also wish to consider the relative cost effectiveness of each service as indicated by the scores in Table 2.

The findings for cholesterol and hypertension screening are low in Table 3 because most adults are up-to-date with screening. Increasing the portion of adults who adhere with use of antihypertensive and cholesterol-lowering drugs following screening would result in a greater number of QALYs saved than simply increasing screening rates above current levels.

Sensitivity analysis identified variables that contributed the greatest uncertainty to estimates. For the counseling services, where the level of adherence with repeated advice is very uncertain, the CPB and cost-effectiveness estimates were sensitive to this uncertainty. The USPSTF classified three services as chemoprevention, yet each also has a critical counseling component that was not recognized by the USPSTF. Data were extremely limited on the portion of the target population who adhere with advice to use aspirin, folic acid supplements, and calcium and vitamin D supplements. On the other hand, CPB and cost-effectiveness estimates for most services were insensitive to the duration of morbidity and utility weights used to estimate QALYs. However, the CPB and cost-effectiveness estimates for vision screening, Chlamydia screening, hearing screening, advice to use calcium and vitamin D supplements, and osteoporosis screening were more sensitive to duration of morbidity and utility weights. In addition, the cost-effectiveness estimate for screening for problem drinking was very sensitive to several variables making any single point estimate a nearly arbitrary designation of a base-case estimate.

The scores for three services in Table 2 have the potential to change by ≥2 points. Due to uncertainty in the underlying data, many scores in the table may change by 1 point. Therefore, readers should use caution in interpreting differences in services of only 1 point.

Discussion

This study offers a tool to help decision makers at multiple levels choose where to improve utilization rates by indicating which services are most consequential and cost effective for the population or individuals. Thoughtful decisions based on a careful review of each

Table 2. Priorities among effective clinical preventive services

Services (short name)	Description	CPB	CE	Total
Aspirin chemoprophylaxis	Discuss the benefits/harms of daily aspirin use for the prevention of cardiovascular events with men ≥40, women ≥50, and others at increased risk.	5	5	10
Childhood immunization series	Immunize children: diphtheria, tetanus, pertussis, measles, mumps, rubella, inactivated polio virus, Haemophilus influenzae type b, hepatitis B, varicella, pneumococcal conjugate, influenza.	5	5	10
Tobacco-use screening and brief intervention	Screen adults for tobacco use, provide brief counseling, and offer pharmacotherapy.	5	5	10
Colorectal cancer screening	Screen adults aged ≥50 years routinely with FOBT, sigmoidoscopy, or colonoscopy.	4	4	8
Hypertension screening	Measure blood pressure routinely in all adults and treat with antihypertensive medication to prevent incidence of cardiovascular disease.	5	3	8
Influenza immunization	Immunize adults aged ≥50 against influenza annually.	4	4	8
Pneumococcal immunization	Immunize adults aged ≥65 against pneumococcal disease with one dose for most in this population.	3[a]	5	8
Problem drinking screening and brief counseling	Screen adults routinely to identify those whose alcohol use places them at increased risk and provide brief counseling with follow-up.	4	4[a]	8
Vision screening—adults	Screen adults aged ≥65 routinely for diminished visual acuity with Snellen visual acuity chart.	3	5	8
Cervical cancer screening	Screen women who have been sexually active and have a cervix within 3 years of onset of sexual activity or age 21 routinely with cervical cytology (Pap smears).	4	3	7
Cholesterol screening	Screen routinely for lipid disorders among men aged ≥35 and women aged ≥45 and treat with lipid-lowering drugs to prevent the incidence of cardiovascular disease	5[a]	2[a]	7
Breast cancer screening	Screen women aged ≥50 routinely with mammography alone or with clinical breast examination, and discuss screening with women aged 40 to 49 to choose an age to initiate screening.	4	2	6
Chlamydia screening	Screen sexually active women aged <25 routinely.	2	4	6
Calcium chemoprophylaxis	Counsel adolescent and adult women to use calcium supplements to prevent fractures.	3[a]	3[a]	6
Vision screening—children	Screen children aged <5 years routinely to detect amblyopia, strabismus, and defects in visual acuity.	2	4[a]	6
Folic acid chemoprophylaxis	Counsel women of childbearing age routinely on use of folic acid supplements to prevent birth defects.	2	3	5
Obesity screening	Screen all adult patients routinely for obesity and offer obese patients high-intensity counseling about diet, exercise, or both together with behavioral interventions for at least 1 year.	3	2	5
Depression screening	Screen adults for depression in clinical practices that have systems in place to assure accurate diagnosis, treatment, and follow-up.	3	1	4
Hearing screening	Screen for hearing impairment in adults aged ≥65 and make referrals to specialists.	2	2	4
Injury prevention counseling	Assess safety practices of parents of children aged <5 years and provide counseling on child safety seats, window/stair guards, pool fence, poison control, hot water temperature, and bicycle helmets.	1	3[a]	4
Osteoporosis screening	Screen women aged ≥65 and women aged ≥60 at increased risk routinely for osteoporosis and discuss benefits and harms of treatment options.	2	2	4
Cholesterol screening—high risk	Screen men aged 20 to 35 and women aged 20 to 45 routinely for lipid disorders if they have other risk factors for coronary heart disease, and treat with lipid-lowering drugs to prevent incidence of cardiovascular disease.	1	1[a]	2
Diabetes screening	Screen for diabetes in adults with high cholesterol or hypertension, and treat with a goal of lowering levels below conventional target values.	1	1	2
Diet counseling	Offer intensive behavioral dietary counseling to adult patients with hyperlipidemia and other known risk factors for cardiovascular and diet-related chronic disease.	1	1	2
Tetanus-diphtheria booster	Immunize adults every 10 years.	1	1	2

[a]Services in boldface are those with scores of 6+ for which data indicate that delivery to the U.S. population eligible for the services is likely ≥50%.

CE, cost effectiveness; CPB, clinically preventable burden.

Table 3. Additional QALYs saved if current percent receiving services increased

Services (short name)[a]	Current % receiving services nationally	Additional QALYs saved if current % receiving services increased to 90%[b]
Tobacco-use screening and brief intervention	35%[c]	1,300,000
Colorectal cancer screening	35%[d]	310,000
Influenza vaccine—adults	36%[f] among adults aged 50 to 64 years 65%[e] among adults aged ≥65 years	110,000
Breast cancer screening	68%[f]	91,000
Cervical cancer screening	79%[f]	29,000
Chlamydia screening	40%[g]	19,000
Pneumococcal vaccine—adults	56%[e]	16,000
Cholesterol screening	87%[f]	12,000
Hypertension screening	90%[f]	0
Based on limited available data, utilization rates of 50% were assigned to the following services:		
Aspirin chemoprophylaxis	50%	590,000
Problem drinking screening and brief counseling	50%	71,000
Vision screening—adults	50%	31,000

[a]See Table 2 for a description of each service. Childhood immunizations were omitted from the table due to high utilization rates and low prevalence of vaccine-preventable disease.
[b]Indicates additional lifetime QALYs saved if 90% of a cohort of 4 million were offered the service as recommended.
[c]The National Health Interview Survey (2001) and HEDIS performance data indicate that about 68% of smokers who visited a healthcare provider in the past year received advice to quit. However, only about 35% of smokers enrolled in commercial and Medicaid health plans reporting HEDIS performance data received brief counseling that involved discussion of medication and cessation strategies as recommended by the USPSTF (see The state of healthcare quality 2005, available at www.ncqa.org/Docs/SOHCQ_2005.pdf, accessed November 17, 2005).
[d]Based on use for screening purposes only of FOBT in last 2 years, sigmoidoscopy in last 5 years, and colonoscopy in last 10 years from National Health Interview Survey 2003 public use data set (www.cdc.gov/nchs/nhis.htm).
[e]National Health Interview Survey early release of selected estimates based on data from January to March 2005, available at www.cdc.gov/nchs/nhis.htm, accessed November 17, 2005.
[f]Behavioral Risk Factor Surveillance Survey 2002, available at www.cdc.gov/brfss/index.htm, accessed November 17, 2005.
[g]Based on 2004 data from Medicaid and commercial health plans that report HEDIS performance data (see The state of healthcare quality 2005, available at http://www.ncqa.org/Docs/SOHCQ_2005.pdf, accessed November 17, 2005).
FOBT, fecal occult blood test; HEDIS, Health Plan Employer Data and Information Set; QALY, quality-adjusted life year; USPSTF, U.S. Preventive Services Task Force.

score and the underlying data should lead to larger improvements in population health and more efficient allocation of resources in contrast with decisions based on incomplete data, noncomparable data, or no data at all. Details about the data used and analytical decisions made are available on the NCPP website (prevent.org/ncpp). The findings and methods are works in progress and will be improved even further as the data improve.

Readers should understand that all services in the ranking are recommended and ideally should be provided to all people in the target population. Also, there are other evidence-based services that were not included in the ranking (the cut-off date for USPSTF and ACIP recommendations was December 2004), and there are a number of potentially important services that lack enough evidence for the USPSTF to make a recommendation one way or another. To account for new recommendations as well as changes in evidence over time, the NCPP will guide an ongoing review and updating of the ranking. Readers should also keep in mind that the USPSTF evaluates only the effectiveness of services aimed at asymptomatic populations and only considers services one at a time. Some interventions not evaluated by the USPSTF may be consequential and cost effective in the presence of symptoms and/or when combined with other interventions.

All services that received scores of 7 or higher in this ranking also received scores of 7 or higher in the 2001 ranking (advising high-risk adults to consider using aspirin is a new service, and therefore was not in the 2001 ranking). Immunizing children and tobacco-use screening and brief intervention were at the very top of the ranking then as now. The cost-effectiveness score for tobacco-use screening and brief intervention increased from a 9 in 2001 to a 10 in this ranking as the result of a more detailed model that led to greater certainty that the service is cost saving. Chlamydia screening received a score of 7 in 2001, but received a score of 6 in this ranking. The CPB of Chlamydia screening has dropped relative to other CPB estimates because this is a different group of services than was evaluated in 2001. This does not reflect an absolute reduction in the value of Chlamydia screening for its target population.

This ranking included five services that were not yet recommended by the USPSTF when the 2001 ranking was completed: screenings for depression, diabetes, obesity, and osteoporosis, plus advising adults to consider the benefits of aspirin use. In addition, the ACIP and USPSTF have made changes to the target population for several services since the 2001 ranking was published: influenza vaccination was extended to peo-

ple aged 50 to 64, cholesterol screening was extended to adults aged over 65 and under 35 with cardiovascular risk factors, and mammography was extended to women aged 40 to 49. For each of these services, extending the target population resulted in higher CPB estimates, but lower cost-effectiveness estimates.

Seven counseling services included in the 2001 ranking were not included this time (listed in next paragraph). These are services for which USPSTF recommendations have been or would likely be changed to an "insufficient evidence" rating based on the modified USPSTF approach to recommending counseling services established by the current USPSTF since the 2001 ranking was published. Previously, the USPSTF recommended that counseling services be offered if there were strong evidence that behavior change produces risk reduction even in the absence of evidence for assessing the effectiveness of clinician counseling. According to its current methodology, the USPSTF does not recommend clinician counseling in the absence of sufficient high-quality evidence to determine whether counseling produces sustained beneficial changes in health outcomes and health behaviors.

As a result, the current USPSTF has given "insufficient evidence" ratings to the following services ranked in 2001: (1) counseling the general population of adults and children about physical activity and diet, (2) counseling children about preventive dental practices, (3) counseling adolescents to avoid or quit using tobacco, and (4) counseling adolescents to avoid or quit using alcohol and drugs. In each case, the USPSTF concluded that there was insufficient evidence to reach a conclusion about efficacy, and not evidence of insufficient efficacy. Additional services ranked in 2001 that would likely receive an "insufficient evidence" rating if evaluated today by the USPSTF include: (5) counseling adults on preventive dental care (which was combined with counseling children in the 2001 ranking); (6) counseling the general population on risks of STDs (including HIV) and measures to reduce risk; and (7) counseling older children, adolescents, and adults on safety practices.

The absence from the ranking of many counseling services aimed at modifying health behaviors highlights the critical distinction between the quality and availability of evidence on the importance of behavioral risk factors for disease and the quality and availability of evidence for clinical preventive services to modify these risk factors. Giving a low ranking or no ranking at all to clinical efforts to address behavioral risk factors (such as physical activity) has no bearing on the high priority for people to address these risk factors or for communities to address them. Also, some counseling services that the USPSTF does not currently recommend or that receive lower scores in this ranking might make a greater impact if the interventions were delivered at a higher intensity and with stronger clinical support systems than currently exist. This ranking is not intended to discourage clinical approaches to reducing major risk factors for disease, such as physical activity. It builds only on the areas for which the USPSTF and ACIP determined there was good evidence. For example, the only USPSTF recommendation related to addressing physical activity is limited to obese adults (see screening for obesity). The USPSTF found insufficient evidence to recommend behavioral counseling or other preventive interventions to encourage physical activity among overweight (but not obese) adults or with overweight children and adolescents.

Although there is still no direct evidence to support counseling adolescents to avoid or quit using tobacco, alcohol, and drugs, these services performed quite well in the 2001 ranking based on the assumption of nearly negligible adherence to clinician advice during the course of adolescence. Data for counseling adolescents to avoid tobacco were updated in 2005. Only 1 in 1000 adolescents must adhere with clinician advice to avoid tobacco for this counseling service to be cost saving.

Unfortunately, this ranking provides little guidance for a pediatric population. Most services on the list are aimed at adults, since incidence of disease is greater among adults, providing more opportunities for screening and chemoprevention. Many interventions have yet to be studied in children and adolescents. Effective clinical interventions for preventing or changing negative youth behaviors related to use of tobacco, alcohol, and drugs; physical activity; and nutrition are especially needed. These interventions have the potential to be both consequential and cost saving. Injury prevention counseling aimed at parents of young children received a low score for CPB in this ranking due to the small size of the target population (parents of children aged 0 to 4) relative to other services. In a list aimed at a pediatric population, this service would be a top priority; decision makers should take note of this service's relatively low cost per QALY saved.

It is not possible in a single article to explain all the reasons why some services performed better than others, but several examples may help readers understand the ranking. Despite substantial burden of disease, obesity screening and diet counseling received low scores due to poor adherence with recommendations to change behaviors. Osteoporosis screening received low scores due to the relatively low risk of hip fracture until women are very old, relatively low mortality, and costs of repeated screening. Osteoporosis screening has been found to be substantially more cost effective when analyzed as a one-time screen while assuming 100% adherence with alendronate therapy after the screen.[16] Depression screening received low scores due to its relatively small target population (limited to adults in clinical practices that have systems in place to ensure accurate diagnosis, treatment, and follow-up per the USPSTF recommendation), small benefit of early de-

tection relative to usual care, and minimal mortality prevented. Diabetes screening is limited to screening in adults with hypertension or hyperlipidemia per the USPSTF recommendation and, consistent with the evidence found in the USPSTF review,[17] included only the marginal cardiovascular benefits of lowering blood pressure in people with diabetes below conventional target values. Cholesterol screening among high-risk men and women under age 35 and 45, respectively, received low scores primarily due to the size of the target population. Older people at high risk—who have higher incidence of disease—were included in the cholesterol screening service for unselected populations, a service that performed much better in the ranking.

Healthcare systems and policy changes are critical to increasing the delivery of many clinical preventive services, including diet counseling, screening for problem drinking and brief counseling, immunizations, screening for tobacco use and brief intervention, and cancer screenings, among others.[18,19] For all these services, there is growing evidence that multicomponent systems changes, such as computerized reminder systems, registries, and provider education combined with performance measurement and feedback, are needed to integrate USPSTF recommendations successfully into routine clinical care and to achieve the full value of science-based prevention.[20,21]

Patient adherence with clinician offers to use services are lower for some than for others because attention, resources, and technology have yet to make some services acceptable to patients. Colorectal cancer screening is the best example of a service that is not yet as acceptable to patients as are many other preventive services currently. Stronger clinical support systems that improve patient adherence with medication use and behavior changes would also increase the impact and value of these services.

The NCPP chose to base the ranking (Table 2) on the delivery of the service to the entire population (an average analysis) rather than a marginal analysis. Data on risk characteristics among those not receiving services were not adequate to quantify the impact that services would have on those populations. Also, quality delivery rate data were lacking for many services. There are pros and cons to both approaches. By necessity, a marginal analysis would be based on national delivery rates. Therefore, decision makers would need to consider how their delivery rates differ from national rates and how the national rates influence the results. With the approach used here, decision makers need judge only whether delivery rates for the highest-priority services are high enough in the population for which they are responsible to focus additional effort on lower-priority services. Also, while total CPB indicates the absolute value of the service, marginal CPB might make it appear that a highly effective, well-delivered service, such as childhood immunizations, was less valuable. A marginal approach, on the other hand, would present a more direct picture of where to focus additional efforts, at least at the national level.

To provide additional guidance on national priorities, Table 3 offers a limited marginal analysis. Decision makers should consider how their own population's delivery rates differ from the national rates presented and should recognize that if people who are not currently receiving services are at substantially greater or lesser risk for disease than the average, the ordering in Table 3 could be different. However, the large differences in marginal CPB in Table 3 indicate that there would need to be substantial differences in either the delivery rates used in the table or the risk profiles of those not currently receiving the services to alter the relative marginal CPB for most services in that table.

It was obviously not feasible to incorporate all factors important to decision making into the ranking. Other issues that may be important for clinicians and healthcare decision makers, but are not reflected in the ranking, include the costs of systems changes to improve clinician delivery rates (which are not accounted for in the cost-effectiveness estimates), patients' perceived value of each service, reimbursement policies, mandates, performance measurement requirements, and disparities.

Apparent disparities in the use of preventive services and in health outcomes between racial and ethnic minority groups and the general U.S. population are a particular cause for concern. For example, only 45% of Hispanics received an influenza vaccination in 2004 compared to 65% of the total population aged ≥65 years.[3] However, the limitations of current data did not allow us to determine if priorities for racial and ethnic subpopulations would be different from the ranking in Table 2. Because data for subpopulations are increasingly being reported, the NCPP plans to issue report cards in future years that track the relative health and economic impact of disparities in the use and benefit of clinical preventive services.

The societal perspective used to estimate cost effectiveness followed PCEHM guidelines, and is not likely to be ideal for all decision makers. The societal perspective includes all costs and savings, except financial savings from reduced work loss, as this might lead to double-counting the value of time lost both in the cost-effectiveness ratio's numerator (as dollars saved) and denominator (as QALYs saved). Additional preventive services would be cost saving if such costs were used to estimate a full cost–benefit model rather than a cost-effectiveness analysis model. At present, the paucity of data on financial savings from reduced work loss prevents their use in a comprehensive comparison of evidence-based preventive services. Potential short- to medium-term productivity gains may be among the additional factors that employers (and health plans that

compete for employer contracts) consider in developing their own priority ranking.

In the societal perspective, patients' costs are considered for every service, including the value of patients' time associated with the preventive service and any follow-up. Placing a monetary value on patients' time used for preventive care assumes that individuals consider the time commitment when making decisions about health care and health maintenance, and that any time devoted to these behaviors has alternative uses (such as paid and unpaid work, leisure, and sleep) that are valuable to individuals. Time costs for services in this analysis are principally for, but not limited to, travel to clinic visits and participation in these visits. Obesity screening stands out as a service with significant time costs; to benefit, patients must comply with an intensive intervention, which is defined here as a 1-year weight management program, and maintain their physical activity levels over time. The NCPP chose to include only patient time costs associated with the initial screen and intensive intervention and to exclude patient time needed for maintenance of physical activity. The NCPP reasoned that those who maintain physical activity beyond the intervention do so because they get as much short-term benefit from physical activity as they did from the activities foregone and therefore have no opportunity costs for their time. The literature provides no guidance on this issue; other studies have measured patients' time costs for physical activity using different approaches than the one used here.[22–25] Users should keep in mind that obesity screening was substantially more cost effective when all patient time costs were eliminated from the analysis, and substantially less cost effective when time costs for long-term maintenance were included.

The methods used here may over-state the value of a service if another preventive service targeting the same health problem is simultaneously implemented. For example, widespread repeated counseling for tobacco cessation may reduce heart disease enough to affect the value of screening for high cholesterol. It is not certain that tobacco and high cholesterol are independent risk factors, and thus unclear whether the delivery of one service influences the value of the other. The same is true for other recommended preventive services that target heart disease risk factors (screening for hypertension, screening for obesity, and prescribing aspirin) and services that target fractures (calcium chemoprophylaxis, screening for osteoporosis, and vision screening for the elderly).

The literature on which to base decisions about the relative value of clinical preventive services is vast, inconsistent, and confusing. Thus, decision makers have scant guidance to determine which services matter the most for themselves, their patients, or the population. The goal of this study was to summarize the best available data on clinical preventive services to assist all types of decision makers in choosing where to focus their prevention efforts. Those who are currently less engaged in prevention also may be motivated by these findings to take the first steps necessary to improve the delivery of those clinical preventive services that will lead to the largest improvements in population health and most efficient allocation of resources.

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References

1. National Committee for Quality Assurance. The state of healthcare quality 2005. Washington DC: National Committee for Quality Assurance, 2005.
2. Centers for Disease Control and Prevention. National Health Interview Survey 2003, public use data set. Available at: www.cdc.gov/nchs/nhis.htm. Accessed November 2005.
3. Centers for Disease Control and Prevention. National Health Interview Survey. Early release of selected estimates based on data from January to March 2005. Available at: www.cdc.gov/nchs/nhis.htm. Accessed November 17, 2005.
4. Yarnall KSH, Pollak KI, Ostbye T, Krause KM, Michener JL. Primary care: is there enough time for prevention? Am J Pub Health 2003;93:635–41.
5. Rafferty M. Prevention services in primary care: taking time, setting priorities. West J Med 1998;169:269–75.
6. Smith RA, Wender RC. Cancer screening and the periodic health examination. Cancer 2004;100:1553–7.
7. Coffield AB, Maciosek MV, McGinnis JM, et al. Priorities among recommended clinical preventive services. Am J Prev Med 2001;21:1–9.
8. Maciosek MV, Coffield AB, McGinnis JM, et al. Methods for priority-setting among clinical preventive services. Am J Prev Med 2001;21:10–9.
9. Maciosek MV, Edwards NM, Coffield AB, et al. Priorities among effective clinical preventive services: methods. Am J Prev Med 2006;31:90–96.
10. Maciosek MV, Solberg LI, Coffield AB, Edwards NM, Goodman MJ. Colorectal cancer screening: health impact and cost effectiveness. Am J Prev Med 2006;31:80–89.
11. Maciosek MV, Solberg LI, Coffield AB, Edwards NM, Goodman MJ. Influenza vaccination: health impact and cost effectiveness among adults aged 50 to 64 and 65 and older. Am J Prev Med 2006;31:72–79.

12. Solberg LI, Maciosek MV, Edwards NM, Khandchandani HS, Goodman MJ. Repeated tobacco-use screening and intervention in clinical practice: health impact and cost effectiveness. Am J Prev Med 2006;31:62–71.
13. Maciosek MV, Edwards NM, Solberg LI, et al. Technical report of the National Commission on Prevention Priorities: methods update for priority setting among clinical preventive services. Washington DC: Partnership for Prevention, 2005. Available at: www.prevent.org.
14. U.S. Census Bureau. Statistical abstract of the United States: 2003 (123rd edition). Washington DC: Census Bureau, 2003.
15. Gold MR, Siegel JE, Russell LB, Weinstein MC. Cost-effectiveness in health and medicine. New York: Oxford University Press, 1996.
16. Schousboe JT, Ensrud KE, Nyman JA, Melton LJ 3rd, Kane RL. Universal bone densitometry screening combined with alendronate therapy for those diagnosed with osteoporosis is highly cost-effective for elderly women. J Am Geriatr Soc 2005;53:1697–704.
17. Harris R, Donahue K, Rathore SS, Frame P, Woolf SH, Lohr KN. Screening adults for type 2 diabetes: a review of the evidence for the U.S. Preventive Services Task Force. Ann Intern Med 2003;138:215–29.
18. Institute of Medicine. Priority Areas for National Action: Transforming Health Care Quality. Washington DC: National Academies Press, 2003.
19. Task Force on Community Preventive Services. The Guide to Community Preventive Services: What Works to Promote Health? New York: Oxford University Press, 2005.
20. Glasgow RE, Orleans CT, Wagner EH. Does the chronic care model serve also as a template for improving prevention? Milbank Q 2001;79:579–612, iv–v.
21. McAfee T, Thompson RS. Improving community-based prevention by transforming managed care organizations into health improvement organizations. J Public Health Manag Pract 1998;4:55–65.
22. Hatziandreu EJ, Pierce JP, Fiore MC, Grise V, Novotny TE, Davis RM. The reliability of self-reported cigarette consumption in the United States. Am J Public Health 1989;79:1020–3.
23. Diabetes Prevention Program Research Group. Within-trial cost-effectiveness of lifestyle intervention or metformin for the primary prevention of type 2 diabetes. Diabetes Care 2003;26:2518–23.
24. Hernan WH, Brandle M, Zhang P, et al. Diabetes Prevention Program Research Group. Costs associated with the primary prevention of type 2 diabetes mellitus in the diabetes prevention program. Diabetes Care 2003;26:36–47.
25. Eddy DM, Schlessinger L, Kahn R. Clinical outcomes and cost-effectiveness of strategies for managing people at high risk for diabetes. Ann Intern Med 2005;143:251–64.