The Use of Preventive Services by the Elderly

January 1989

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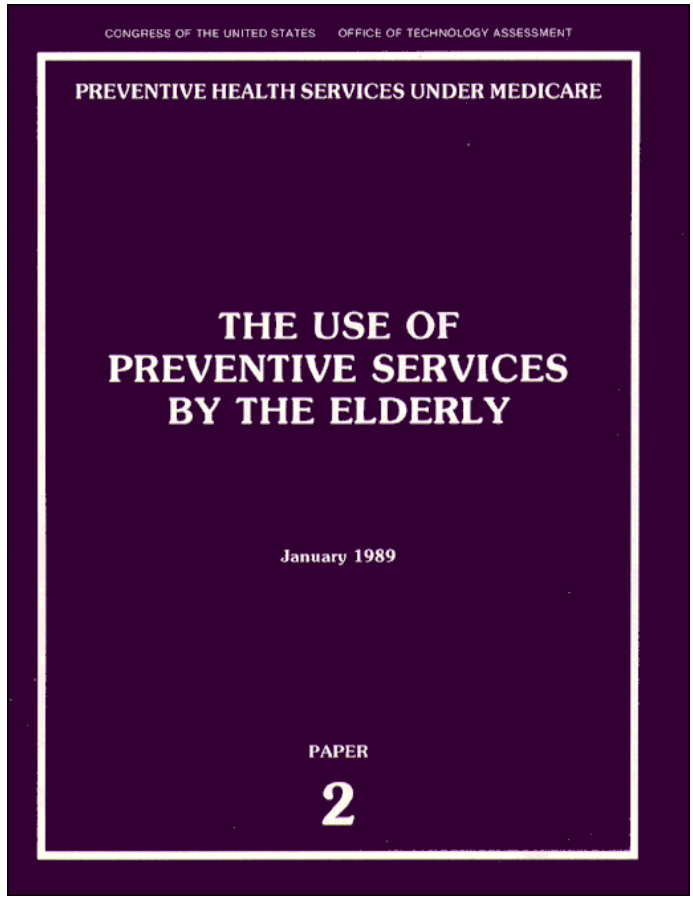

FOREWORD

Interest in health promotion and disease prevention strategies for the elderly has grown in the last ten years, partly as a result of advancing knowledge in these areas and partly due to the search for ways to moderate the rising cost of health care in this growing segment of the population. Reflecting this interest, the House Committee on Ways and Means requested that OTA analyze the effectiveness and costs of providing selected preventive health services to the elderly under the Medicare program. The Senate Labor and Human Resources Committee has also requested that OTA provide information on the value of preventive services for the American people.

This Staff Paper, *The Use of Preventive Services by the Elderly, is* the second in a series of papers being prepared in response to these requests. Understanding the use of preventive services by the elderly is an important component of assessing their effectiveness as Medicare benefits. In this paper we review both new and previously published data on the proportions of elderly currently receiving a variety of preventive health services; we examine factors associated with whether the elderly receive these services; and we analyze the likely implications for Medicare if preventive health services were offered as covered benefits.

The first paper in this series on "Preventive Health Services Under Medicare" examined glaucoma screening as a potential- Medicare benefit. Subsequent papers will assess screening for cholesterol, cervical cancer, and colorectal cancer, and will analyze broad issues related to Medicare financing of preventive services for the elderly.



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The Use of Preventive Services by the Elderly

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in OTA's Series on
Preventive Health Services Under Medicare

Carol Guntow prepared this Staff Paper for publication.

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In recent years, clinicians, academics, and policy makers have begun to examine the potential benefits of services to promote health or to prevent disease, disability, or death in the elderly. Although Medicare, the Federal program responsible for paying the bulk of the noninstitutionalized elderly's health care bills, currently pays for few preventive services, Congress has several proposals pending to expand Medicare coverage of these procedures. In this paper, OTA examines the implications of potential Medicare coverage for the use of preventive services by analyzing current use and the determinants of that use.

How Many Elderly Use Preventive Services?

OTA found few sources that measure the use of preventive services by the elderly. The data that are available (summarized in table 3 in the text of the paper) suggest two main conclusions:

- The use of preventive services by the elderly varies according to the type of service from a low of 20 to 30 percent for routine fecal occult blood testing in some sites to a high of 93 percent for blood pressure measurement. These differences cannot be explained by differences in the periods of time over which use is measured.
- Rates of use of specific services show a high level of consistency across studies, despite differences in methods.

Trends in available data suggest that the use of these procedures has increased over the last 15 years. Data also indicate that if an elderly person receives any preventive services, he or she is likely to receive multiple services.

Which Elderly Use Preventive Services?

Studies to isolate factors associated with the use of preventive services fall into two categories:

- those that focus on the behavior of patients, and
- those that focus on the behavior of health care providers and organizations.

Most of the studies in both of these categories examine preventive service use among the nonelderly. An analysis of data for the over-65 population in the 1982 National Health Interview Survey (NHIS) found that, controlling for other factors, the probability that an elderly person used each of five selected preventive services--glaucoma screening, eye exams, blood pressure measurement, breast exares, and Pap smears--was consistently related to:

- being male (for the three services available for both men and women),
- being younger (although still over-65),
- having more education,
- having greater family income,
- having some health insurance in addition to Medicare,
- living in a metropolitan area, and
- having spent more days in bed during the previous year.

OTA found that receiving health care through a prepaid health plan was not related to the use of any preventive service. However, so few people in the study sample belonged to prepaid plans that it may not have been possible to find a statistically significant effect. Race, living alone, and having some limitation in activity had no clear or consistent effect on the use of the five services studied.

Other studies of the relationship between patient characteristics and the use of preventive services have had similar findings.

Among health care providers, physicians play a key role in the provision of preventive services. The evidence suggests that gaps exist between physicians' knowledge and experts' recommendations on the use of preventive services as well as between physicians' knowledge or beliefs and actual practice. These gaps may be more prominent in relation to elderly patients. While they may suggest a shortcoming in physicians' performance, they could also indicate that physicians take individual patients' situations into account when ordering preventive services.

Other insights into the importance of health care providers in determining whether the elderly receive preventive services come from trials designed to improve compliance with expert recommendations. These studies indicate that health care organizations can organize themselves to affect the percentage of individuals receiving such services. Strategies suggested in the literature worthy of further study include:

- targeting groups in need of prevention,
- using non-physician medical professionals to deliver services, and
- generating reminders to physicians and patients about the periodic need for preventive services (especially with the aid of computerized record-keeping systems).

Although OTA's analysis of preventive service use showed that health maintenance organizations (HMOs) had no discernible effect on elderly enrollees' preventive activities, the review of the literature on provider behavior indicates that HMOs and other group practices with centralized administration and record-keeping may have potential for increasing the use of such services.

Implications of Medicare Coverage for the Use of Preventive Services by the Elderly

The findings of this study have three main implications for potential Medicare coverage of preventive services:

- Reducing patients' out-of-pocket expenses for preventive services through Medicare would probably increase the percentage of elderly receiving preventive care. For four of the five services examined in detail by OTA, having some insurance coverage beyond Medicare is associated with about a 10 percent increase in the likelihood of receiving each service.

However, there are three caveats to this finding:

(1) OTA's analysis measured the presence of insurance that reduced patients' total out-of-pocket health care expenditures, not direct coverage of preventive services. The effect of direct coverage on use may be different from the effect observed in OTA's analysis.

(2) The association between insurance and use may not always reflect a direct cause and effect. Rather, some people may be likely both to buy supplemental insurance and use preventive services out of concern for their own health.

(3) OTA's analysis suggests that insurance coverage alone would not be sufficient to induce many elderly to avail themselves of preventive services.

- Medicare coverage of preventive services may indirectly increase the use of preventive services by raising interest in preventive care among non-Medicare health care consumers, providers, and payers. Such coverage would, in effect, place the authority of the Federal Government behind the covered services. OTA found no existing data to estimate the existence or magnitude of this potential effect.
- Because large numbers of elderly people already use preventive services, expansion of Medicare to cover preventive procedures will represent an immediate boost in the program's financial obligations even if increases in use are minimal or nonexistent. While Medicare may already pay for some screening services incorrectly labeled as diagnostic procedures, Medicare coverage would still transfer a large portion of the current costs of preventive services from patients or other payers to the Federal Government.

Other Implications for Policy

Among other factors important in determining whether the elderly receive preventive services, a few such as gender, age, education, income, rural or urban residence, and bed days could be useful in helping policy makers target educational efforts on the need for preventive services to those elderly at highest risk of not complying with expert recommendations. The relationship between use and educational level suggests that policy makers should carefully consider the media they employ to promote preventive service recommendations, benefits, and other programs they undertake. Pamphlets or other materials that rely heavily on the written word are not as effective for the less well-educated who also have a relatively higher risk of not receiving preventive procedures. Policy makers could consider using visual media to communicate their messages to such groups.

Some of the factors important to the elderly's use of preventive services, such as income or educational level, are unlikely to be the focus of policy efforts designed solely to increase the use of preventive services. However, changing these factors for some other purpose might result in increases in use.

The analysis in this paper concentrates on those services most often raised in congressional discussions of prevention under Medicare--screening and immunizations. The conclusions presented above may have limited applicability to consideration of other preventive services such as health risk appraisals, health education, counseling services, or prevention of disability among elderly suffering from chronic disease.

In 1984, personal health care expenditures for the 28 million Americans over the age of 65 totaled $120 billion, nearly all of which went toward the treatment of existing conditions rather than to screening for or preventing health problems (85). Recently, however, policy makers, health advocates, and medical practitioners have begun to focus greater attention upon the potential of preventive medicine for the elderly. As the elderly population has grown, physicians and decisionmakers have looked to preventive services as a possible means of extending life, reducing morbidity and disability, and controlling health care costs (67,50). Congress has recently mandated studies of community-based preventive health service programs for the elderly and expanded Medicare coverage of certain services, including screening mammography and some immunizations (34).

This paper has three purposes:

- to summarize existing professional recommendations for older adults' use of preventive health services,
- to estimate the percentage of elderly who currently use such services, and
- to identify the factors related to elderly individuals' use of preventive care with particular attention to the potential effects of Medicare coverage.

The information brought together in this paper has two major policy implications. First, in order to estimate the impact of Medicare coverage of preventive services on Medicare program expenditures, one must know the number of potential users. While current rates of use alone may not adequately predict use under expanded third-party financing of preventive services, examination of existing literature and data provides insight into factors associated with use. In particular, such analysis reveals the relative importance of Medicare coverage in removing barriers to use for elderly Americans.

Planners and administrators of disease prevention for the elderly also benefit from an analysis of current use. By understanding those factors that affect whether older people accept and receive preventive services, Congress may be able to target initiatives where they will be most effective or most needed. Where supported by the evidence, this paper points out such implications for public policy.

Types of Preventive Services

The traditional taxonomy of prevention distinguishes among primary, secondary, and tertiary prevention (38,56). *Primary prevention* refers to activities designed to avoid disease or other conditions that adversely affect health. Immunizations are one example of primary prevention. *Secondary prevention* includes efforts to identify existing conditions that could cause illness and disability before the appearance of clinical symptoms, or to minimize the progression of disease. Disease screening is one form of secondary prevention. *Tertiary prevention* refers to efforts to control irreversible chronic conditions in order to avoid disability or death. Kane, et al., have suggested that this typology does not adequately distinguish among preventive services, especially those targeted toward the chronic conditions common among the elderly. For example, while diet change can be a means of primary prevention of hypertension, treatment of existing hypertension is also primary prevention of stroke.

To avoid such ambiguities, this paper simply distinguishes among *immunizations*, *disease screening*, and *educational or counseling services*. Table 1 lists specific examples of each category of prevention. While the list of services in table 1 is not exhaustive of all preventive services applicable, it does include the procedures examined in this paper.

Table 1.--Selected Potential Clinical Preventive Services for the Elderly

Immunizations
■ Influenza
■ Tetanus
■ Pneunococcua
■ Hepatitis B[b]
Screening
■ Cancer screening:
-Breast cancer (clinical examination; mammography)
-Colorectal cancer (occult blood stool; sigmoidoscopy)
-Cervical and uterine cancer (clinical examination; Pap smear; endometrial biopsy)
-Prostate cancer (clinical examination; ultrasound)
-Skin cancer (clinical examination)
■ Blood pressure measurement
■ Vision examination
■ Glaucoma screening
■ Hearing test
■ Cholesterol measurement
■ Mental status/dementia
■ Osteoporosis (standard x-ray; quantitative CT; other radiological techniques)
■ Diabetes screening
■ Asymptomatic coronary artery disease (exercise stress test)
■ Dental health assessment
■ Multiple health risks appraisal/assessment
■ Functional status assessment
■ Depression screening
Screening for hyperthyroidism
Education and Counseling
■ Nutrition
■ Weight control
m Sinking cessation
■ Home safety/injury prevention
■ Stress management
■ Appropriate use of medications
■ Alcohol use
■ Exercise

Abbreviation: CT =computed tomography.

[a]Currently covered by Medicare.
Currently covered by Medicare for high risk patients.

SOURCE: Office of Technology Assessment, 1989.

Preventive Services and Medicare

In defining preventive services and measuring their use, this paper focuses on the implications for their potential coverage under Medicare. This perspective limits the preventive interventions analyzed to personal health services offered to individuals. This review does not examine mass media education programs targeted toward the elderly.

As enacted in 1965, Medicare covered no preventive services. It paid for procedures on a "diagnostic" basis only--that is, when the patient has a symptom or a previous diagnosis for a condition. However, because treatment of most diagnosed conditions is covered, Medicare does pay for much tertiary prevention designed to control existing chronic conditions. In addition, some physicians probably receive payment for screening services they incorrectly label as "diagnostic." The extent of this *de facto* coverage of prevention has gone unmeasured.

In recent years, however, Congress has incrementally added coverage of some immunizations and screening services. These include hepatitis B immunizations for beneficiaries at high risk of contracting the disease and pneumococcal pneumonia vaccinations for all beneficiaries. The Medicare Catastrophic Coverage Act of 1988 (Public Law 100-360) includes coverage of up to $50 for biannual screening mammographies beginning in 1990. In addition, Congress has mandated that the Health Care Financing Administration (HCFA) fund demonstrations of influenza immunization coverage, and of therapeutic shoes for diabetics, and several community-based demonstration projects to analyze health outcomes and costs associated with the provision of screening, health risk appraisals, education, and counseling to Medicare beneficiaries,

Additional proposals brought before the 100th Congress included coverage of Pap smear screening for cervical cancer and a physical examination with medical history upon enrollment in Medicare or on a periodic basis.

3. RECOMMENDATIONS OF PROFESSIONAL AND EXPERT GROUPS FOR THE USE OF PREVENTIVE SERVICES BY OLDER ADULTS

One way to measure the use of preventive services is to compare the actual behavior of individuals with the frequency of use recommended by expert groups. Numerous groups have provided recommendations about the periodicity with which the elderly should receive particular immunizations and screening services. In interpreting the medical evidence on frequency of use, these expert groups vary in the criteria they employ in developing recommendations.

Table 2 summarizes several selected sets of recommendations made by professional or expert groups for older adults, primarily for those over 65 years old. The summary is not comprehensive; rather it includes a range of views on the use of preventive services analyzed in this paper.

The most comprehensive guidelines come from the two governmental task forces. Over the last ten years, the Canadian Task Force on the Periodic Health Examination has analyzed medical evidence about the effectiveness of preventive services and made recommendations for Canadian citizens (18). The U.S. Preventive Services Task Force has engaged in a similar exercise and recently published some of its findings. The task force will publish its full report in 1989 (39,43,79).

Among other U.S. governmental organizations, individual institutes within the National Institutes of Health (NIH) have made recommendations for cancer and coronary heart disease screening (37,77,78). Some of these recommendations result from intramural efforts within NIH, while others are the product of consensus development conferences that bring together experts and interested organizations. Additional guidelines come from professional societies such as the American College of Physicians (4,5), the American Medical Association (68), the American Academy of Ophthalmology (2), the American Optometric Association (9), the American College of Obstetrics and Gynecology (42), and the American College of Radiology (6) as well as health consumer organizations such as the American Cancer Society (3), the American Society to Prevent Blindness (10), and the American Heart Association (8). As table 2 indicates, there is nearly complete agreement among the included groups making recommendations for immunizations for the elderly. For screening services there is a high degree of consistency among groups, but some disagreement does exist.

Table2. --Published Recommendations for the Use of Selected Preventive Services by Older Adults

Preventive service	CDC[a]	ACP[b]	NIH[c]	CTF[d]	USPSTF[e]	Professional societies[f]	Consumer organizations9
Tetanus immunization	Booster every 10 years if primary series has been done	Booster every 10 years		Booster every 10 years	Booster every 10 years		
Pneumococcal immunization	Over age 65--once	Over age 65--once		High risk patients--once	Over age 65--once		
Influenza immunization	Over age 65--every year	Over age 65--every year		Over age 65--every year			
Occult blood in stool			NCI: over age 50--every year				ACS: over age 50--every year
Sigmoidoscopy			NCI: over age 50--every 3-5 years				ACS: over age 50--every 3-5 years after 2 negative tests
Digital rectal exam			NCI: over age 40--every year	Not recommended for prostate cancer; no recommendation for enlarged prostate screening			ACS: over age 40--every year
Clinical breast examination		Considered in conjunction with mammography	NCI: over age 50--every year	Every year from age 50 to 59	Over age 40--every year	ACR: over age 35--every year (with monthly breast self-examination) ACOG: advises following ACS guidelines	ACS: over age 40--every year (with monthly breast self-examination)
Mammography		Says screening with mammography is effective; does not specify frequency or when to start; says screening women aged 50 to 59 saves lives	NCI: over age 50--every year	Between ages 50 and 59--every year	Over age 50--every year	ACR: over age 50--every year ACOG: advises following ACS guidelines AMA: between ages 40 and 49--every one to two years; age 50 and over--every year	ACS: over age 50--every year

Table 2.--Published Recommendations for the Use of Selected Preventive Services by Older Adults (Continued)

Preventive service	CDC[a]	ACP[b]	NIH[c]	CTF[d]	USPSTF[e]	Professional societies[f]	Consumer organizations
Pap smear			MCI: over age 18 or if sexually active--3 consecutive annual Pap smears and pelvic exams with negative results, then less frequently at discretion of physician	Every 5 years from age 35 to age 60; screening should continue if prior smears have been abnormal		ACOG, AMA, ANA, AAFP, AND AWJA: support NCI guidelines	ACS: supports NCI guidelines
Cholesterol screening			NHLBI: over age 20--every 5 years				AHA: supports NHLBI recommendations
Serum glucose				Not recommended without family history of diabetes or previous circulatory problems			ADA: people at risk should be screened (no frequency specified) AHA: every 5 years from age 20 to 75; optional after age 75 if baselines are uell-documented
Blood pressure			NHLBI: over age 18--at least every 2 years, depending previous reading	Over age 65--every 2 years			AHA: every 5 years starting at age 20
EKG				Recommended for symptomatic adults only			AHA: at ages 20, 40, and 60
Vision examination including glaucoma screening by tonometry				Not recommended		AOA: over age 40--every year MO: over age 40--every 2 to 5 years	ASPB: over age 35--every 2 years

able 2.--Published Recommendations for the Use of Selected Preventive Services by Older Adults (Cont'd)

	CDC[a]	ACP[b]	NIH[c]	CTF[d]	USPS F[e]	on oc	on ume on
examination							ACS: over age--40 every year AHA: every 5 years from age 20 to 60; every 2.5 years from age 61 to 75; over 75--every year

Abbreviat ons: AA me ademy ... AAO = American Academy of Ophthalmology; ACOG = American College of Obstetricians and Gynecologists; ACP = American College of Physicians; ACR = American College of Radiologists; ACS = American Cancer Society; ADA = American Diabetes Association; AHA = American Heart Association; AMA = American Medical Association; AMWA = American Medical Women's Association; ANA = American Nurses Association; AOA = American Optometric Association; CDC = Centers for Disease Control; CTF = Canadian Task Force; EKG = electrocardiogram; NCI = Nat onal Cancer Institute; NIH = National Institutes of Health; USPSTF = United States Preventive Services Task Force.

[a]Centers or Disease Control, Publ c Health Service, U.S. Department of Hea th and Human Serv ces, Adult Immunizations: Recommendations of the Immunization Practices Committee, undated.

[b]Immunizations: American College of Physicians, Committee on Immunizations, Guide For Adult Immunization Philadelphia, PA, 1985; clinical breast examination and mammography: American College of Physicians, Health and Public Policy Committee, "The Use of Diagnostic Tests for Screening and Evaluating Breast Lesions," Annals of Internal Medicine 103:143-146, 1985.

[c]Cancer: Early Detection Branch, Division of Cancer Prevention and Control, National Cancer Institute, National Institutes of Health, U.S. Department of Health and Human Services, "Working Guidelines for Early Cancer Detection: Rationale and Supporting Evidence to Decrease Mortality," (Bethesda, MD: December 1987); cholesterol: National Cholesterol Education Program, National Heart, Lung, and Blood Institute, National Institutes of Health, U.S. Department of Health and Human Services, "Report of the Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults," (Bethesda, MD: October 1987); blood pressure: 1988 Joint National Committee, "The 1988 Report of the Joint Nat onal Committee on Detection, Evaluation, and Treatment of High Blood Pressure," Arch. Intern. Med. 148(5):1023-1038, 1988.

[d]Canadian Periodic Health Examination Task Force, "The Periodic Health Examination," Canadian Medical Association Journal 193-1254, 979; and 130(10):1276-1292, 1984.

[e]Preventive Services Task Force, U.S. Department of Health and Human Services, "Recommendations for Breast Cancer Screening," J.A.M.A. 257(16):2196, 1987; F.M. LaForce, "U.S. Preventive Services Task Force: Immunizations, Immunoprophylaxis, and Chemoprophylaxis To Prevent Selected Infections," J.A.M.A. 257(18):2464-2470. 1987.

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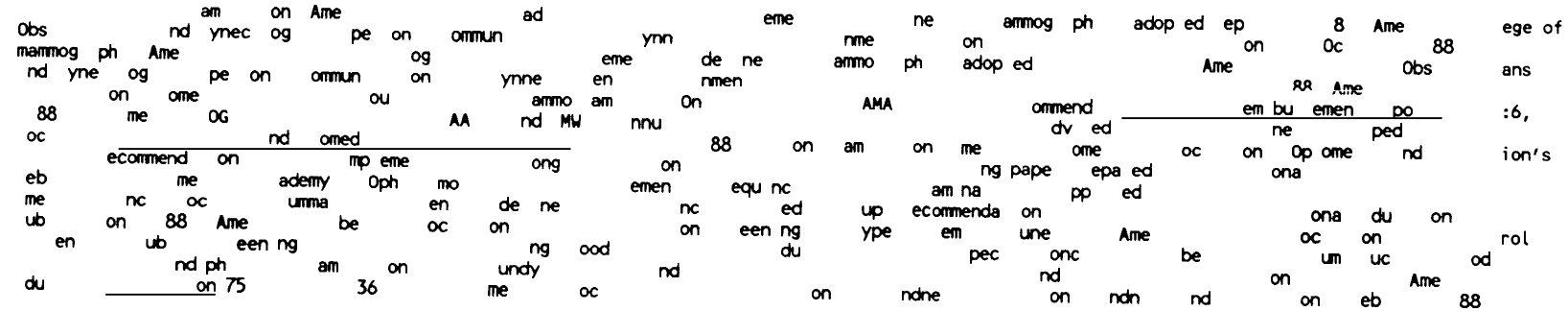

SOURCE: Office of Techno ogy Assessment, 1989.

While a large empirical literature exists on the use of medical services in general, few studies concentrate on preventive services and fewer still analyze use of these services by the elderly.[1] Apart from the analyses presented for the first time in this paper, only nine studies offer empirical evidence about the use of preventive services among older adults. Appendix C summarizes the scope and methods of each of these studies.

Because of the small volume of research examining preventive service use by the elderly, this paper also draws upon empirical investigations of use by the non-elderly. Appendix D describes 35 studies in this category. Several of these studies examine how age affects the use of preventive services and offer insight into the behavior of older patients in seeking out such care.

Sources of Data

Table 3 presents comparative estimates of the percentages of elderly people using 17 preventive services within specified periods of time. Three of the seven sources contain national estimates. OTA analyzed data from the 1982 National Health Interview Survey (NHIS). (See appendix E for a description of the NHIS.) Results of this analysis, showing the percentage of the elderly who have received five preventive services--glaucoma screening, eye exams, blood pressure measurement, breast exams, and Pap smears -- within periods of time roughly similar to the intervals suggested by expert groups are shown in the sixth column of the table.

The second source of national estimates in table 3 comes from a survey conducted by the Gallup Organization every 3 or 4 years for the American Cancer Society (ACS). This household, mail survey examines individuals' knowledge of cancer risk factors and the frequency with which they receive certain screening tests (28). Gallup publishes results by gender, age, and selected demographic variables. Although the study does not present findings for Medicare-eligible respondents as a separate group, it does give results for individuals over 50 years old.

These two studies rely on respondents' self-reported behavior, which may affect the accuracy of the estimates. The direction of this potential bias is unclear. On the one hand, lack of familiarity with medical services may cause respondents not to know that they had received a given service, and hence, to underreport use. On the other hand, respondents may perceive preventive behavior to be socially desirable and may inflate the use they report to the interviewer. The relative importance of each of these biases in affecting the estimates is unknown.

The third national data source is the U.S. Immunization Survey conducted annually by the Centers for Disease Control (CDC) until 1985. A household survey, it provides data on the percentages of individuals immunized against influenza and pneumococcal pneumonia, broken down by age (including people over 65)(26).

Another set of estimates, found in the seventh column of table 3, comes from a large, urban "closed-panel"* health maintenance organization (HMO). This HMO pro-

1 Many studies have been carried out on the use and correlates of use of non-preventive medical services and dental care by the elderly. However, because the purpose, nature, and likely determinants of use of these services differ markedly from those of preventive health services, such studies are not reviewed in this paper.

2 In a 'closed panel" HMO, enrollees must receive health care from a physician employed directly by the HMO usually in a clinic run by the organization.

Table 3--- Percent of Elderly People Receiving Preventive Services Within Specified Periods of Time

Service	Study[a]								
	ACS[b]	Brown[c]	CDC[d]	Chao[e]	Lazaro[f]	OTA[g]	OTA[h]	Rundall[i]	Winawer[j]
Blood pressure									
Men				93		91			
Women				93		92			
Breast exam									
Women	48 (I<yr)					53 (<2 yr)			
Breast self-exam									
Women									
Monthly or more frequently				37					
Less frequently				39					
Cholesterol									
Men							75		
Women							73 (5yr)		
Complete check-up					By age, not sex:				
Men	62				60-74=45		49		
Women	67 (<l yr)				75+=24 (WA)		51 (1 yr)		
Eye examination									
Men						73	72		
Women						76 (<3 yr)	75 (2 yr)		
Fecal occult blood									
Men	20			30			49		
Women	19			29			52	70-80	
Total									
Glaucoma screening									
Men						64			
Women						70 (<3 yr)			
Influenza vaccine									
Men			23				58		
Women			(both sexes; 1 yr)				57 (1 yr)		
Mammography									
Women		6 (ever)		11 (1 yr)					
Pap smear									
Women	60 (<=3 yr)			63 (1 yr)		50 (<4 yr)	71 (3 yr)		
Pneumococcal vaccine									
Men			11				38		
Women			(both sexes; 1 yr)				30 (ever)		

(Cont'd)

Table 3--- Percent of Elderly People Receiving Preventive Services Within Specifed Periods of Time (Cent'd)

Service	study[a] ACS[b]	Brown[c]	CDC[d]	Chao[e]	Lazaro[f]	OTA[g]	OTA[h]	Rundall[i]	Winawer[j]
Procto exam									
Men	15								
Women	12								
	(1 yr)								
Rectal exam									
Men	28								
Women	28								
	(1 yr)								
Sigmoidoscopy									
Total									95
									(N/A)
Swine flu vaccine									
Sample estimate								72	
Population est.								63	
								(N/A)	
Tetanus vaccine									
Men							30		
Women							26		
							(10 yr)		

Abbreviations: HMO = health maintenance organization; NHIS = National Health Interview Survey.

[a] Full descriptions of methodology of each study can be found in table 4.

[b] Gallup Organization, "The1987 Survey of Public Awareness and Use of Cancer Detection Tests: Summary of Findings," Conducted for the American Cancer Society (Princeton, NJ: Gallup Organization, January 1988); n=952; age=50+.

[c] J.T. Brown and B.S. Hulka, "Screening Mammography in the Elderly: A Case-Control Study," J. Gen. Intern. Medicine d 3:126-131, 1988; n=309; age=60+.

D.S. Fedson, "Influenza and Pneumococcal Immunization Strategies for Physicians," Chest 91:436-443, 1987; n=not given; age=65+.

[e] A. Chao, A. Paganini -Hill, R.K. Ross, et al., "Use of preventive Care by the Elderly," Preventive Medicine 16:710-722, 1987; n=11,888; age range=48--100; mean age=74.4.

[f] C.M.Lazaro, D.N. Logsdon, and R. Meier, "Utilization of Preventive Health Services by the Elderly," Insure Project, Lifecycle Preventive Health Services, New York, NY, presentation to the American Pyschological Association Convention, Aug. 31, 1987, New York, NY; n=713; age=60+. Use rates from Lazaro study are proportions of all persons invited to receive checkup who actually received the service. Proportions of persons accepting the invitation who actually received the checkup are as follows: ages 60-74=.65; ages 75+=.53.

[g] Office of Technology Assessment/NHIS, 1988a; n=11434; age=65+.

[h] Office of Technology Assessment/HMO, 1988b; n=5394 for checkup, influenza, and fecal occult blood; 3371 for eye exams and Pap smears; 2322 for cholesterol; and 894 for pneumococcal and tetanus; age=65+.

[i] T.G. Rundall and J.R.C. Wheeler, "Factors Associated With Utilization of the Swine Flu Vaccination program Among Senior Citizens in Tompkins County," Medical Care 17:191-200, 1979; sample n=232; population N=5000; age=65+.

[j] S.J. Winawer, M. Baldwin, E. Herbert, et al., "Screening Experience With Fecal Occult Blood Testing as a Function of Age," in Prospectives on Prevention and Treatment of Cancer in the Elderly, R. Yancik (cd.) (New York, NY: Raven Press, 1983); n=21,961; age=40+.

[k] Notation in parentheses indicates period of time over which use was measured.

Key for parenthetical notations:
yr = year or years
< = up to but not including
<= = up to and including
N/A= not applicable; study is a single trial conducted over a finite period.

SOURCE: Office of Technology Assessment, 1989.

vialed OTA with data on the percentages of adults in various age categories who received each of nine preventive services within periods of time specified in table 8. (See appendix F for a more complete discussion of the data and estimation methods.)

Unlike the three national surveys, these estimates come directly from the provider's records, thus avoiding the potential inaccuracies of self-reported data. However, the population from which the HMO data are drawn is probably not representative of the national experience or even of other HMOs. The elderly enrolled in this single prepaid plan may be different from the total elderly population in the HMO's market area as well as the elderly population of other areas. In addition, HMOs in general tend to provide better coverage of preventive services than do other insurance plans (46). ' This HMO in particular engaged in activities to promote the use of some preventive procedures. All of these potential distortions suggest that estimates from this HMO are probably indicative of the upper bound of use attainable under Medicare coverage rather than national estimates of current use.

In the four remaining sets of data presented in table 3, estimating use was not the authors' primary objective. One paper was a case-control study of breast cancer in elderly women (15). Another looked at the relationship between screening and disease prognosis for colorectal cancer. The third examined factors associated with swine flu vaccination during the predicted epidemic of 1977 and 1978 (59), and the fourth presents self-reported data from a retirement community about respondents' most recent use of five preventive services (19).

Estimates of Use

Because of some overlap in the services examined in the seven studies discussed above, one can compare different estimates of use of the same services. These procedures are general examinations, fecal occult blood screening, mammography, breast examinations, Pap smears, eye examinations, and blood pressure checks. For four services, the estimates of use are consistent across data sources. About 92 percent of the elderly report having their blood pressure checked within a l-year period and 74 percent report eye examinations within the previous 2 years. Although estimates for Pap smear use show a bit more variation across studies, the range runs only from about 50 percent of elderly people in the NHIS sample to 71 percent in the HMO data.

Differences in the periods of time over which researchers measure use do not account for the variation in estimates that does exist. For example, the ACS estimate of Pap smear use within a 3-year period is actually higher than the NHIS estimate that examines a period of up to 4 years. Hence, these differences reflect either different populations or different survey methods.

Despite some consistency across studies for the same service, there is little similarity in rates of use across different services. For example, while less than 15 percent of the elderly report having had annual rectal exams, 92 percent report an annual blood pressure check. Estimates for the remaining services fall within this wide range. These drastic differences in rates of use suggest that preventive services are more different from one another than they are alike. Several studies discussed later in this paper have examined these differences.

Use of Multiple Services

Measuring the percentage of elderly individuals who receive multiple preventive services provides a slightly different profile of individuals' preventive behavior than is revealed by examining one service at a time. As indicated in table 4, a majority of elderly persons report receiving all three services that both sexes can receive (glaucoma screening, eye exams, and blood pressure measurement). One-quarter of men and one-fifth of women

report receiving one or fewer of the three services. The extremely small percentages who report using no services reflect the almost universal measurement of blood pressure. Looking only at women and including the two additional services they can receive (Pap smears and breast exams) reveals that only 13 percent report using none or one service. However, only 30 percent report using all five services. These data indicate a great deal of variation in the number of services elderly people receive. In the only other study to examine multiple preventive service use, Calnan found that among middle-aged women, the probability of using one service does not predict whether an individual uses others (17).

Time Trends

The ACS and NHIS data allow examination of time trends in self-reported use of several services over the period from 1973 through 1987. As shown in table 5, the percentage of older Americans who report *ever* having received these preventive services grew over the periods measured. Using identical questionnaires, the NHIS showed substantial increases in the use of seven services between 1973 and 1982 (72,75).

The trends in the ACS data are not quite as dramatic (28). Some procedures show little change between 1980 and 1983 with five services showing a decline in use. The declines between 1980 and 1983 most likely reflect sampling error. While all of the tests except digital rectal exams for women increased between 1980 and 1987, the jumps are less dramatic than those suggested by the NHIS data.

The differences in trends between the ACS and NHIS data sources have several possible explanations:

- Only Pap smears and breast exams overlap the NHIS and ACS surveys. The differences between the two data sources could be due to different trends in the particular services each survey examined.
- NHIS estimates are for individuals over 65 years old, while the ACS data are for wider age ranges. If the trend in the NHIS applies only to the elderly, the inclusion of non-elderly people in the ACS samples might obscure this trend.

Table 4--- Percent of Persons Over 65 Using Multiple Preventive Services (From the 1982 National Health Interview Survey)[a]

Number of services	Glaucoma, eye exam and blood Pressure[a]		Breast exam, Pap smear glaucoma, eye exam and blood pressure
	Men	Women	Women
Zero	4	3	3
One	22	19	10
Two	16	13	11
Three	58	65	26
Four	N/A	N/A	21
Five	N/A	N/A	30
Total	100	100	100

Abbreviation: N/A = Not applicable.

[a]For men and women, table presents proportions of the noninstitutionalized, civilian, over-65 population using none, one, two, or three of the following services--glaucoma screening, eye examination, and blood pressure measurement--within ~the periods of time listed in table 8.
For women only, the table also presents the proportions of this same population using none, one, two, three, four, or five of the following services--glaucoma screening, eye examination, blood pressure measurement, Pap smears, and breast examination--within the periods of time listed in table 8.

SOURCE: Office of Technology Assessment, 1989.

Table 5.--Some Trends in the Percent of Adults or Older Adults Ever Having Received Selected Preventive Services[a]

Service	National Health Interview Survey[b] Year 1973	1982	American Cancer Society/Gallup Organization survey[c] Year 1976	1980	1983	1987
Check-up (annual)[a]			45 (All adults)	42	46	47
Breast exam (Women only)	58 (Ages 65+)		74	79 (All adult women)	89	81
Pap smear (women only)	54 (Ages 65+)		79	86 (All adult women)	84	87
EKG	67 (Ages 65+)	82				
Eye exam	(Ages 65+)					
Glaucoma	56 (Ages 65+)					
Fecal occult blood						
Men				17	29	43
Women				20	27 (Ages 50+)	47
Mammography (women only)				43	41 (Ages 50+)	62
Proctosigmoidoscopy						
Men				37	32	43
Women				35	31 (Ages 50+)	42
Rectal exam						
Men				54	56	53
Women				52	47 (Ages 40+)	58

Abbreviation: EKG = electrocardiogram

With the exception of the medical check-up, this table presents data on the proportion of individuals who report ever having received each service. For medical check-ups, the statistics refer to the proportion who report having a regular, annual exam.

[b] National Center for Health Statistics, U.S. Department of Health, Education, and Welfare, "Use of Selected Preventive Services U.S.--1973," Vital and Health Statistics, Series 10, No. 110 (Washington, DC: U.S. Government Printing Office, March 1977); and National Center for Health Statistics, U.S. Department of Health and Human Services, "Use of Selected Preventive Services U.S.--1982," Vital and Health Statistics, Series 10, No. 157 (Washington, DC: U.S. Government Printing Office, August 1986).

[c] Gallup Organization, "The 1987 Survey of public Awareness and Use of Cancer Detection Tests: Summary of Findings," conducted for the American Cancer Society (Princeton, NJ: Gallup Organization, January 1988).

SOURCE: Office of Technology Assessment, 1989.

Theoretical Approaches

In addition to providing estimates of the percentage of the population receiving preventive services, the literature laid out in appendixes C and D offers insight into factors associated with use. These studies represent at least two theoretical approaches to explaining the use of preventive services: 1) an appreach that emphasizes patient behavior, and 2) an approach that emphasizes provider behavior.

Patient Behavior

Underlying this approach is the assumption that the decision to use a preventive health service is made by the recipient. Receipt of these services results from factors that influence the decision to seek preventive care and the patient's ability to carry out that decision. There are two main versions of this approach: 1) a model of medical service utilization first proposed by Andersen and his colleagues (11,12,36), and 2) the Health Belief Model (57,58).

The Andersen Model.--According to this model, three types of factors determine an individual's probability of using medical services as well as the volume of use:

- *Predisposing variables* include demographic factors and the individual's beliefs about the services.
- *Enabling variables* that affect the patient's ability to gain access to services include the individual's financial resources, the availability of the services in the individual's community, and insurance coverage.
- *Need variables* include practitioners' and patients' own perceptions of the patient's health status. Poor health status may indicate a need for better health care, including preventive services. Alternatively, variables that measure health status may actually be proxies for the need for nonpreventive health services. To the extent that the need for these other services increases contact with the health care system, individuals may be more likely to receive preventive services that require some health care intervention. Hence, health status variables may enable or predispose individuals to receive preventive services by increasing their contact with the health care system.

The Health Belief Model. --This behavioral model arose from an attempt by medical sociologists during the early 1970s to understand patterns of preventive health and health maintenance (48). It is similar to Andersen's model in its focus on the patient. However, it posits that patient beliefs and attitudes are the most direct determinants of the decision to receive preventive care. Sociodemographic factors, characteristics of the health care system, and other exogenous variables (such as public education or illness of a family member) all indirectly affect preventive behavior by influencing the individual's beliefs and attitudes (57,58).

These attitudinal factors include:

- the patient's perceived *susceptibility* to a given disease or condition;
- the perceived potential *severity* of that disease;
- the perceived *benefit of preventive action* in reducing susceptibility or severity;
- *cues* to taking the action such as public education programs, reminders and physician recommendations; and
- the perceived *barriers* to taking the action including cost, inconvenience, and embarrassment.

One major limitation of the Health Belief Model in explaining the use of preventive services is the lack of data measuring individual attitudes and perceptions. Only data sets constructed specifically for Health Belief Model analyses are likely to contain the requisite information (23,31 ,54).

However, some researchers have used the underlying relationships suggested by the Health Belief Model to design experiments to improve preventive behavior among patients (70).

Provider Behavior

While patient behavior models focus on the consumers of health, provider behavior models focus upon providers of such services (86). They suggest that patients receive preventive services as the result of their providers' decisions to offer, encourage, and enable their uptake. While the patient behavior models see patients as active decisionmakers, the provider behavior approach sees patients as more passive, less important than their providers.

Explanatory studies that use the provider behavior approach examine the effects on use of health care organization, patient contact with the health care system, or with different types of health personnel, and providers' knowledge of preventive services (55,92). This approach also underlies experiments and demonstration projects that try to determine how the manner in which services are provided can maximize their use. Mass screening programs or trials that employ physician education are examples of these types of studies (20,24,62,74).

Combining the Patient and Provider Approaches

The patient and provider approaches need not be mutually exclusive. At least three studies have attempted to combine the provider and patient approaches into a single model (21,29,86). Although each approach places emphasis upon different groups of potential determinants of preventive behavior, they may be valid in explaining different parts of the variation in use. In addition, there is some overlap among the two approaches. Andersen's enabling variables represent the same basic ideas that the provider behavior models focus upon. However, in the patient behavior models, characteristics of the health care system affect individual patient decisionmaking. Provider behavior studies implicitly assume a more passive role for patients who respond largely to actions of health providers.

Evidence on Patient Behavior

This section describes the results of OTA's analysis of the 1982 NHIS data set (see appendix E for detailed discussion of methods) and examines how these results compare with results of studies listed in appendixes C and D. While many of the studies in appendix D are limited in their implications for elderly use of prevention, they provide a general context within which studies of elderly populations can be interpreted.

OTA's Analysis of the 1982 NHIS

Although the 1982 NHIS does not contain all of the variables described in Andersen's approach and in the Health Belief Model, it is the most comprehensive existing source of information about the determinants of preventive behavior among the noninstitutionalized elderly. Table 6 lists potential explanatory variables included in the NHIS data set.

Table 6.--Selected Factors Hypothesized To Affect Use of Preventive Services by the Elderly

Predisposing factors
■ Gender
■ **Age**
■ **Race** (white/non -white)
■ Education
Enabling factors
■ Family income
■ Having health insurance in addition to Medicare[a]
■ Receiving health care through a prepaid plan
■ **Living alone**
■ Living in a metropolitan area
Measures of health status
■ Bed days in the previous 12 months
■ Having some limitation on activity

[a]**Potential insurance coverage** for the elderly **in addition to Medicare includes privately purchased health insurance, Veterans Administration or military health insurance, or means tested public assistance health benefits including Medicaid.**

SOURCE: Office of Technology Assessment, 1989.

The major category of variables missing from these data are the health belief variables: patient perceptions of disease threat, perceived benefits of preventive services, and perceived barriers to their use.

OTA used weighted logit models to estimate the independent effects of each of the variables listed in table 6 on the use of each screening test or examination included in the NHIS. These models posit that the probability that an individual uses a preventive service within a specified period of time is a function of the variables listed in the table. Appendix E describes each model specification in greater detail and presents actual estimates. Table 7 summarizes the statistically significant predictors of use.

Table 7--- Significant Predictors of Use From OTA Multivariate Logit Analysis of 1982 National Health Interview Survey[a]

Variable	Glaucoma screening	Eye exam	Blood pressure	Pap smear	Breast exam
Predisposing factors					
1. Sex (male)	..	..	..	N/A	N/A
2. Age		NS	++	..	..
3. Race (non-white)	..	NS	NS	NS	NS
4. Education	++	++	+	++	++
Enabling factors					
5. Family income	++	+	NS	++	++
6. Having health insurance in addition to Medicare	++	++	++	++	++
7. Receiving health care through a prepaid plan	NS	NS	NS	NS	NS
8. Living in a metropolitan area	++	++	NS	+	++
9. Living alone	NS	NS	NS	NS	++
Measures of health status					
10. Bed days in the previous 12 months	++	++	++	++	++
11. Having sane limitation on activity	NS		+	NS	NS

Abbreviations: NS = Estimated coefficient on variable not statistically significant; N/A = Not applicable; variable not included in model.

[a]Use measured according to standards described in appendix E and in table 8.

Key to symbols:

+ =Difference in proportions using service significant at 0.05 level (2 tailed), variable positively associated with use

++ =Difference in proportions using service significant at 0.01 level (2 tailed), variable positively associated ~wth use

· =Difference in proportions using service significant at 0.05 level (2 tailed), variable negatively associated with use

·· =Difference in proportions using service significant at 0.01 level (2 tailed), variable negatively associated with use

SOURCE: Office of Technology Assessment, 1989.

Despite the substantial variation that exists across the five services in the percentage of elderly receiving the specified levels of prevention, the estimated models show a great deal of consistency across services in the significant predictors. Only the use of blood pressure checks appears different. The analysis suggests that fewer variables are important in predicting blood pressure checks than in predicting the other services. This is consistent with the relative lack of variation in the use of this service; over 90 percent of the elderly report having had their blood pressure measured within the previous 2-year period. Almost every medical visit includes blood pressure measurement, and individuals can use machines found in many supermarkets and restaurants to screen themselves for hypertension.

As expected, OTA's analysis found that younger age, more education, and higher income are all consistently associated with a higher probability of using the five preventive services measured in the NHIS. For the three services applicable to both genders, men over 65 are less likely than women of similar age to receive them.

More bed days are consistently related to use of the five services, suggesting that sicker individuals have greater contact with the health care system, and hence, a greater opportunity to be offered preventive services. The analysis showed no relationship between limitation in activity and the use of any of the preventive services except for eye exams, where the direction of the association is neg-

ative, and blood pressure measurement, where the direction is positive.[1]

For all services except blood pressure measurement, living in one of the Census Bureau's Standard Metropolitan Statistical Areas (SMSAs), which are defined by geography and population density, is positively and significantly related to the use of preventive services. In urban communities with a large number of health facilities and personnel, individuals are likely to live closer and have more ways to get to appropriate health facilities than their rural counterparts.

Having some health insurance in addition to Medicare is also associated with use. Although such "Medigap" coverage (held by 71 percent of the elderly in the NHIS sample) is unlikely to pay for preventive services, it does lower patients' out-of-pocket expenses for medical care, thus making preventive services more affordable. In addition, a patient's willingness to buy such insurance may indicate a certain concern for his or her own health also found in individuals likely to use preventive services.

Among variables *not* associated with the use of preventive services, membership in an HMO or other prepaid health plan is the most unexpected. Published literature indicates that such health care providers are more likely than others to offer preventive services to their patients in hopes of lowering treatment expenses (46,54). While OTA's analysis suggest that this relationship may not exist, it is also possible that the small number of elderly NHIS respondents enrolled in HMOs did not provide enough statistical power to detect an actual effect of prepaid membership. In 1982 only 2.3 percent (or about 573,000) of the elderly belonged to HMOs,[2] and the NHIS sample reflects this relatively small number.

The remaining two variables in the logit models are not consistently associated with use: race is positively associated with glaucoma screening; living alone is positively associated with breast examinations.

Summary of Evidence on the Determinants of Use of Preventive Services

Age.--Age has generally been found to be a negative predictor of the elderly's use of preventive services (16,19,69). Studies of younger adult populations have also found such an association (32,44,80,81,81,88). In the OTA analysis, all services except blood pressure followed this pattern.

Two studies have examined the relationship between age and immunization behavior; neither found any strong association between age and swine flu immunization (22,59). Of the other studies that look at age, one found a positive correlation with the likelihood and volume of preventive visits to a single HMO (40). Another study that looked only at fecal occult blood screening within a well-defined trial also found no age effect.

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1 It is possible that bed days and limitations are measuring health status in the same way. If the two variables are measuring the exact same idea, the logit estimation procedure would not be able to distinguish the independent effects of each variable. This could lead to the insignificant coefficients found for the limitation variable. To test for this potential problem (multicollinearity), we examined the correlation between the bed days and limitations variables. We found a correlation coefficient of 0.31 suggesting that while the estimated standard errors of the two logit coefficients may be somewhat biased downward (thus creating potential non-significance), the two variables largely measure different notions of health status.

2 Since 1982, the number of Medicare beneficiaries has grown due to risk- and cost-based Medicare demonstration programs. Under contract with the Health Care Financing Administration, each HMO participating in these programs agrees to provide Medicare benefits to eligible enrollees. As of January 1988, over 1.7 million elderly were participating in Medicare/HMO demonstration programs (71).

Despite these exceptions, the bulk of available evidence suggests that use of preventive services falls with age, especially among the elderly. There are at least three explanations for this observation:

- As an individual gets older, he or she may perceive fewer benefits and more barriers to receiving commonly recommended levels of prevention.
- The observed difference may reflect a tendency of individuals who were elderly in the early 1980s not to use prevention --a tendency that will disappear among future groups of elderly.[3] The benefits and availability of most preventive services emphasized today have been known for only the past generation. By the time that these services became widespread, older individuals may already have established patterns of health care that did not include prevent ion. According to this reasoning, succeeding generations may have more uniform rates of preventive care over the adult age spectrum.
- As individuals age, they are more likely to visit the doctor for diagnostic and therapeutic services. While they still may receive preventive services, they may not remember that the clinician performed these procedures. Prevention becomes obscured by treatment.

Education .- - All studies of use that have examined education as an explanatory variable have found it to be a statistically significant predictor of the use of preventive services (22,40,6 1,8 1). The more education a person has, the more likely he or she is to use preventive services. OTA's analysis of the NHIS data set conforms to this observation. There are two possible explanations for the association between education and use:

- Education may affect the decision to use preventive services by altering patients' perceptions about disease and potential services. It increases their general knowledge and ability to evaluate health risks and the net benefits of prevention. In addition, it may increase their knowledge of specific diseases, recommendations for preventive services, and sources of care.
- Education and prevention are both investments with expected future payoffs (27). Individuals with more education may be more oriented toward the future than less educated people. Hence, these people tend to seek both education and prevention.

Gender. - - The evidence on the effect of gender on the use of preventive health services is conflicting. Several studies, including OTA's analysis, found a strong significant association between being female and engaging in preventive health measures (31,40,41). An analysis of swine flu vaccinations, however, indicates only a weak correlation between being a woman and use (22). On the basis of two services for the elderly (from OTA'sq analysis) and a few other studies of the whole adult population, one cannot conclude that elderly women have a consistently greater predisposition toward the use of preventive services than do their male counterparts. Even if such a conclusion were empirically justified, no explanation for this finding is readily apparent.

Race .- - The relationship between race and the use of preventive services by the elderly or other adults is ambiguous. OTA's multivariate logit analysis revealed that elderly whites are more likely to receive glaucoma screening than are elderly members of other racial groups. However, race was not a significant predictor of any of the other services studied.

Other studies that have looked at the relationship between race and the use of preventive services by the non-elderly present inconsistent results. Four studies found a statistically significant negative association

3 This is sometimes called a "cohort effect. " The trend data presented earlier in this paper are consistent with this hypothesis.

between being black or non-white and using preventive services (60,62,66,82), but three other studies found no significant relationship (15,31,44). In one study, the results varied according to the preventive service (91). In a review of studies of participation in fecal occult blood screening, Blalock and colleagues report similarly inconsistent results of the effect of ethnicity on the use of this one cancer screening test and draw no conclusions (14).

Income---Income is a reflection of the availability of financial resources to purchase health services. Economic theory suggests that the consumption of most goods rises with income. Preventive health services for the elderly may be particularly sensitive to income for two reasons. First, unlike acute illness care and even some types of chronic illness care, preventive care can be put off without short-term consequences. Thus, preventive care may receive a lower priority than other types of health care or other necessary consumption. Second, Medicare, the primary health insurer for the elderly, does not cover most preventive services. Hence, to use such services, the elderly must have private health insurance (discussed be**10W)**, **wealth**, or income to pay the out-of-pocket expenses.

Almost all multivariate studies of preventive use, including the OTA analysis, found that income has a significant positive effect in predicting the use of preventive services (17,22,31,32,40,41,44). Studies examining only the bivariate relationship between prevention and income have also consistently found such an association between prevention and income (54,81,91).

Using Michigan survey data, Rundall and Wheeler examined the relationship between income and the use of preventive visits in greater detail. Their analysis indicated that although income has little direct effect on preventive use, it indirectly increases the likelihood of use by altering perceptions about health and susceptibility to illness, and by increasing the probability that individuals have a regular source of care (60).

Insurance and Price---Except for OTA's analysis, which found that insurance coverage beyond Medicare had a consistently positive significant effect on the use of preventive services, the effect of insurance has not been studied in elderly populations. The published literature on adults' use of preventive services generally supports the contention that the out-of-pocket price is a significant negative predictor of use (16,32,47,61,63,86,91). However, no study has examined the relationship between actual cost to the patient and the use of services.

The potential impact of insurance coverage on use has important policy implications for consideration of Medicare coverage of preventive services. In assessing the benefits and costs of such a decision, one would want to know the number of new users of covered services as well as the total number of users. The OTA analysis and other studies (16,45) suggest that while insurance coverage does increase use, a substantial percentage of individuals do not receive recommended levels of preventive care, even in the presence of generous health insurance. A recent study that compared the use of three preventive services--blood pressure measurement, breast exams, and Pap smears--in Canada, where preventive services are covered by national health insurance, and in the United States found little difference in rates of use by elderly individuals in the two countries (76). Only breast exams were used with statistically significantly greater frequency in Canada.

Enrollment in Prepaid Plans.--Except for OTA's analysis, which found no evidence that enrollment in HMOs increases the use of preventive services by the elderly, only one other study has compared preventive care in HMOs with that of traditional insurance plans (66). The researchers in that study found that employed adults in a prepaid group practice had utilization rates for preventive services no different from those of similar individuals in a Blue Cross plan.

Living Arrangements and Logistical Barriers. --In addition to the financial costs of preventive services, these procedures also entail time and transportation costs. One would expect the use of preventive services to decline as the distance between services and an individual's home or job increases. Two analyses of adult demand for preventive care in an HMO found that distance to a source of medical care was negatively (but nonsignificantly) related to the probability of use (40,41). Two other multivariate analyses that included indexes of time, transportation, and perceived difficulties in obtaining preventive procedures also found no significant relationship between these logistical barriers and the likelihood of using preventive services (16,22).

A less perfect measure of logistical barriers to access that may be especially relevant for the elderly is whether or not the individual lives alone. Living with another person could either raise or lower the logistical barriers to preventive services. An additional household member could assist an individual in overcoming immobility or distance; on the other hand, if the additional household member is in some way limited in mobility or function, the effect on the healthy member's use of preventive services may be negative since it may be difficult to leave a dependent partner to receive preventive care. In OTA's analysis of the NHIS data, living alone was a statistically significant, positive predictor of use for breast exams only.

Geographical Location. --The community in which an older person lives may affect his or her access to prevention. In a multivariate analysis of the effect of geographic location on use based on the same data set that OTA used (i.e., the 1982 NHIS), Woolhandler and colleagues found that among middle-aged women, nonrural residence had a negative effect on the likelihood of having a glaucoma test but had no effect on the use of hypertension screening, Pap smears, and clinical breast examinations (91). These results conflict with OTA's analysis which found that people in urban communities use more preventive care than do those in non-urban communities. The differences between the two studies may be due to several factors:

- Woolhandler, et al., estimated a logit model with fewer explanatory variables and a slightly different distinction between urban and rural residence from that used by OTA;
- Woolhandler, et al., used a less sophisticated method of estimating variances from the complex NHIS sample design than OTA did;

  living in a rural area may be less of a barrier for middle-aged women than for the elderly population in obtaining preventive services.

Health Status. --The evidence on the effect of health status on preventive health service use is equivocal. Most multivariate analyses have found *no* significant effect of health status on use (19,40,41,44,91).4 Except for OTA's analysis, which found a strong positive significant relationship between number of bed disability days and use, only Rundall and Wheeler found that reporting relatively poor health has a direct positive effect on the likelihood of receiving preventive care (60). However, variation in measures of health status, model specifications, and samples make it difficult to draw conclusions from these studies.

A few other researchers have measured health status by the presence of chronic disease. Blalock, et al., reported that having a chronic condition increases the likelihood of receiving fecal occult blood screening for colorectal cancer (14). Warnecke, et al., found a similar association with the probability of a regular check-up in Illinois adults (86).

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4 In their multi variate models of the use of prevent i ve services by middle-aged women using the 1982 NH I S data, Wool handl er, et a 1., found that being healthy was significant ly and positively related only to blood pressure screening.

Limitations of the Patient Behavior Analyses of Preventive Service Use

The literature and analysis reviewed in this section suggest at least two major limitations of the patient behavior approach to understanding the use of preventive services:

- Existing studies do not account for many factors specific to a particular preventive intervention such as patients' perceptions of pain, discomfort, embarrassment, or complexity of administration that may impinge on the willingness to use of a particular procedure. Inclusion of variables that measure these perceptions would be consistent with the Health Belief Model.
- The models of use examined in this section assume that patients themselves decide whether to receive preventive care. OTA's analysis and most of the published patient behavior literature do not directly examine the role of the primary care physician and the health care organization in the decision to use services.

Evidence From Studies of Health Care Provider Behavior

The Physician

Physicians must perform, supervise, or prescribe most preventive services in order for a patient to receive them. In fact, many adults may depend on their primary care physician to tell them what types of prevention they should receive and how often (92). The literature examining the role of physicians in determining the use of preventive services includes three types of analysis:

- comparisons of physicians' knowledge about appropriate prevention with published sets of recommendations;
- analyses of actual physician performance; and
- experiments to increase physician compliance with recommended procedures.

Because almost all of the trials designed to narrow the gap between published recommendations and actual practice focus on changes in health care organization or management rather than just physician behavior, this paper considers studies that fall into the third category in the section on health care organization below. None of the published studies analyzed the elderly as a group separate from the general patient population.

Physician Knowledge and Actual Practice. -- Woo and her colleagues asked 83 physicians in a hospital-based teaching ambulatory care practice about the *frequency* with which they recommend 16 screening procedures to different age groups (92). Across all patient age groups and procedures, physicians with less training recommended with greater frequency. Doctors with a history of cancer in their families recommended more frequent sigmoidoscopies and mammograms. The mean physician recommendation for preventive use was more frequent than the mean of published guidelines in 48 situations and less frequent in 18 situations. The researchers found close agreement among the respondents on Pap smears, blood pressure checks, physical exams, and medical histories, but wide variation in glucose and cholesterol measurement and mammography.

Almost half the physicians reported that they knew they recommended preventive services more frequently than published guidelines and cited as reasons patient desires and the belief that the guidelines are insufficient. Woo suggests that despite recommendations published by the Canadian Task Force and others, the physicians in this study may believe it better to err on the conservative side by recommending services for which the supporting medical evidence of effectiveness is inconclusive.

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5 A "situation" is a particular screening service for a particular age group.

An analysis of patient records in the same study found a higher level of physician compliance with recommended guidelines for those services that doctors could order other health personnel to perform, such as laboratory or radiological tests, than with services that require labor by the primary care physician, such as sigmoidoscopy and breast exams. Woo and her colleagues infer that because the patients they surveyed desire screening with appropriate regularity, the gap in performance must be due to doctors failing to offer prevention according to their own or published recommendations. They also suggest that rates of use are partially related to the ease with which physicians can provide them. Other studies support this hypothesis that variation in the use of different preventive services is a function of characteristics of the services themselves (e.g., patients' pain, discomfort, and embarrassment) (57, 63,65).

Another study compared the preventive care recommendations of 31 physicians practicing general internal medicine in North Carolina with three sets of published guidelines (55). The participating doctors listed procedures they considered essential to a periodic examination for three age groups (30-39; ages 40-49; and ages 50-59). Among the procedures recommended in published guidelines but not chosen as essential or routinely recorded in the medical record by at least two-thirds of the sample physicians were hearing exams, vision exams, fecal occult blood tests, lipid profiles, mammography for women over 50, immunizations, and exams for hypothyroidism. The North Carolina physicians also recommended services not recommended in the published guidelines, including thorough examinations of the major organ systems, measurement of blood urea nitrogen, white blood counts, chest x-rays, and microscopic urinalysis.

Examining the records of 334 patients visiting the 31 North Carolina internists for general examinations, the researchers found that, on average, 59 percent of the procedures recommended by expert groups were found in the record. Compliance was greater for younger patients, a result consistent with the estimates of use of several services reviewed earlier in this paper. The researchers also found that compliance was greater for laboratory and physical examination procedures than for medical history and counseling services and was inversely related to the number of expert groups recommending each procedure.

Noting that the lowest compliance occurred with procedures identified by the Canadian Task Force on the Period Health Examination, one of the recommending bodies, as having strong scientific validity, Romm and colleagues suggest that improving compliance requires physician education. In discussing ways to improve compliance, they did not consider the possibility that physicians may take into account individual patient characteristics and circumstances in deciding not to provide recommended preventive services.

In another study, McPhee, et al., found that discrepancies exist between American Cancer Society (ACS) recommendations for the use of seven preventive services and physician performance and that physicians tend to overestimate their own provision of these procedures (51). The researchers report that physicians cite four reasons most frequently for not providing recommended services: forgetfulness, lack of time, inconvenience or logistical difficulties, and patient discomfort or refusal.

One study suggests that physicians may differ by specialty in their performance of some preventive services. In a study of Pap smear use by physicians in Maryland, Teitelbaum, et al., found that specialists in obstetrics and gynecology (OB/GYN) were more likely than general practitioners and internists to encourage patients to receive Pap smears, to remind patients by mail or telephone to get a Pap smear, and to achieve compliance with their recommendations (69).

Finally, one study currently underway may shed additional light on the role and motivations of the physician in providing preventive services. Schwartz and Lewis in cooperation with the American College of Physicians (ACP) recently surveyed ACP members about preventive practices (64). In addition to examining the frequency with which physicians say they perform a number of services, Schwartz and Lewis will look for relationships between preventive practices for patients and demographic characteristics, the physicians' experience, and the physicians' preventive practices for themselves.

Health Care Organization

Because physicians work within a larger health care system with other practitioners and administrators, it is possible that health personnel and characteristics of the office, hospital, clinic, group practice, or HMO providing patients' care could affect whether or not older individuals receive preventive services. This section considers the relationship between the use of preventive procedures and the health care organizations that provide them.

Health Maintenance Organizations (HMOs) and Other Prepaid Plans. --Some researchers have claimed that HMOs, in general, may promote the use of preventive services (46). To the extent that HMOs stand to gain from potential savings in health care costs resulting from preventive services, these organizations would have an economic incentive to offer more preventive services. In addition, since visits to HMOs are either free or very inexpensive, HMO patients may demand more such visits.

Data from a single HMO that provided OTA with estimates of preventive service use suggests that these health care providers may have the ability to organize themselves to provide more preventive services than is now generally received by patients. As table 3 above indicates, the rates of use in the HMO were at least as high as or higher than comparable rates of use reported in other studies. Not only has this HMO made preventive care a stated organizational goal, but it has developed management tools to achieve compliance with some preventive recommendations, including computer-generated reminders to both patients and physicians for immunizations. However, these relatively high rates of use may be achieved by recruiting patients who already have characteristics that make them more likely to use preventive care. If the high levels of use found in the single HMO for which OTA obtained data are related to its organization, it is not clear whether less centralized prepaid health plans such as independent practice associations (IPAs) would be able to do the same.

OTA's multivariate analysis of the 1982 NHIS found that the elderly enrolled in an HMO are no more likely to use prevention than their unenrolled counterparts. Given the small number of elderly in HMOsq, however, the NHIS sample may not have been large enough to detect an actual difference. With respect to preventive services other than screening, Riddiough, et al., reported mixed evidence about the relative likelihood of HMOs to provide immunizations (54).

Organizational Factors Related to Use---Other characteristics of health providers may also affect the use of preventive procedures. For example, the use of non-physician personnel, cues to compliance such as reminders and media, or health fairs are all organizational strategies that have been employed to increase the use of preventive services.

One potential mechanism for increasing the use of preventive services is the health screening fair in which participants can receive selected procedures at a publicized time and place. In an analysis of the cost-effectiveness of this screening method, Berwick concluded that fairs work best when the target population is clearly defined, the screening tests are appropriately chosen, reliable and accurate, and the fair provides appropriate guidelines for abnormal results,

follow-up, referral, and treatment (13). Although fairs may increase the ability to detect and prevent illness, significant risks may exist if screening in the fair setting is relatively insensitive or unspecific or does not provide adequate follow-up.

Among interventions designed to increase patient compliance with recommended services, Thompson, et al., studied the value of combining talks by physicians and nurses, postcard reminders to patients, and phone calls to comply with a fecal occult blood test (70). While those receiving any one of these interventions had an average compliance rate of 89 percent versus 68 percent among the control group, the reminder postcard was especially cost-effective, raising compliance about 25 percent to an overall rate of 93 percent at a relatively small cost. The talk by health personnel, which was somewhat more labor intensive, increased compliance about 13 percent.

McDonald and colleagues found similar results in another randomized trial. Interns and resident physicians who received computer-generated reminders provided 49 percent of the preventive services suggested to them, while physicians in the control group provided only 29 percent of the services (49). Among physicians who received the reminder intervention, the researchers found that overall attitudes toward the reminder system and whether the physician read and signed the reminder were statistically significant predictors of use, while years of training and faculty assessments of the physicians were not. The researchers conclude that noncompliance with recommendations is an error of omission that can be mitigated by technological aids.

In another study, Satarino and colleagues retrospectively asked patients receiving free breast cancer screening at two clinics in New York City how they learned of the service and their need to be screened (62). Most black screenees with less than a high school education learned of the clinic through television ads followed by word-of-mouth and private physician referrals. While this paper suggests that television may be a useful cue in promoting use, it does not indicate how one might reach individuals who were *not* screened at one of the two clinics.

Two studies have tested strategies to induce the *provision* of preventive services to patients. In one study, four clinics were randomly assigned either to participate in a program that combined physician education with a checklist of services due each patient on the medical record or to a control group. Over a 4-month period, the researchers measured rates of mammography and influenza and pneumococcal immunizations among eligible patients in each group. The intervention group had significant increases in the use of these services, ranging from 2 to 40 percent over the control group. The researchers also found significant increases in tests of physician knowledge and attitudes about prevention among physicians (20).

In another randomized trial, nurses who already routinely reviewed patient charts in a university-based internal medicine practice reminded physicians when a patient was due for particular screening services and immunizations (24). For patients receiving the nurse-reminder intervention, the researchers found statistically significant increases in rates of use for fecal occult blood screening (32 to 47 percent), breast exams (29 to 46 percent) and influenza immunizations (18 to 40 percent), but not for Pap smears (13 to 14 percent). The study represents the only randomized experiment to analyze the role of non-physician personnel in providing or boosting the use of preventive services.

Physicians believe that such organizational strategies would improve the use of preventive services. In two studies of physician attitudes, researchers conclude that while most physicians see themselves as ineffective in improving patient compliance with their recommendations for preventive care, they believe that they could be much more effective if they had more resources at

their disposal including better training for themselves and their support staff, improved reimbursement for preventive services, and better educational materials for patients (84,87).

Other research currently underway may enhance our understanding of the impact of organization on use. The Health Services Research Center at the University of North Carolina, with funds from the National Center for Health Services Research and Health Care Technology Assessment (NCHSR), has recently surveyed administrators, medical directors, and staff physicians in 150 large medical practices of different types (25). While most of the study seeks to identify organizational characteristics that contribute to physician satisfaction with his or her work environment, it will also focus on the participating organizations' preventive care practices.

Limitations of Evidence About Provider Behavior

Compared to studies of patient behavior, there are relatively few studies of the structure of the health care system or the role of physicians in the use of preventive services (54), and none focuses exclusively on prevention for an elderly population. A new study of preventive practices among physicians currently underway may shed more light on these issues. However, no current or completed studies to date have examined the role of other potentially important factors, including:

- potential revenue obtainable from preventive services,
- potential liability associated with offering or withholding preventive services, and
- the degree of management control within the health care organization.

The evidence about whether or not HMOs provide greater levels of prevention is ambiguous. While HMO enrollees may receive more preventive care than enrollees of other health plans, other predisposing and enabling factors such as gender, education, and income may explain this differential. Controlling for these factors, OTA's analysis of the NHIS data revealed no effect of HMO membership on the probability of using five preventive services. The data gathered by OTA from one closed-panel HMO suggest that prepaid health plans may have the potential to increase the use of preventive services among older adults. No data exist about whether other prepaid plans achieve a level of preventive care comparable to the one OTA examined.

The literature contains several studies of interventions within clinics, ambulatory care practices, and HMOs designed to promote the use of preventive services. They suggest that provider-based strategies can increase the use of preventive strategies. However, the narrowness of these studies indicates the need for more research. In particular, the existing literature does not adequately address:

- the generalizability of particular interventions to other settings,
- the most effective means of informing the public about the need for and availability of screening programs,
- the role of non-physician personnel in affecting patient use of preventive services, and
- the potential of technological advances (e.g., the introduction of computerized medical records and new screening technology for the physicians' offices) in affecting patient use of preventive services.

Potential Medicare Coverage

Medicare represents the Federal Government's major financial and policy commitment to health care. In 1986, Medicare represented 58 cents of each Federal dollar spent on health care and was the source of payment for 29 percent of all expenditures for hospital care and 21 percent of expenditures for physician services (73). The use and correlates of use of preventive services for the elderly have several important implications for the Medicare program.

First, covering preventive services under the Medicare program **would probably bring about increases in the percentage of elderly receiving preventive care. However, current evidence suggests that reducing out-of-pocket expenses for patients is not sufficient to assure compliance with published preventive recommendations.** OTA's analysis of five preventive services suggested the presence of insurance beyond Medicare is associated with about a 10-percent increase in the percentage of elderly receiving each service during the period of time examined. With the exception of blood pressure measurement, which almost all elderly already receive on a routine basis, substantial portions of the elderly with additional coverage that defrays out-of-pocket expenses do not use each of the preventive services OTA examined. In addition, because the additional insurance coverage held by Medicare recipients in most instances excludes preventive services, the OTA analysis is not a direct test of the impact of coverage of specific procedures on the rates of use of these services.

Other factors enter into the physician's decision about whether to offer or provide the service and the patient's decision about whether to seek or use it. Some of these factors may be amenable to change through public policy, while other characteristics describe groups of elderly patients at relatively high or low risk of not receiving adequate preventive care.

Second, coverage of preventive services for Medicare beneficiaries could affect preventive use beyond the Medicare population itself. Medicare payment may raise interest in preventive care among health care providers and payers by placing the authority of the Federal Government behind it. In addition, consumers of health care may put more weight on preventive services in managing their own health because of the public discussion and attention focused on Medicare coverage. None of the data or literature currently available allows OTA to estimate the existence or magnitude of this potential indirect effect. A recent analysis of preventive services in Canada where such procedures are paid for by the government revealed rates of use comparable to those in the United States, suggesting that both the direct and indirect effects of government coverage may be small (76). The Medicare Catastrophic Coverage Act of 1988 (Public Law 100-360) may offer an opportunity to assess the full impact of Medicare coverage of breast cancer screening for the elderly by "analyzing trends if the use of this service is monitored.

Third, expansion of Medicare to cover preventive procedures will represent an immediate boost in the program's financial obligations even if increases in use are minimal or nonexistent. Although gaps exist between experts' recommendations and current levels of use, substantial numbers of elderly still receive a variety of preventive services at recommended frequencies. OTA's analysis indicated that at least one-half of the noninstitutionalized elderly receives each of the five services examined on a regular basis. For three of these services (glaucoma screening, eye examinations, and blood pressure measurement), rates of use were even higher. Estimates of costs attributable to expanded Medicare coverage of preventive services must take account of the program's obligation to pay for procedures whose costs are currently borne by other payers. However, some portion of these services are for patients with a related medical history or symptoms and are

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"diagnostic" and already reimbursable under Medicare. It is also probable that some physicians may categorize some examinations and screening services as "diagnostic" so that the procedure will be covered by Medicare. No existing data from published literature or the records of the Health Care Financing Administration (HCFA), the Federal agency that administers Medicare, indicate what portion of all procedures reimbursed by Medicare are actually for screening purposes.

Fourth, the conclusions of this paper about the use of medical **services such as screening and immunizations may have limited applicability for policymakers considering Medicare coverage of other preventive services such as health risk appraisals, education, counseling services, or tertiary prevention of disability among elderly suffering from chronic disease.** Many of the services listed in table 1 could rely on non-physician personnel to a greater degree than do screening and immunization, and patients could receive them in a wider array of settings than they receive most medical services. These characteristics suggest that use of preventive services not examined in this paper may be markedly different from those explored here. Hence, an understanding of the implications of Medicare coverage of services other than screening and immunizations use would require additional study.

Delivery of Preventive Services for the Elderly

Although one of the major focuses of this paper is the potential impact of insurance coverage on the use of preventive services by the elderly, the data and literature reviewed in this paper suggest that other factors are strongly related to use. This information would be useful to public policy makers who seek strategies for altering the elderly's use of preventive services. Of the patient and provider characteristics related to use, a few are immutable, some are amenable to change through policy, and others are theoretically amenable to change, although the policy interventions to accomplish these changes are unlikely to prove cost-effective.

Public policy cannot affect age, gender, rural versus urban residence, and usually, days spent in bed during the previous year, three factors correlated with the use of preventive services. However, these demographic and health status characteristics do identify segments of the population particularly at risk of not receiving adequate screening or immunizations. Knowing that on average more women than men receive such care or that recommended prevention appears to decline with age and good health may help policy makers target some of their preventive care efforts toward the more vulnerable groups. Because Medicare is an entitlement program available to all persons over 65 who receive Social Security, it is an unlikely means of focusing efforts on demographically defined subsets of the elderly population. Nevertheless, other government investments in prevention such as mass media campaigns and screening fairs may be able to narrow their target. Policy makers who want to bolster use among elderly groups unlikely to receive preventive services may wish to study the potential costs and effectiveness of such programs in detail.

Other factors related to the elderly's use of preventive care do seem amenable to policy interventions. Studies that examine influences on physician behavior suggest that better or more frequent physician education may bring about better compliance with preventive recommendations. In addition, evidence suggests that record-keeping systems and reminders to physicians (possibly aided by computer technology) have positive effects on use. This paper has discussed the potential for insurance coverage to increase somewhat the percentage of elderly receiving prevention. Government and providers could design policies to bring about these changes where they do not already exist.

The relationship between use and provider characteristics is not clear. For exam-

pie, conflicting published literature and the small number of elderly enrolled in HMOs makes it difficult to determine if the enrollment of older adults in prepaid health plans increases the amount of preventive care they receive. Additional research is also needed to establish the potential of nurses and other non-physician health professionals in providing or promoting the appropriate use of preventive services. Previous research suggests the substantial contact they have with patients in an ambulatory care setting, the availability of new screening technologies (e.g., instruments that can measure cholesterol in a physician's office from a finger prick), and the growth in "health fairs" that provide some preventive services in alternative settings may enhance the role of these professionals.

The remaining variables affecting older individuals' use of screening and immunizations - -educational level and family income --are also potentially susceptible to government interventions. However, public policies designed to change these characteristics are so much more broadly construed that they would never be implemented simply to affect the use of preventive care. If, however, the government decides for some other reason to promote education or supplement income among the elderly, long-term increases in the use of preventive procedures may be an additional benefit.

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Advisory Panel members provide valuable guidance during the preparation of OTA reports. However, the presence of an individual on the Advisory Panel does not mean that individual agrees with or endorses the conclusions of this particular paper.

Appendix B: ACKNOWLEDGMENTS

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Appendix C: EMPIRICAL STUDIES OF THE USE AND/OR DETERMINANTS OF USE OF PREVENTIVE SERVICES BY THE ELDERLY

Study	Services examined	Period of time in which use is measured	Sample description and design	Analyses
American Cancer Society/Gallup, 1987[a]	Fecal occult blood Proctosigmoidoscopy Rectal exam Mammography Breast exam Pap smear	Measures frequency of regular use	Representative national random sample of 1549 adults over 18 years old	Percent having knowledge of and using cancer screening tests by age; trends from previous ACS surveys
Brown and Hulka, 1988[b]	mmo ph	Ever	109 cases of women over 60 with metastatic breast cancer from a single hospital; 211 control women with similar characteristics with cancers of other sites drawn from tumor registry	-control study of whether elderly women metastatic breast cancer were screened than women with other types of cancer
Chao et a ., 1987[c]	Blood pressure Fecal occult blood Pap smear Mammography Breast self-exam	Last use: las year, before last year, never; breast self-exam on a monthly basis	1',888 residents of a southern C≡lifornia retirement community; mailed survey	Use of screening tests by sex, age, medica condition and health habits
Fedson, .987[d]	I fluenza acci ne P8eumococcil vaccine	1-year period l.'etime	Data from national probability sample: the U.S. Immunization Survey conducted annually as part of Bureau of Census Household Survey from late 1960s to 1985	Estimates of annual use of influenza vaccine among elderly, and prevalence estimates for pneumococcal vaccinations; additional sources of evidence combined to discuss strategies to increase physician immunization of high risk patients
Lazaro, ogsdon, and Meie-, 1987[e]	General preventive exam; health r sk counseling	Not applicable	713 individuals over age 60 invited to receive preventive services from participating physician at no cost; drawn from geographically separate areas; sample represents a 69 percent response rate to baseline survey of characteristics and attitudes	Bivariate and multivariate analyses of use during experimental period as a function of demographic and psychosocial characteristics, health status, and attitudinal indices
National Center for Health Statistics, 1988[f]	Blood pressure Breast examination Pap smear	Most recen use	U.S. data are from 1985 National Health Interview Survey of Health Promotion and Disease Prevention; Canadian data are from 1985 Canadian Health Promotion Survey carried out by Statistics Canada for Health and Welfare Canada	Comparison of national rates of use of preventive services in Canada and U.S. (in addition to preventive services, surveys also ask about other patient preventive health practices)
OTA, 1988[g]	Glaucoma screening Eye exam Blood pressure Pap smear Breast exam	<3 years <3 years <2 years <4 years <2 years	All individuals over 65 from 1982 National Health Interview Survey (11,434 people); two-stage nationa random sample	Percent receiving services; relationship between use and predisposing, enabling, and health status variables (logit and bivariate models)

Study	Services examined	Period of time in which use is measured	Sample description and design	Analyses
GHA, 1988	Cholesterol Fecal occult blood Pap smear Eye exam Mammography Physical exam Pneumococcal vaccine Influenza vaccine vaccine	5 years 1 year 3 years 2 years 1 year 1 year Lifetime 1 year 10 years	Enrollees over 40 in a closed panel urban HMO in the northeast; data from HMO computer system	Descriptive analyses of percentages receiving services by age and sex
Radecki, et al 1988[i]	34 categories of diagnostic tests including specific screening procedure	Individual visits	28,265 visits to internists, family, and general practitioners	Bivariate and multivariate analyses of the effect of specialty and patient age on rate with which physicians order procedures including routine screening tests; rates of use compared with efficacy of procedures for older patients
Rundall and Wheeler, 1979[j]	Swine flu vaccine	Lifetime (though only offered for a limited period)	232 responses to questionnaire mailed to random sample of 500 senior citizen residents of Tomkins County, New York	Bivariate and multivariate (logit) analyses relationships between vaccine use and health belief (attitudinal) variables
Winawer, et al 1983[k]	Fecal occult blood Sigmoidoscopy	Not applicable	Memorial Sloan Kettering Cancer Center-Strang Clinic trial of 21,96[illegible] patients offered fecal occult blood test followed by sigmoidoscopy	Compliance with screening recommendations and rates of detected cancer as a function of age; use data gained as part of larger test for effectiveness of screening in reducing mortality

[illegible]: Acs = American Cancer Society, HMO = health maintenance organization.

[a]Gallup Organization, "The 1987 Survey of Public Awareness and Use of Cancer Detection Tests: Summary of Findings," conducted for the American Cancer Society (Princeton, NJ: Gallup Organization, January 1988).

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[g]Office of Technology Assessment, primary analysis of data from the National Health Interview Survey, presented later in this paper, not a study published elsewhere.

[illegible]ice of Technology Assessment, primary analysis of data from an HMO presented later in this paper, not a study published elsewhere.

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[k]S.J. Winawer, M. Baldwin, E. Herbert, et al., "Screening Experience With Fecal Occult Blood Testing as a Function of Age," in Prospectives on Prevention and Treatment of Cancer in the Elderly, R. Yancik (ed.) (New York, NY: Raven Press, 1983).

SOURCE: Office of Technology Assessment, 1989.

Appendix D: EMPIRICAL STUDIES OF THE USE AND/OR DETERMINANTS OF USE OF PREVENTIVE SERVICES BY THE NON-ELDERLY

Study	Services examined	Period of time in which use is measured	Sample description and design	Analyses
American College of Physicians/Schwartz and Lewis, forthcoming[1]	Patient history Chest x-ray EKG Cholesterol Sigmoidoscopy Fecal occult blood Breast exam Pap smear Hepatitis B vaccine Influenza vaccine Pneumococcal vaccine Risk counseling	Measures date of last use	Survey mailed to 2000 ACP members asking about physician's preventive behavior for self and for patients	Relationships between self-reported physician preventive care for patients and practice characteristics, patient risk factors, demographics, medical knowledge, medical opinion and preventive care for self
Adams and Kerner, 1982[2]	Breast cancer screening (mammography and exam)	Not applicable	Retrospective survey of 2300 screenees in free NYC clinic	Demographic characteristics of users and source of knowledge about availability of service, recommended use
Blalock, DeVellis, and Sandler, 1987[3]	Fecal occult blood	Not applicable	Not applicable	Review article of six studies of compliance with FOB screening offer; focus on relationships between participation and age, other demographics, physical health status, family history, other preventive health practices, and health beliefs
Burack and Liang, 1987[4]	Pap smear Mammography Fecal occult blood Sigmoidoscopy Breast exam Pelvic exam Rectal exam	Not applicable	221 users of inner-city teaching hospital ambulatory care clinic	Rates of acceptance and compliance with offer of service; relationship between use and demographic, enabling and health belief variables (bivariate and multivariate)
Calnan, 1985[5]	Breast screening Cervical screening Dental checkup Dietary practice Exercise Smoking behavior Safety belt use	Study measures e of ve items except dietary practice and smoking behavior	Interview surveys with 2084 women 40 to 64 years drawn randomly from general practitioner registers in th[illegible] English cities	Examined regular use of seven individual and multiple preventive behaviors; the relationships between use and sociodemographic characteristics, health status, attitudes, and social support/network
Cohen, Littenberg, et al., 1982[6]	Periodic health exam (defined by American Cancer Society and Canadian Task Force recommendations)	Recent pa:	Experiment to increase preventive services given by physicians to patients from outpatient clinic of urban teaching hospital	Compared physician preventive knowledge, attitudes and compliance with preventive health recommendations between experimental and control groups; experimental group received checklists and education

Appendix D. --cont'd

study	Services examined	Period of time in which use is measured	Sample description and design	Analyses
Cummings et al., 19797	Swine flu vaccine	Lifetime (albeit only offered within finite period)	Telephone survey of 286 adults randomly drawn from all households in Oakland City, Michigan	Uptake of swine flu vaccine as a function of Health Belief Model variables using regression and path analyses
David and Boldt, 1980[8]	None; examined patient attitudes toward preventive care	Not applicable	92 responses to mailed survey of random 10% of active patients of University of Kentucky Medical Center	Descriptive statistics of patient attitudes toward prevention, physician preventive function, time and cost of preventive care; bivariate relationships between attitudes and social position
Davidson et al., 19849	Pap smear Fecal occult blood Breast exam Influenza immunization	3 years 1 year 1 year 1 year (for 65+) (or 1 year for all services: not clear)	Patients receiving outpatient care through university based general internal medicine practice during two l-year periods; randomized trial; n=450	Effect of nurse-initiated reminder system of preventive services due; outcome measure is the difference in rate of compliance with recommendations between experimental and control periods
Harris and Guten, 1979[10]	Health protective activities including regular medical and dental checkups	Not applicable	Interview With 842 randomly selected adults from Cleveland, Ohio area	Relationships between constructed scales of health protective behavior and Health Belief Model variables (bivariate)
Hayward et al., 1988[11]	Pap smear Breast examination Mammography Periodic health exam	1 year and 3-5 years 1 year 1 year 1 year	4659 women from random national telephone survey (1986 Access to Care Study)	Estimates of proportions of women receiving cancer screening within recommended periods of time; bivariate and multivariate analysis of correlates of use
Howard, 1979[12]	Mammography	Date of last use	Not applicable	Reviews four studies on use of mammography and three studies of major deterrents to physician use of mammography
Larison and Swint, 1976. 1978[13]	Preventive and non-preventive physician visits	1 year	5% random sample of 3892 individuals enrolled in large prepaid plan (Kaiser Portland)	Compared likelihood and volune of use of preventive and nonpreventive visits in an HMO as a function of health status, demographic, insurance, and other economic variables
McDonald et al., 198415	Variety of screening services, immunizations, and weight reduction	Not applicable	115 resident physicians in a teaching hospital general medicine practice (61 study and 54 control, randomly assigned) studied over a 2-year period	Estimated the effectiveness of ccmputer-generated reminder system in achieving compliance with medical indications for preventive and other procedures; analyzed the correlates of physician use and reasons for nonuse

Appendix B cont'd

Study	Services examined	Period of time in which use is measured	Sample description and design	Analyses
McPhee, et al., 1986[15]	Fecal occult blood Rectal exam Sigmoidoscopy Pap smear Pelvic exam Breast exam Mammography	From 1980 ACS recommendations: 1 year for all services except sigmoidoscopy and Pap smears which are 3 years	Stratified random sample of [illegible] adults from 52 providers in a university general [illegible] medicine practice	Comparison of rates of use (based on ACS recommendations) with actual physician performance and physicians' perceptions of their performance; also examines correlates with use and of each service
Physician Employment Project/ DeFriese, Madison, Konrad, et al., ongoing[16]	General preventive care General immunizations Tobacco risk counseling Colorectal cancer screening Breast cancer screening	Not applicable	Cross-sectional telephone survey of members of 119 large medical group practices followed by mailed survey of 6000 physicians from [illegible] practices	Descriptive statistics of organizational policies toward selected preventive services, aggregate preventive physician visits, and physician attitudes; bivariate and multivariate analyses to test effect of individual, organizational, and environmental factors on these same outcome measures
MMWR, 1988a[17]	Pap smear Breast exam	Measures date of last use	Interviews with 603 adult women randomly selected in four-stage process from a 36 county area of rural Kentucky	Knowledge and use of Pap smears and breast exams by age and other contact with the health care system
MMWR, 1988b[18]	Mammography Breast exam Physician visit	year	852 Rhode Island women over 40 randomly selected from telephone numbers	Use of three preventive services by age, income, and education
MMWR, 1988c[19]	Pap smear Breast exam Mammography Digital rectal exam Fecal occult blood Proctoscopy	Date of last use: <1 year or >=1 year	1987 National Health Interview Survey Supplement on Cancer Control (1st quarter data: January-March)	Estimates of proportions of non-institutionalized adults over 40 years old with knowledge of and using each service broken down by gender and race
Rand, 1986 and 1987[20]	Tetanus vaccine Pneumococcal vaccine Influenza vaccine Pap smear Mammogram Fecal occult blood Sigmoidoscopy Chest x-ray	3 years for a services	2276 enrollees in Rand health insurance experiment between 17 and 65 years; (separate analysis for children's use of preventive care)	Use of preventive services as a functior of health insurance experiment cost-sharing plans; estimated efficacy of preventive care in terms of health status and costs; estimated cost of bringing use up to recommended levels
Riddiough et al., 1981[21]	Diphtheria vaccine Tetanus vaccine Polio vaccine Smallpox vaccine Asian flu vaccine Influenza B vaccine Swine flu vaccine	Not applicable	2 national random surveys of Opinion Research Company in 1977 and 1978; 2006 and 2080 adults in respective samples; also reviews some existing literataure	Baseline public data on attitudinal health belief model variables (likelihood and seriousness of disease, safey and effectiveness of vaccines, social factors, demographics, cost)

Appendix D.--cont'd

Study	Services examined	Period of time in which use is measured	Sample description and design	Analyses
Komm, Fletcher, and Hulka, 1981[22]	Risk counseling Medical history Pap smear Cholesterol Blood glucose EKG Urinalysis Fecal occult blood Lipid profile Tetanus vaccine Diphtheria vaccine	Used three sets of sets of time periods each broken down by age based on published expert recommendations	Sample of 31 North Carolina physicians and the medical records of 334 of their patients	Comparison of expert recommendations, surveyed physician opinion and actual physician use of preventive servics, counseling, and medical history taking
Rundall and Wheeler, 1979b[23]	Preventive visits	year	Cluster sample of 781 completed household interview in Washtenaw County, Michi	Path analysis of impact of income on volume of preventive visits; tests three hypotheses of income effect: direct (financial constraints), indirect via beliefs (culture of poverty), indirect via usual source of care (system barriers)
Salkever, 1976[24]	General physical exam	1 year	Household samples of 4296 adults from Baltimore, Maryland, northern Vermont, and Saskatchewan, Canada collected as part of World Health Organization International Collaborative Study of Medical Care Utilization	Using multivariate regression analysi examined the effects of economic vari including income, insurance coverage, time costs on the likelihood adults receive a preventive examination
Satarino, Schwartz, and Swanson, 1982[25]	Cervical cancer (Pap smear and pelvic exam)	Not applicab	34,135 women screened in Metro Detroit Cancer Control Program over 2.5-year period	Retrospective comparison of proportion of screenees seen in outreach clinics, standing clinics, and employee programs; estimated relative effectiveness of each clinic type in terms of rate of detected cancer by age and race
Sawyer et al., 1988, unpublished manuscript[26]	Pap sme	years	Interview survey of 149 black women 16-75 years old from rural North Carolina solicited door-to-door, referrals from social workers, other participants	Use of Pap smears as a function of health beliefs, provider, cues, income, education, and health insurance (bivariate and multivariate)
Slesinger, Tessler, and Mechanic 1976[27]	General checkup TB skin test Blood pressure Urinalysis Complete blood count Pap smear Sickle cell (blacks onl		408 Blue Cross and 506 prepaid participant families drawn from two large industrial firms in Midwestern city	Use and volume of prevent services as a function of demographics, insurance type, and attitudes

Appendix D.--cont'd

Study	Services examined	Period of time in which use is measured	Sample description and design	Analyses
Feitelbaum et al., 1988[28]	Pap smears	Asks whether patients received smear in each of 10 previous years	Telephone surveys of 1200 women over age 45 drawn randomly and 400 physicians representing three specialties (general medicine, OBGYN, and internists from the State of Maryland	Physicians surveyed about their recommendations for frequency of Pap smear use; broken down by age of patient and specialty of physician; women surveyed about their own use of Pap smears in previous 10 years; broken down by age and specialty of regular source of
Thompson et al., 1986[29]	Fecal occult blood	Not applicable (experiment)	Factorial design random trial of different cues to use FOB based on Health Belief Model; 500 members of HMO over 45 with existing physical exam appointment	Estimated effectiveness and cost-effectiveness of cues: physician talk, nurse talk, phone reminder, postcards, and combinations
Valente et al., 1986[30]	Variety of health behaviors	Not applicable	Data from mailed survey of randomly sampled Maryland physicians	Estimates of physician beliefs and proportions of physicians reporting that they gather information from patients on 11 health behaviors broken down by career age and specialty
Warnecke, Havlicek, Manfredi, 1983[31]	Physical exam Prostate exam Pap smear Rectal/procto exam Breast self-exam	Within the 3.5-year study: annual, <annual, never	968 low-income adults over 35 drawn from stratified random sample of Illinois phone numbe	Multivariate model of determinants of use as a function of health belief, economic, demographic, and health knowledge factors
Wechsler et al., 1983[32]	Variety of health behaviors	Not applicable	Data from survey of 490 randomly sampled Massachusetts of general medicine, internal medicine, and family practice physicians	Estimates of physician attitudes and beliefs and proportions reporting that they gather information and counsel patients on health behaviors
Williamson et al., 1988[33]	Screening health exam	2 years	1788 adults from 47 family physicians' offices within a single State	mates of proportions of patients receiving exam within previous 2 years; proportions of patients who say they would accept physician recommendations receive each of 10 preventive offered (analyzed by age); knowledge of recommended s and health practices
Windsor and Morris, 1984[34]	Hypothetical community health promotion program including diet control and smoking cessation	Not applicable	Survey of 400 randomly selected residents of urban Mobile, Alabama, age 20-69	Willingness to pay estimates by age for hypothetical program, projected use derived from self-reported risk factors wi o pay, and assumptions

ppend x D.--cont'd

Study	Services examined	Period of time in which use is measured	Sample description and design	Analyses
oo et a ., 9[illegible]55	History/physical exam Blood pressure Cholesterol Fecal occult blood Pap smear Mammogram Glaucoma Sigmoidoscopy EKG Serum glucose Rectal exam Breast exam Urinalysis Pelvic exam Chest x-ray	Rather than use a set period of time, authors calculate means of published and physician recommendations, generate expected number patients receiving each service for each physician, and compare actual numbers to expected numbers	85 physicians and 188 patients from an urban teaching hospital ambulatory care practice; actual use from patient records	Compares published recommendations, expected physician use, actual physician use, and patient desires for 16 preventive services

Abbreviations: ACP = American College of Physicians; ACS = American Cancer Society; EKG = electrocardiogram; FOB = fecal occult blood; HMO = health maintenance organization; MMWR = Morbidity and Mortality Weekly Report; OBGYN = obstetrician/gyneco ogist.

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SOURCE: Office of Technology Assessment, 1989.

Appendix E: OTA ANALYSIS OF PREVENTIVE SERVICE USE BY THE ELDERLY WITH DATA FROM THE 1982 NATIONAL HEALTH INTERVIEW SURVEY

Methods

The Data

The National Health Interview Survey (NHIS) is a representative household survey conducted annually since 1957 by the U.S. Department of Health and Human Service's National Center for Health Statistics (NCHS). In addition to a core questionnaire that measures the self-reported prevalence of various medical conditions, the use of health services, general health status, disability, and demographic characteristics, NCHS adds supplemental questionnaires on specific topics that vary from year to year. In 1982, the NHIS contained supplemental questionnaires on the use of preventive health services and the types and degree of health insurance coverage. Although NCHS has published some data from the preventive services supplement in tabular form (75), no published work to date has attempted to use these data to understand what factors are associated with the use of preventive services by the elderly. OTA decided to conduct such an analysis.

OTA obtained magnetic tapes of the core and supplemental questionnaire data for the 1982 NHIS from NCHS. These data files contained 103,923 observations reflecting respondents of all ages with 11,434 observations for individuals 65 years or older. In addition to responses to survey questionnaires, each observation contained a unique identifier, variables identifying a stratum and cluster from which it was drawn, and the weights necessary to produce representative estimates.

Among the variables on the data set, OTA was interested in:

- the amount of time elapsed since the respondent last received each of five screening services (glaucoma screening, blood pressure measurement, eye examination, breast examination, and Pap smear); and
- factors potentially associated with the use or nonuse of these five services.

OTA converted each of the five variables measuring elapsed time since use of preventive services to a binary variable that measures whether or not the individual used the service within a specified period of time.

These periods of time are based on the recommendations of expert groups presented in table 2 in the text of this paper. Because there is some variation across the different sets of expert guidelines listed in table 2, OTA summarized the published recommendations in the composite measures presented in table 8. These composite measures do not represent a set of recommendations themselves; rather, they are merely one benchmark for comparing actual use to what is generally considered adequate by recommending groups. Where there is disagreement among recommending groups, the composite measures tend toward *longer* intervals between screenings in order to measure compliance with *minimal* recommended levels of prevention. These composites of expert recommendations pertain only to the primary analyses conducted by OTA. As a source of comparison, table 8 also includes the periods used by two other studies of the use of preventive procedures. In one of these papers, the authors measured recommended periodicity as the mean of published recommendations (92). The other paper formed a consensus based on their own review of relevant literature (45).

Because of the coding scheme of the NHIS, use within an 'x" year period really means that the individual had used the service within a period of less *than but not including* "x+1" years. For example, consider the case of breast examinations. Table 2 suggests that one should measure use within the previous year. However, under the NHIS coding scheme, one would consider an elderly

woman who had her last breast examination 21 months ago to have been adequately screened; a woman whose last breast examination was 24 months ago would not. Table 9 lists all variables used in the analysis and also includes appropriately weighted descriptive statistics.

Methods of Analysis

OTA used PC-CARP® software (on an 80286 personal computer) to analyze the data. PC-CARP® was developed by the Statistical Laboratory at Iowa State University especially for analyzing data from surveys with complex designs like the NHIS. It makes use of the sampling information in the data files to produce appropriate point and variance estimates. OTA performed two separate analyses on the data set:

- a descriptive summary of the percentages of elderly individuals who reported using each of the five screening services within the specified time; and
- a multivariate weighted logistic regression analysis of the use or nonuse of these services.

In addition, OTA:

- examined whether observations dropped from the multivariate analysis because they contained some missing information differ in any important ways from observations included in the analysis, potentially biasing our estimated parameters;

Table 8--- Periods of Time Used by OTA and Two Studies to Measure Older Adults' Use of Preventive Services

Service	Period of time to measure use employed by: OTA[a]	Lillard, et al., 1986[b]	woo, et al., 1985[c]
■ Initial or periodic physical exam	1 year	....	1.4 years
■ Blood cholesterol level	5 years	....	4.5 years
■ Fecal occult blood test	1 year	1 year	1.0 year
■ Pap smear	3 years*	3 years	4.1 years
■ Glaucoma screening	2 years*	....	----
■ Optometry/ophthalmology exam	2 years*	----	----
■ Pneumococcal immunization	Lifetime	Lifetime	----
■ Influenza immunization	1 year	1 year	....
■ Tetanus immunization	10 years	10 years	....
■ Hypertension screening	1 year*	....	1.4 years
■ Breast examination	1 year*	....	....

Abbreviation: HMO= health maintenance organization.

[a] Intervals listed in this column represent composites of the expert recommendations summarized in table 2.
[b] L.A. Lillard, W.G. Manning, C. Peterson, et al., Preventive Medical Care: Standards Usage and Efficacy (Santa Monica, CA: The Rand Corporation, 1986).
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*As described in greater detail in appendices E and F, OTA estimated the use of preventive services among the elderly with two different data sources--a single HMO and the 1982 National Health Interview Survey (NHIS). The asterisk indicates services included in the NHIS analysis. Because of the coding scheme of the NHIS, use within an "x" year period really means that the individual has used the service within a period of less than but not including "x+1" years. Under this scheme, we would consider an elderly woman who had her last breast examination 21 months ago to have been adequately screened; a woman whose last breast examination was 24 months ago would not. For the HMO data, use within "x" years carries a literal definition.

Sources: Office of Technology Assessment, 1989.

- considered whether multicollinearity in the models might reduce precision; and
- examined how the probabilities of use predicted by the models varied with each significant variable.

The multivariate analysis uses Taylor series techniques to estimate a weighted logistic regression model of the form:

$P_{ij} = 1 /$

where

P_{ij} is the probability of elderly person i using service j. Use is measured by binary variable Y_{ij} (=1 if person i had service j within the specified period of time; Y_{ij} O otherwise).

D_i is a vector of predisposing characteristics describing elderly person i.

E_i is a vector of enabling characteristics describing elderly person i.

H_i is a vector of health status characteristics describing elderly person i.

α_j is an estimated parameter, and β_j, δ_{j^*} γ_j are vectors of estimated parameters for service j.

ε_j is an individual, service specific error term.

PC-CARP® produces estimated coefficients that are consistent and appropriately weighted. Estimates of asymptotic variances also appropriately reflect the complex survey design.

PC-CARP® requires that no observation in the data matrix contain missing values. For the logistic regression analysis, OTA used SPSS-PC+ to create two data files. OTA purged both files in a listwise fashion of observations containing missing data on any variable in the models.[1] OTA used one of the data sets to estimate models for preventive services potentially used by both sexes--glaucoma screening, eye examinations, and blood pressure measurement. OTA used the other data set, which contained only the observations for women, to estimate models for breast examinations and Pap smears.

The data set for both sexes contained exactly 9,000 out of the original 11,434 observations. The remaining 2,434 observations, which had missing data, represented a weighted 21.5 percent of the over-65 population. The single variable with the most missing observations was family income. This variable alone had missing observations representing 15.3 weighted percent of the elderly population. Of each of the other variables containing missing values, none lacked data on observations representing more than 4 weighted percent of individuals over-65. The data set containing only women had 5,040 observations out of a possible 6,655. The 1,615 observations with missing data represented 19.6 weighted percent of all women over 65.

Results

The estimates of the national proportions of elderly using each of the five screening services within the specified time are presented in table 3 in the text of the paper. Additional descriptive statistics are presented in table 9. Table 10 below presents the parameters of the estimated logistic regressions that attempt to explain the use or nonuse of each service. Table 7 summarizes these results, and the text of the paper discusses their significance.

1 To estimate the descriptive statistics presented in table 9 and the national percentages of elderly receiving the five screening services, OTA used data sets that contained all observations for which any data is available for the particular variable in question. The Listwise deletion of missing values described here only applies to the logistic regression analysis.

Table 9--- 1982 National Health Interview Survey: Selected Descriptive Statistics for Persons Over 65

Number of observations: 11,434
Weighted number of observations: 25,391,023

Weighted Means and Standard Deviations for Continuous Variables

Variable	Mean	Standard deviation
AGE	73.39	6.63
INCOME	15,217.97	13,853.56

Weighted Frequency Distributions for Categorical Variables

Variable	Proportion
GLAUCOMA	
1=screened for glaucoma within previous 2 years, 11 months	0.66
0=otherwise	0.34
EYE	
1=received eye examination within previous 2 years, 11 months	0.75
0=otherwise	0.25
BLOODP	
1=had blood pressure measured within previous 1 year, 11 months	0.93
0=otherwise	0.07
BREAST	
1=had clinical breast examination within previous 1 year, 11 months	0.50
0=otherwise	0.50
PAP	
1=had Pap smear within previous 3 years, 11 months	0.52
0=otherwise	0.48
MALE	
1=male	0.41
0=female	0.59
NONWHITE	
1=nonwhite	0.10
0=white	0.90

Variable	Proportion
EDLEVEL Highest educational level attained:	
0=none or kindergarten	0.02
1=1 to 8 years (elementary)	0.38
2=9 to 11 years (some high school)	0.16
3=12 years (high school graduate)	0.26
4=1 to 3 years college	0.09
5=college graduate	0.05
6=post-graduate education	0.04
SMSA	
1=resides in a Census Bureau Standard Metropolitan Statistical Area (urban area)	0.64
0=otheruise	0.36
PREPAID	
1=enrolled in HMO or sane other prepaid health plan	0.02
0=otherwise	0.98
HLTHINSR	
1=has some health insurance coverage or health benefits beyond Medicare including prepaid, Veterans', military, or means tested public assistance health benefit	0.78
0=otherwise	0.22
ALONE	
1=lives alone	0.30
0=otherwise	0.70
BEDDAYS days in bed during previous 12 months:	
0=none	0.65
1=1 to 7 days	0.16
2=8 to 30 days	0.12
3=31 to 180 days	0.05
4=181 to 365 days	0.02
LIMITED	
1=limited in some activity	0.70
0=otherwise	0.30

SOURCE: Office of Technology Assessment, 1989.

Table 10.--Elderly Use of Five Screening Services: Logistic Regression Results

Independent variable	Mean value	GLAUCOMA Estimated coefficients	BLOOOP Estimated coefficients	EYE Estimated coefficients	Mean value	-BREAST Estimated coefficients	PAP Estimated coefficients
INTERCEPT	1.0000000	0.4160073	-0.3433352	0.8399042	1.0000000	-0.0166337	2.1542170
		(0.2927390)	(0.7538013)	(O.296341O)**		(0.39609n)	(0.3889979)**
Predisposing factors:							
MALE	0.4162490	-0.3009192	-0.3259628	-0.2439690	..	-.	..
		(0.0534922)**	(0.0957841)**	(0.5874069)**	..	..	..
AGE	73.2137000	-0.0091917	0.0264826	-0.0061867	73.4815000	-0.0167258	-0.0400128
		(0.0038157)*	(0.0095720)"	(0.0039844)		(0.0051317)**	(0.0049593)**
NONWHITE	0.0945106	-0.3735570	-0.0368144	-0.0887188	0.0937475	0.0263338	0.1506788
		(0.0838741)**	(0.1647689)	(0.0923361)		(0.0982817)	(0.1056188)
EDLEVEL	2.3429000	0.1601070	0.1038493	0.1147214	2.3367600	0.1132536	0.0962961
		(0.0223536)**	(0.0436750)*	(0.0229877)**		(0.0255863)**	(0.0249885)**
Enabling factors:							
INCOME	15276.8000000	0.0000114	0.0000106	0.0000066	4059000000	0.0000119	0.0000102
		(0.0000026)**	(0.0000058)	(0.0000028)*	(0.0000027)**	(0.0000028)**	(0.0000028)**
SMSA	0.6336510	0.2167839	0.0064913	0.2054843	0.6364580	0.3110662	0.1555873
		(0.0571966)**	(0.1049219)	(0.0589708)**		(0.0694007)**	(0.0700830)*
PREPAID	0.0229561	0.2349249	0.6391572	0.1612398	0.0199337	0.3845290	0.4433711
		(0.2200813)	(0.5023571)	(0.2554439)	(0.2405225)	(0.2723756)	(0.2723756)
HLTHINSR	0.7896040	0.4306881	0.5616778	0.3853976	0.7834470	0.3761862	0.3581028
		(0.0625027)**	(0.1248533)**	(0.0628222)**	(0.0884009)**	(0.0861343)**	(0.0861346)**
ALONE	0.3067190	0.0062441	-0.1136007	0.0406232	0.4099680	0.1971576	-0.0397508
		(0.0589261)	(0.0944282)	(0.0638674)	(O.O743910)**	(O.O665113)**	(0.0651125)
Health status measures:							
BEDDAYS	0.6316600	0.1227310	0.8908110	0.0776005	0.6405870	0.3337425	0.1943092
		(0.0304799)**	(O.1O5O414)**	(0.0281800)**	(0.0327194)**	(0.0335717)**	(0.0333572)**
LIMITED	0.2992070	0.0003354	0.3276151	-0.1233437	O.3O8W1O	0.0448802	0.0331326
		(0.0585122)	(0.1317948)*	(0.5909522)*	(0.0703522)	(0.0762676)	(0.0762676)
Model statistics:							
N		9000.0	9000.0	9000.0		5040.0	5040.0
Dependent variable mean		0.6635	0.9319	0.7432		0.4985	0.5243
F-statistic		32.41**	15.14**	15.12**		23.09**	25.87**
Average design effect[c]		1.32	1.53	1.28		1.20	1.23

[a] Asymptotic standard errors are in parentheses below each estimated coefficient.
[b] Variable means were calculated from data matrices used to estimate logit models (i.e., purged of observations with missing values).
[c] Average "effect" of complex survey design on variances of estimated coefficients. This "effect" is measured as the number of times greater the variance from the complex design is than the variance from a simple random design.
*Estimated parameter significant at the 0.05 level, two-tailed test.
**Estimated parameter significant at the 0.01 level, two-tailed test.

Variable Key:

Dependent Variables:

GLAUCOMA --1=screened for glaucoma within previous 2 years, 11 months; O=otherwise
EYE --l=received eye examination within previous 2 years, 11 months; O=otherwise
BLOODP --1=had blood pressure measured within previous 1 year, 11 months; O=otherwise
BREAST --1=had clinical breast examination within previous 1 year, 11 months; O=otherwise
PAP --l=had Pap smear within previous 3 years, 11 months; O=otherwise

Independent Variables

MALE --l=male~ O=female
AGE --respondent's age in years
NONWHITE --l=nonwhite; O=white
EDLEVEL --highest educational level attained; O=none or kindergarten; 1=1 to 8 years (elementary); 2=9 to 11 years (sp,e high school); 3=12 years (high school graduate); 4=1 to 3 years college; 5=college graduate; 6=post-graduate education
INCOME --family income in dollars
SMSA --l=resides in a Census Bureau Standard Metropolitan Statistical Area (urban area); O=otherwise
PREPAID --l=enrolled in HMO or some other prepaid health plan; O=otherwise
HLTHINSR --l=has some health insurance coverage or health benefits beyond Medicare including prepaid, Veterans', military, or means tested public assistance health benefit; O=otherwise
ALONE --l=lives alone; O=otherwise
BEDDAYS --days in bed during previews 12 months; O=none; 1=1 to 7 days; 2=8 to 30 days; 3=31 to 180 days; 4=181 to 365 days
LIMITED --l=limited in some activity; O=otherwise

SOURCE: Office of Technology Assessment, 1989.

Table 11. --Correlation Matrix for Variables in Logistic Regression Models[a]

	GLAUCOMA	BLOODP	EYE	BREAST	PAP	MALE	AGE	NON-WHITE	ED-LEVEL	INCOME	SMSA	PREPAID	HLTH-INSR	ALONE	BEDDAYS	LIMITED
GLAUCOMA	1.00															
	xx															
BLOODP	0.19	1.00														
	xx	xx														
EYE	0.69	0.18	1.00													
	xx	xx	xx													
BREAST	xx	xx	xx	xx												
	xx	xx	xx	1.00												
PAP	xx	xx	xx	xx	xx											
	xx	xx	xx	0.49	1.00											
MALE	-0.06	-0.04	-0.05	xx	xx	1.00										
	xx	xx	xx	xx	xx	1.00										
AGE	-0.05	0.03	-0.03	xx	XX	-0.06	1.00									
	xx	xx	XX	-0.06	-0.15	XX	1.00									
NONWHITE	-0.09	-0.02	-0.03	xx	xx	0.00	-0.01	1.00								
	xx	xx	xx	-0.02	0.00	xx	-0.01	1.00								
EDLEVEL	0.15	0.05	0.10	xx	xx	0.01	-0.14	-0.16	1.00							
	xx	xx	xx	0.11	0.11	xx	-0.14	-0.18	1.00							
INCOME	0.12	0.04	0.07	xx	xx	0.10	“0.11	-0.13	0.39	1.00						
	xx	xx	xx	0.09	0.10	xx	-0.09	“0.13	0.32	1.00						
SMSA	0.07	0.01	0.06	XX	xx	-0.01	-0.00	0.04	0.09	0.12	1.00					
	xx	xx	xx	0.09	0.05	xx	0.01	0.02	0.08	0.11	1.00					
PREPAID	0.03	0.02	0.02	xx	xx	0.03	-0.03	-0.00	0.04	0.03	0.10	1.00				
	xx	xx	xx	0.04	0.04	xx	-0.03	-0.01	0.03	0.01	0.08	1.00				
HLTHINSR	0.12	0.07	0.09	xx	xx	0.02	-0.09	-0.12	0.18	0.11	0.01	0.08	1.00			
	xx	xx	xx	0.10	0.09	xx	-0.08	“0.11	0.18	0.07	0.00	0.08	1.00			
ALONE	-0.01	-0.01	0.01	xx	XX	-0.26	0.18	0.01	-0.02	-0.31	-0.00	-0.04	-0.01	1.00		
	xx	xx	XX	0.01	-0.06	XX	0.21	“0.01	-0.00	-0.36	-0.01	-0.03	0.03	1.00		
BEDDAYS	0.04	0.13	0.02	xx	xx	-0.02	0.06	0.04	-0.05	-0.03	-0.01	-0.02	-0.01	0.01	1.00	
	xx	xx	XX	0.15	0.08	XX	0.06	0.04	-0.05	-0.04	-0.00	0.00	-0.02	0.01	1.00	
LIMITED	-0.00	0.06	-0.03	xx	xx	-0.04	-0.07	0.06	-0.12	-0.07	-0.04	-0.00	-0.02	-0.03	0.31	1.00
	xx	xx	xx	0.04	0.03	xx	-0.04	0.07	-0.12	“0.05	-0.03	0.01	-0.01	-0.04	0.45	1.00

‘Pearson correlation coefficients. First row in each cell gives correlation in data set used to estimate models for GLAUCOMA, EYE and BLOODP (n=9000). Second row gives correlation for data set used to estimate models for BREAST and PAP (n=5040).

symbol Key: XX=Not applicable (Both variables not contained on that data set)

Variable Key:

Dependent Variables:

GLAUCOMA --l=screened for glaucoma within previous 2 years, 11 months; 0=othewise
EYE --l=received eye examination within previous 2 years, 11 months; O=other~ise
BL00DP --l=had blood pressure measured within previous 1 year, 11 months; O=otherwise
BREAST --l=had clinical breast examination within previous 1 year, 11 months; O=otherwise
PAP --l=had Pap smear within previous 3 years, 11 months; O=otherwise

Independent Variables:

MALE --l=male; O=female
AGE --respondent’s age in years
NONWHITE --l=nonwhite; O=white
EDLEVEL --highest educational level attained; O=none or kindergarten; 1=1 to 8 years (elementary); 2=9 to 11 years (some high school); 3=12 years (high school graduate); 4=1 to 3 years college; 5=college graduate; 6=post-graduate education
INCOME --family income in dollars
SMSA --l=resides in a Census Bureau Standard Metropolitan Statistical Area (urban area); O=otherwise
PREPAID --l=enrolled in HMO or some other prepaid health plan; O=otherwise
HLTHINSR --l=has some health insurance coverage or health benefits beyond Medicare including prepaid, Veterans', military, or means tested public assistance health benefit; O=otherwise
ALONE -l=lives alone; O=otherwise
BEDDAYS --days in bed during previews 12 months; O=none; 1=1 to 7 days; 2=8 to 30 days; 3=31 to 180 days; 4=181 to 365 days
LIMITED --l=limited in some activity; O=otherwise

SOURCE: Office of Technology Assessment, 1989.

To examine the possibility that multicollinearity among the independent variables in the model might preclude precise estimation, OTA estimated the weighted first-order Pearson correlation matrices for the two data sets. Table 11 presents the correlation statistics. Only three pairs of independent variables had correlations greater than 0.25 (or less than -0.25): EDLEVEL and INCOME (0.39 in the two-gender data set and 0.32 in the women only data set), ALONE and INCOME (-0.31 and -0.36 respectively), and the two measures of health status, LIMITED and BEDDAYS (0.31 and ().43 respectively). In addition, ALONE and AGE have correlations of 0.18 and 0.21 respectively in the two data sets. However, despite the potential effect of this collinearity on the estimated variances, the conclusions are unlikely to change. In all models except blood pressure measurement, EDLEVEL and INCOME are both already significant predictors of preventive service use. ALONE is significant in three out the five (with blood pressure measurement and Pap smears being the exceptions). Although there is a high degree of correlation between BEDDAYS and LIMITED, at least one of them is statistically significant in all of the models except glaucoma screening, thus supporting the notion that health status is associated with preventive service use among the elderly.[2]

OTA excluded a substantial proportion of observations because data were missing for one or more variables in the model. In order to examine if these exclusions could have biased the results of the multivariate models, OTA compared the characteristics of the included and excluded groups. In both data sets, the included respondents were significantly different from those eliminated because of missing data for only two variables: HLTHINSR (the presence of any health insurance beyond Medicare) and INCOME.[3] For each of the other variables (including the dependent variables), the mean for the observations with missing data did not differ statistically from the mean for observations included in our analyses. This analysis suggests that the exclusion of observations with missing data is unlikely to introduce bias into the multivariate models, but OTA cannot rule out the possibility.

In order to examine the effect of each significant variable in the estimated models, OTA simulated, one independent variable at a time, how the probability of using each screening service varied with each possible value of the independent variables. In these simulations, all independent variables, except the one whose effect was being simulated, assumed their mean values.

Table 12 and figures 1 through 4 present the results of this analysis for each *significant* variable in our models. Among the independent variables, holding other factors constant, age, education, and health insurance appear to have the greatest overall effect on the probability of receiving each of these services. This analysis also supports the notion that blood pressure measurement is different from other services. Since almost everyone receives it, there is less variation to explain. Hence, the variables in the model appear less important in predicting its use than they do for the other services.

Z However, because multicol 1 i neari ty reduces the precision of the estimator, the standard error of these two variables' estimated coefficients may be biased in the glaucoma screening model.

3 The group of observations excluded from the analysis had a lower mean income ($14,475 versus $15,276 in the two gender data set; p<0.01) and was less likely to have any insurance coverage beyond Medicare (0.70 versus 0.79 in the two gender data set; p<0.05) than was the included group. The income statistic may not accurately reflect the entire group of observations with missing data since three-quarters of the observations missing any data at al 1 did not have income data.

Table 12--- **Effect of Statistically Significant Binary Variables[a] in Logistic Regressions on Elderly Use of Five Screening Services: Predicted Probabilities[b]**

	GLAUCOMA Predicted probability	BLOOOP Predicted probability	EYE Predicted probability	BREAST Predicted probability	PAP Predicted probability
MALE					
= 0	0.70	0.96	0.77	xx	xx
= 1	0.63	0.94	0.72	xx	xx
NONWHITE					
= 0	0.68	..	..	..	..
= 1	0.59	..	--	..	
SMSA					
= 0	0.64	..	0.73	0.45	0.50
= 1	0.77	..	0.77	0.53	0.54
HLTHINSR					
= 0	0.59	0.92	0.69	0.43	0.46
= 1	0.69	0.96	0.77	0.52	0.55
ALONE					
= 0	..	..	..	0.48	..
= 1	..	..	..	0.53	..
LIMITED					
= 0	..	0.95	0.76	..	..
= 1	..	0.96	0.74	..	..

[a]Effect of significant non-binary variables shown in figures 1 through 4.

[b]Predicted probability is estimated as $1/[1 + e^{-X\beta}]$ where β is the vector of estimated coefficients and X is the vector of individual characteristics. Of these characteristics (all independent variables included in the estimated model), each takes on its mean value except the one designated in that row of the table above; it takes on the value shown in the row header.

Symbol Key:
XX=Independent variable not included in model
--=Estimated coefficient on independent variable not significant at 0.05 level, two-tailed test

Variable Key:

Dependent Variables:
GLAUCOMA --l=screened for glaucoma within previous 2 years, 11 months; O=otherwise
EYE --l=received eye examination within previous 2 years, 11 months; O=otherwise
BLOOOP --l=had blood pressure measured within previous 1 year, 11 months; O=otherwise
BREAST --l=had clinical breast examination within previous 1 year, 11 months; O=otherwise
PAP --l=had Pap smear within previous 3 years, 11 months; O=otherwise

Independent Variables:
MALE --l=male; O=female
NONWHITE --l=nonwhite; O=white
SMSA --l=resides in a Census Bureau Standard Metropolitan Statistical Area (urban area); O=otherwise
PREPAID --l=enrolled in HMO or some other prepaid health plan; O=otherwise
HLTHINSR --l=has some health insurance coverage or health benefits beyond Medicare including prepaid, Veterans!, military, or means tested public assistance health benefit; O=otherwise
ALONE --l=lives alone O=otherwise
LIMITED --l=limited in some activity; O=otherwise

SOURCE: Office of Technology Assessment, 1989.

Figure 1.--Effect of Age on Use
Predicted Probabilities

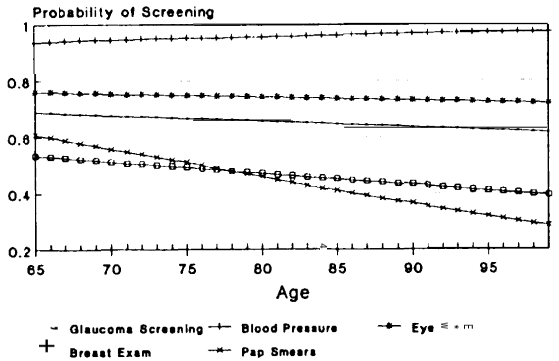


Figure 2.--Effect of Income on Use
Predicted Probabilities

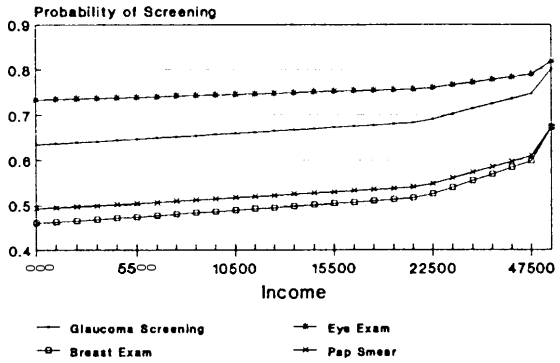


Figure 3.--Effect of Education on Use
Predicted Probabilities

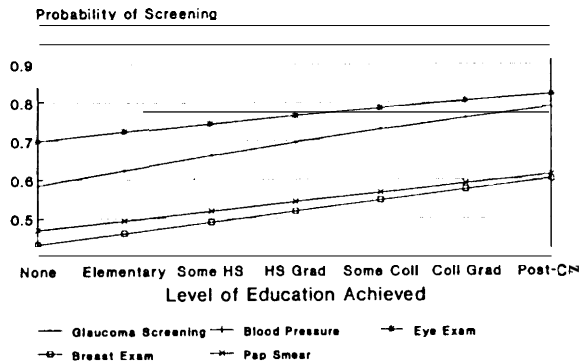
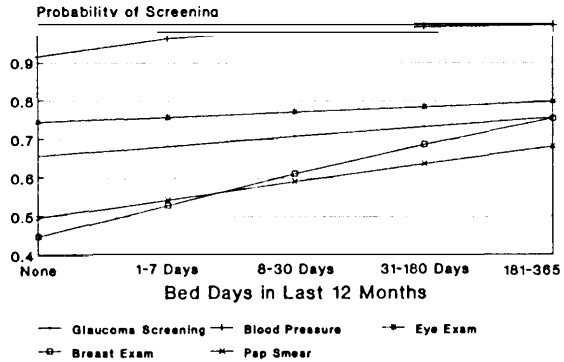


Figure 4.--Effect of Bed Days on Use
Predicted Probabilities



Key to Figure 3: Elementary = 1 to 8 years education; Some HS = 9 to 11 years education; HS Grad = 12 years education; Some Coll = 1 to 3 years college; Coll Grad = college graduate; Post-Col = post-graduate education.

SOURCE: Office of Technology Assessment, 1989.

APPENDIX F: ANALYSIS OF PREVENTIVE SERVICE USE BY OLDER ADULTS IN A HEALTH MAINTENANCE ORGANIZATION

Methods

The Data

OTA contracted with a health maintenance organization (HMO) to provide data on the use of eight preventive services by their over-65 year old enrollees:

- Check-up visit,
- Cholesterol measurement,
- Eye examination,
- Fecal occult blood test,
- Pap smear,
- Influenza immunization,
- Pneumococcal immunization, and
- Tetanus immunization.

OTA chose these services in consultation with the HMO to meet the following criteria:

- they are services often included among discussions or recommendations for elderly preventive health; and
- the HMO's data system routinely records their use as distinct services.

To examine how use varies with age, the HMO also provided comparable data for enrollees between the ages of 40 and 64. The HMO measured the proportions of enrollees using each service within the periods of time presented in table 8.

The HMO is a large, urban, staff model health maintenance organization located in the Northeastern United States. It serves enrollees through private employers, government agencies, and individual accounts. Since January 1976, the HMO has served Medicare beneficiaries, initially under a plan where the HMO billed Medicare for Medicare-covered procedures on a fee-for-service basis. The HMO provided non-covered procedures, including the preventive services examined in this study, through a "wraparound" or "Medi-gap" policy purchased by or for the enrollee.

Beginning in July 1985, the HMO entered into a Medicare demonstration risk contract with over 80 percent of its 2500 existing Medicare enrollees transferring into this plan within the first three months. All of the services covered under the HMO's basic benefit package, including preventive services, were included in the risk contract plan.

The HMO has traditionally encouraged the use of preventive services by at-risk populations through clinical guidelines for preventive care and coverage of regular check-ups. Before October 1987, the monitoring of compliance with these guidelines was limited to pediatric screening and immunization, prenatal screening, and influenza immunization. Since that date, the HMO has adopted a program to monitor and inform clinicians at each visit of a patient's compliance with the HMO's preventive guidelines. Since OTA believed that this program is not typical of most HMOs, this HMO used October 1987 as the endpoint for measuring rates of use for each preventive services studied. Hence, during the periods of time examined, only influenza immunizations reflect any monitoring by the HMO, and for that service, clinicians only received information on aggregate rates of compliance among all enrollees.

Methods of Analysis

The base population for this study is all present and former HMO enrollees who were age 40 or older as of October 1, 1987. The HMO identified the base population through a computerized search of enrollment records and separated the population into four subgroups on the basis of age:

- 40 to 49 years old,
- 50 to 64 years old,
- 65 to 74 years old, and
- 75 years and older.

Because the HMO calculated age at the end of the observation period, some of the enrollees in each group fell below the low age threshold at the time they actually used a specific service.

Through computer searches of this base population, the HMO defined a "denominator population" for each age group and observation period over which the use of a specific preventive service was to be measured. Each "denominator poplation" consisted of all persons of appropriate age continuously enrolled in the HMO during the observation period. Since two of the HMO's ten clinics did not have computerized records at the level of specific clinical services, enrollees from these sites were excluded from the analysis. Enrollees excluded from the denominator files because they came from one of the noncomputerized sites or because they were not continuous members represented 20 percent of the base population in each age group.

The "denominator" file for the over-65 age groups consists of *all* continuously enrolled individuals from the eight sites. The denominator population for the 40 to 64 age groups were so large that the HMO used a random sample of these groups for the analysis. They chose a 10-percent random sample for all but the 10-year observation period, where they chose a 20-percent random sample. Table 13 presents the number of observations in each "denominator" file used to calculate the rates of use.

In order to measure the use of each service for each age group, the HMO searched the base population to form "numerator" files consisting of persons who met *both* of the following criteria:

- the individual was enrolled in one of the eight sites at the time the analysis was conducted (June through September 1988); and
- the individual received the specific preventive service within the observation period.

To calculate rates of use, each "numerator" file was compared to its corresponding "denominator" file. Individuals in the numerator file who did not appear in the denominator file were discarded. Stratifying by gender, the HMO tallied the number of individuals remaining in each "numerator" file and divided that number by the number in the corresponding "denominator" file to calculate a rate of use for each service and age-gender group. Table 14 presents the results of this analysis.

It is possible that a few continuously enrolled members transferred from one of the two excluded sites to one of the eight included sites before October 1, 1987. While such individuals would be included in the "denominator" files, they would not appear in the "numerator" file if they received a preventive service at the excluded site. This would deflate the use rate. However, because the two excluded sites serve geographically distinct communities with most members living in close proximity to the clinic, transfer to another site is relatively rare. Therefore, OTA and the HMO concluded that the potential undercounting in the use rates is minimal.

Table 13---Sample Sizes for Each Measurement Period in OTA'S Analysis of Preventive Service Use in One HMO

Age	10 yr. period (10/77-10/88)			5 yr. period** (10/82-10/87)			3 yr. and 2 yr. ** (10/84-10/87) and (10/85-10/87)			1 yr. period** (10/86-10/87)		
	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total
40-4P	250	260	510	455	507	962	725	797	1522	995	1068	2063
50-64′	246	227	473	282	331	613	466	518	984	654	784	1438
65-74**	329	307	636	849	,956	1805	1265	1440	2705	1902	2219	4128
75+**	113	145	258	204	313	517	271	395	666	514	752	1266

•The n for 40-49 and 50-64 age groups represent a 20 percent sample of members continuously enrolled during each period at the eight sites studied. The 65-74 and 75+ age groups represent all members.

● *The n for 40-49 and 50-64 age groups represent a 10 percent sample of members continuously enrolled during each period at the eight sites studied. The 65-74 and 75+ age groups represent all members.

Table 14---Percents of Continuously Enrolled Members Receiving Eight Preventive Services During Specified Periods of Time

Age	Check-up visit (1 year period)			Cholesterol (5 year period)			Eye exam (2 year period)			Fecal occult blood (1 year period)			Pap smear (3 year period)			Influenza vaccine (1 year period)			Pneunococcal vaccine (lifetime)			Tetanus vaccine (10 year period)		
	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total
40-49 yrs.	24%	39%	32X	68%	67%	67%	39%	50%	44%	21%	32%	27%	N/A	80%	N/A	4%	5%	4%	1%	1%		20%	17	18%
50-64 yrs.	38	49	44	80	77	78	51	55	53	36	46	41	N/A	73	N/A	14	12	13	7	5	6	13	13	13
Subtotal 40-64	29	43	37	73	71	72	44	52	48	27	38	33	N/A	77	N/A	8	8	8	3	2	3	17	15	16
65-74 yrs.	48	52	50	77	76	76	70	74	72	49	53	51	N/A	75	N/A	55	55	55	29	27	28	47	40	44
75+ yrs.	52	47	49	69	64	66	80	79	79	51	46	48	N/A	60	N/A	67	63	64	47	42	44	**40**	**35**	**37**
Subtotal 65+	49	51	**50**	**75**	**73**	**74**	**72**	**75**	**73**	**49**	**52**	50	N/A	71	N/A	58	57	57	33	**30**	**31**	**45**	**38**	**42**

Abbreviation: N/A = Not applicable.

SOURCE: Office of Technology Assessment, 1989.

AAO --American Academy of Ophthalmology
ACOG --American College of Obstetrics and Gynecology
ACP --American College of Physicians
ACR --American College of Radiologists
ACS --American Cancer Society
ADA --American Diabetes Association
A HA --American Heart Association
AMA --American Medical Association
AMWA --American Medical Women's Association
ANA --American Nurses Association
AOA --American Optometric Association
ASPB --American Society to Prevent Blindness
CDC --Centers for Disease Control
CPS --Current Population Survey
CTF --Canadian Task Force on the Periodic Health Examination
EKG --Electrocardiogram
HCFA --Health Care Financing Administration
HMO --Health maintenance organization
IPA --Independent practice association
MMWR --Morbidity and Mortality Weekly Report
NCHS --National Center for Health Statistics
NCHSR --National Center for Health Services Research and Health Technology Assessment
NCI --National Cancer Institute
NHIS --National Health Interview Survey
NHLBI --National Heart, Lung, and Blood Institute
NIH --National Institutes of Health
OTA --Office of Technology Assessment
SMSA --Standard Metropolitan Statistical Area
USPSTF --United States Preventive Services Task Force

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