

Lifetime Costs for Preventive Medical Services A Model

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BACKGROUND. Cost effectiveness and other issues relating to preventive health services have been widely discussed, but a computer search of the literature elicited no reports in which the lifetime cost of a patient's preventive services was calculated. The purpose of our study was to calculate the total lifetime cost of preventive medical services for idealized versions of male and female patients.

METHODS. We used the preventive screening recommendations of the US Preventive Services Task Force¹ as our standard. We developed a model using idealized patients who were asymptomatic, had no risk factors, and lived healthful lifestyles. We determined the typical charges in a specified marketplace for the office visits, procedures, laboratory tests, and purchases required to comply with the screening recommendations.

RESULTS. Lifetime charges ranged from \$5432.60 to \$7529.60 for men and from \$15,307.10 to \$18,525.10 for women.

CONCLUSIONS. Knowledge of the lifetime costs of preventive services may influence the decisions of patients, physicians, and insurance plans when purchasing or providing these services.

KEY WORDS. Preventive health services; health care costs; physical examination. (*J Fam Pract* 1999; 48:706-710)

Preventive services, such as immunizations and cervical cancer screening, have produced dramatic reductions in the morbidity and mortality associated with targeted diseases. Changing patients' health behaviors before clinical disease develops is an important aspect of preventive services. However, multiple barriers interfere with clinicians' intentions to provide recommended preventive services. These barriers include inadequate reimbursement for preventive services, insufficient time with patients to deliver these services, conflicting recommendations from different agencies, skepticism about intervention effectiveness, and concerns about the high cost of active interventions.¹ We quantified the lifetime cost of preventive medical services consistent with current recommendations, in an attempt to test the validity of the cost-associated barrier.

The value of clinical preventive services and the costs of prevention for an asymptomatic person have been topics of controversy for many years. The American Medical Association² recommended annual physical examinations of healthful persons in 1922. Each revision of the Association's publication produced additional recommendations, such as routine laboratory testing and the promotion of mental health care. The complete annual physical examination became a *de facto* standard of care in clinical prac-

tice. This comprehensive all-inclusive approach to preventive health care still exists in some places. Many physicians provide annual "executive physicals" that include a history and a physical examination, as well as a wide array of costly procedures, such as chest radiography, laboratory tests, electrocardiograms, and cardiac stress tests.

In 1975, Frame and Carlson³ questioned the value of yearly physical examinations and studied the potential value of periodic preventive services. Their landmark articles were followed by others that also challenged the usefulness^{4,5} of the annual physical examination. There are now more than 100 published recommended guidelines for preventive services, including those of the surgeon general, the American College of Physicians, and the American Cancer Society.^{6,9}

Today's realities of clinical practice challenge the concept of an all-inclusive approach to health care. The concept of evidence-based medicine is well established and accepted. Physicians must be aware of the benefits and harms to individuals of any services they provide. Additionally, policymakers are concerned with the cost effectiveness of all health care services. All activities must be justified, not only in terms of clinical effectiveness for an individual, but also for cost effectiveness within a population. Information on the most effective ways to use guidelines and recommendations for screening is forthcoming.¹⁰

Few organizations have published recommendations that cover the entire lifetime of a person. Recommendations are typically developed for specific age groups (eg, those by the American Academy of Pediatrics¹¹), or about specific disease processes (eg, those by the American Cancer Society⁹). The recom-

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recommendations from the American Academy of Family Physicians¹² cover all ages and both sexes. Those recommendations are in the process of revision. The second edition of US Preventive Services Task Force guidelines¹ also has recommendations for all ages and both sexes and was used as the basis for our study.

Although the cost effectiveness of individual preventive services has been reported elsewhere, the lifetime cost for an individual patient has not been described. The purpose of our study was to calculate in 1999-equivalent dollars the lifetime cost of routine recommended preventive services for an asymptomatic patient.

METHODS

We used the *US Preventive Services Task Force Guide to Clinical Preventive Services*¹ as the standard for evaluation. Readers interested in the costs associated with other organizations' recommendations can modify our final totals according to those recommendations.

The Task Force report provides a range of acceptable intervals rather than absolute timings for the recommended services. We developed minimum and maximum recommendation calculations using these guidelines. We recognize that clinicians will implement the recommendations as necessary for the individual patient.

We used idealized patients for our model. Each patient (1 man, 1 woman) was constructed to be completely asymptomatic, with a healthful lifestyle and no risk factors. The presence of risk factors, unhealthy lifestyle habits, and intervening illnesses would alter the choice or frequency of screening and interventions. For our model, we assumed that these patients did not become sexually active until age 18, had only one sexual partner, and produced 2 children. The man lived 72.4 years, and the woman 79 years (the average life expectancies in the United States).¹³ Each patient was followed from birth to death. Each patient had one physician for life, even though we recognize that no one physician could follow a patient through more than 70 years.

Costs and charges for each procedure, visit, or service vary across the United States. For modeling purposes, we chose typical charges in Cincinnati, Ohio. Charges can be adjusted for the appropriate locale. Informal comparisons were made among several local practices to assure that these charges were representative of the community. Similar procedures were followed for the other items analyzed, such as laboratory, radiology, pharmacy, and retail store charges. Office visit charges were based on the preventive medicine codes (99381-99387 for new patients and 99391-99397 for established patients). The age-specific breakdown for coding of preventive services is not the same as the

age-specific guidelines for the provision of the services. Only the birth visit was coded as a new patient visit. Although many preventive services are provided within the context of office visits for other problems, for our model we used an idealized system of preventive care in which preventive services were only provided in the context of office visits specifically arranged for that purpose. The provision of preventive services at the time of acute care visits may lower the overall costs of these services.

Charges are reported in 1999 dollars. Over a life span of more than 70 years, inflation would alter these dollar amounts. The framework we used for the study model was developed using the typical charges to the patient. Our report of charges to the patient represents what the patient would actually be billed for the service, whether it is an office visit, a laboratory test, or a purchased commodity, such as a bicycle helmet. What the patient is charged does not always represent what the patient actually pays and, therefore, may not be the true cost to the patient. For health care services provided by a physician, the patient may only have a relatively small out-of-pocket expense, such as a copayment. The patient may also bear the expense of sharing in the premium paid to the insurance company. In addition, what the physician charges for a given service may not reflect the true cost of the provision of the service. In some cases the costs may be higher than the charges; in some the costs may be lower. Also, some physicians may be reimbursed according to a fee schedule that is vastly different from the charges listed on an encounter form. Specific examples include capitated systems and discounted fee for service.

Charges for all recommended procedures, visits, and materials were added to determine the total lifetime costs of all preventive services (minimum and maximum recommendations) recommended by the US Preventive Services Task Force for an asymptomatic man and an asymptomatic woman during their lifetimes.

RESULTS

Table 1 displays the lifetime charges for a woman for preventive services delivered in the physician's office if the maximum Task Force recommendations were followed. Table 2 provides the same information for a man.

Table 3 shows the costs for items that a patient would need to purchase to be in compliance with the Task Force recommendations. The differences in costs between the woman and the man are because of variations in average life span and the recommendations for use of vitamins and folate as a preventive measure in women of childbearing age.

Table 4 provides a range of charges by sex for the maximum and minimum recommendations. We determined the maximum charge by adding the results of

TABLE 1

Office-Based Charges for the Lifetime Care of a Woman

Age	Recommended Preventive Health Service	Charge, in dollars	Age	Recommended Preventive Health Service	Charge, in dollars
Birth	Well-child visit, new patient (1)	75	11 to 16 years	Well-child visit (1)	90
	Ocular prophylaxis	19		dT	17
	Hepatitis B vaccine #1	32	18 to 24 years	Preventive visit (every 2 years)	4 x 95
	Hemoglobin electrophoresis	12		Pap (every 2 years)	4 x 25
	PKU	48		Chlamydia screen (every 2 years)	4 x 35
	T4	20			
1 to 2 weeks	Home visit (1)	55	25 to 44 years	Preventive visit (every 2 years)*	7 x 95
	Retest PKU	48			3 x 105
	Retest T4	20		Pap (every 2 years)	10 x 25
1 month	Well-child visit (1)	75	dT (every 10 years)	2 x 17	
	Hepatitis B vaccine #2	32			
2 months	Well-child visit (1)	75	45 to 50 years	Preventive visit (every 2 years)	3 x 105
	DPT	35		Pap (every 2 years)	3 x 25
	OPV	48		Cholesterol (every 5 years)	2 x 16
	Flu vaccine (HIB)	40			
4 months	Well-child visit (1)	75	51 to 65 years	Preventive visit (yearly)	15 x 105
	DPT	35		Fecal occult blood (yearly)	15 x 13
	OPV	48		Sigmoidoscopy (every 3 years)	6 x 119
	Flu vaccine (HIB)	40		Mammography (yearly)	15 x 119
				Pap (every 2 years)	7 x 25
6 months	Well-child visit (1)	75	66 to 70 years	Cholesterol (every 5 years)	4 x 16
	DPT	35		dT (every 10 years)	17
	OPV	48		Preventive visit (yearly)	5 x 115
	Flu vaccine (HIB)	40		Fecal occult blood (yearly)	5 x 13
	Hepatitis B vaccine #3	32		Influenza vaccine (yearly)	5 x 12
12 to 15 months	Well-child visit (1)	80	71 to death	Pneumococcal vaccine (once)	16
	MMR	75		Mammography (yearly)	5 x 119
	Varicella	65		Sigmoidoscopy (every 3 years)	119
	DPT	35		dT (every 10 years)	17
	OPV	48		Preventive visit	9 x 115
	Flu vaccine (HIB)	40		Fecal occult blood (yearly)	9 x 13
3.5 years	Well-child visit (1)	80	Influenza vaccine (yearly)	9 x 12	
	Vision screening		Sigmoidoscopy (every 3 years)	3 x 119	
5 years	Well-child visit (1)	85	dT (every 10 years)	17	
	DPT	35	Prenatal visits,	2 x 2900	
	OPV	48	delivery and labs		
	MMR	75			

Note: Rotovirus vaccine was yet to be recommended when the second edition of the Task Force recommendations was published. Changes in injected polio virus and hepatitis B had not yet occurred.

*There are different charges for preventive visits at 18 to 39 years and at 40 to 64 years.

PKU denotes phenylketonuria; T4, thyroxine; DPT, diphtheria-pertussis-tetanus vaccine; OPV, oral polio vaccine; HIB, *Hemophilus influenzae* type B vaccine; MMR, measles-mumps-rubella vaccine; Pap, Papanicolaou test; dT, deoxythymidine.

Table 1 (for women) or Table 2 (for men) with the appropriate total from Table 3. Minimum calculations included no visit at 3.5 years; no repeat phenylketonuria and thyroxine tests at a home visit; Papanicolaou tests every 3 years; mammography every 2 years, and only one sigmoidoscopy.

DISCUSSION

We estimated the lifetime charges to a patient for office-based care provided by a physician following the Task Force guidelines, and found them reasonable.

The cost of lifetime preventive care services for

TABLE 2

Office-Based Charges for Lifetime Care of a Man

Age	Recommended Preventive Health Service	Charge, in dollars	Age	Recommended Preventive Health Service	Charge, in dollars
Birth	Well-child visit, new patient (1)	75	3.5 years	Well-child visit (1)	80
	Ocular prophylaxis	19		Vision screening	
	Hepatitis B vaccine #1	32	5 years	Well-child visit (1)	85
	Hemoglobin electrophoresis	12		DPT	35
	PKU	48		OPV	48
	T4	20	MMR	75	
1 to 2 weeks	Home visit (1)	55	11 to 16 years	Well-child visit (1)	90
	Retest PKU	48		dT	17
	Retest T4	20			
1 month	Well-child visit (1)	75	21 to 34 years	Preventive visit (every 2 years)	7 x 95
	Hepatitis B vaccine #2	32		for blood pressure screening	
2 months	Well-child visit (1)	75	35 to 49 years	dT (every 10 years)	17
	DPT	35		Preventive visit for blood	3 x 95
	OPV	48		pressure screening (every 2 years)*	5 x 105
	Flu vaccine (HIB)	40		dT (every 10 years)	17
4 months	Well-child visit (1)	75	50 to 64 years	Cholesterol (every 5 years)	3 x 16
	DPT	35		Preventive visit (yearly)	15 x 105
	OPV	48		Fecal occult blood (yearly)	15 x 13
	Flu vaccine (HIB)	40		Sigmoidoscopy (every 3 years)	5 x 119
6 months	Well-child visit (1)	75	65 to death	Cholesterol (every 5 years)	4 x 16
	DPT	35		dT (every 10 years)	17
	OPV	48		Preventive visit	8 x 115
	Flu vaccine (HIB)	40		Fecal occult blood (yearly)	8 x 13
	Hepatitis B vaccine # 3	32		Influenza vaccine (yearly)	8 x 12
12 to 15 months	Well-child visit (1)	80	Sigmoidoscopy (every 3 years)	3 x 119	
	MMR	75	Pneumococcal vaccine (once)	16	
	Varicella	65	dT (every 10 years)	17	
	DPT	35			
	OPV	48			
	Flu vaccine (HIB)	40			

Note: Rotavirus vaccine was yet to be recommended when the second edition of the Task Force recommendations was published. Changes in injected polio virus and hepatitis B had not yet occurred.

*There are different charges for preventive visits at 18 to 39 years and at 40 to 64 years.

PKU denotes phenylketonuria; T4, thyroxine; DPT, diphtheria-pertussis-tetanus vaccine; OPV, oral polio vaccine; HIB, *Hemophilus influenzae* type B vaccine; MMR, measles-mumps-rubella vaccine; dT, deoxythymidine.

women is higher because of care related to pregnancies and a longer average life span. Actual charges will vary according to a number of factors, including whether the physician follows the minimum or the maximum Task Force recommendations, or those of another organization. Charges will also vary among different geographic regions. In addition, controversy still exists over what specific preventive measures are worthy of recommendation, what patient ages are appropriate for each measure, and how often they should be performed.

Personal costs to the patient and poor reimbursement to the physician are possible financial barriers to

the provision of preventive services. Patients who are required to pay out of pocket may be less likely to seek preventive care, and physicians may be less likely to provide such services if they do not receive appropriate reimbursement. Our model represents only the office-based component of preventive services. We made no attempt to address concerns such as time lost from work to obtain preventive care.

More research is necessary in the area of preventive health services. We need evidence-based approaches for evaluating screening measures for problems such as family violence, diabetes mellitus, dementia, depression, suicidal tendencies, and scoliosis. The

TABLE 3

Costs of Items Necessary for Patient Compliance with US Preventive Services Task Force Recommendations

Item	Total Cost
Smoke detectors (3)	\$20.91
Batteries, replaced yearly	\$308.10 (women)* \$280.80 (men)
Ipecac (1 bottle)	\$.97
Bike helmets (1 child, 1 adult)	\$31.96
Infant carrier (1)	\$28.96
Child car seat (1)	\$40.00
Multivitamin with folate (1 per day for 30 years)	\$547.20 (women only)

*Cost is higher because of longer average life span.

TABLE 4

Maximum and Minimum Charges for a Lifetime of Prevention Services

	Maximum	Minimum
Men	\$7529.60	\$5432.60
Women	\$18,525.10	\$15,307.10

Note: Charges are shown in 1999-equivalent US dollars.

Task Force did not find enough evidence to recommend for or against screenings for these conditions in particular. Research is also necessary to discover ways to lower the costs of medical care, and must continue toward determining the cost effectiveness of preventive services for society, as well as the individual.

CONCLUSIONS

Our model offers a blueprint to assess lifetime charges for preventive health services. The results of our analysis may help to address one barrier to the delivery of preventive care: concerns about total costs. With the knowledge that lifetime costs to the patient are no higher than the purchase price of some new cars, both physicians and patients can begin to assess the relative value of such services. Further study is needed to determine the impact of this knowledge on the behavior of patients, physicians, and health care insurers. By applying our model, each physician can develop an estimate of the

lifetime charges to a patient for the provision of preventive services and use this information to convince patients of the value of these services.

REFERENCES

1. US Preventive Services Task Force Guide to clinical preventive services. 2nd ed. Rockville, Md: US Preventive Services Task Force; 1996.
2. American Medical Association. Periodic health examination: a manual for physicians. Chicago, Ill: American Medical Association; 1947.
3. Frame PS, Carlson SJ. A critical review of periodic health screening using specific screening criteria. *J Fam Pract Part 1: selected diseases of respiratory, cardiovascular, and CNS.* 1975; 2:29-36. Part 2: selected endocrine, metabolic, and GI disease. 1975; 2:123-9. Part 3: selected disease of the genitourinary system. 1975; 2:189-94. Part 4: selected miscellaneous diseases. 1975; 2:283-9.
4. Breslow L, Somers AR. The lifetime health-monitoring program. *N Eng J Med* 1977; 296:601-8.
5. Canadian Task Force on the Periodic Health Examination. The periodic health examination. *Can Med Assoc J* 1979; 121:1194-254.
6. US Preventive Services Task Force. Guide to clinical preventive services: an assessment of the effectiveness of 169 interventions. Baltimore, Md: Williams and Wilkins; 1989.
7. US Department of Health, Education, and Welfare. Healthy people: the surgeon general's report on health promotion and disease prevention — background papers. Washington, DC: US Department of Health, Education, and Welfare, Government Printing Office; 1979. Publication (PHS) 79-55071A.
8. Medical Practice Committee, American College of Physicians. Periodic health examination: a guide for designing individualized preventive health care in the asymptomatic patient. *Ann Intern Med* 1981; 95:729-32.
9. American Cancer Society: ACS report on the cancer-related checkup. *CA Cancer J Clin* 1980; 30:194-232.
10. Barratt A, Irwig L, Glaszion P, et al, for the Evidence-Based Medicine Working Group. Users guide to the medical literature, XVII: how to use guidelines and recommendations about screening. *JAMA* 1999; 281:2029-34.
11. American Academy of Pediatrics, Committee on Practice and Ambulatory Medicine. Recommendations for preventive pediatric health care. *Pediatrics* 1995; 96:373-4.
12. American Academy of Family Physicians. Age charts for periodic health examination. Kansas City, Mo: American Academy of Family Physicians; 1994. Reprint no. 510.
13. Singh GK, Kochanek KD, MacDorman MF. Advance report of final mortality statistics, 1994. Monthly vital statistics report. Hyattsville, Md: National Center for Health Statistics; 1996; 45:19.